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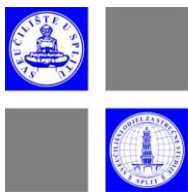
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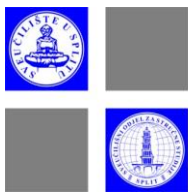
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Track 1

Finance & Accounting

Bank Liquidity Creation and Recessions

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Abstract. We investigate the relationship between bank liquidity creation and recessions in the U.S. For the 1984-2010 sample, we find that (i) bank on-balance sheet liquidity creation forecasts recessions four quarters into the future: lower on-balance sheet liquidity creation signals recessions; (ii) while off-balance sheet liquidity is not a robust predictor of recessions at higher forecast horizons, approximately one quarter prior to recessions, bank off-balance sheet liquidity creation falls in tandem with on-balance sheet liquidity creation, and hence aggregate of on- and offbalance sheet liquidity creation falls; (iii) aggregate, on- and off-balance sheet bank liquidity creation continue to decline during and up to five quarters after recessions; (iv) liquidity creation of larger banks rather than that of smaller ones contains more information about future recessions. The findings have important preemptive macro-prudential policy implications.

Keywords: *Treasury yield curve; Bank liquidity creation; Recessions; Financial Stability; Monetary Policy.*

JEL classification: E43; E47; E52; E58; G17; G18; G21; O40; O43

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1. Introduction

Accurately predicting the onset of recessions is important for households, investors, businesses and policymakers. Prior research has shown that economic and financial variables have significant forecasting power for recessions in the U.S. Estrella and Hardouvelis (1991) and Estrella and Mishkin (1998) have shown that the slope of the Treasury yield curve contains information about future recessions at horizons up to eight quarters into the future. In this paper, we concentrate on bank liquidity creation as a forecasting variable for recessions since monetary policy is one of the determinants of bank liquidity creation and of the slope of the Treasury yield curve. While banks play a central role in virtually all financial crises (e.g., Diamond and Rajan 2005), the existing banking literature does not investigate the relationship between bank liquidity creation and recessions. We find that bank liquidity creation contains information about the onset of the National Bureau of Economic Research (NBER) recessions, and it contracts up to four quarters prior to recessions and continue to fall for about five quarters

past recessions. We further show that bank liquidity creation significantly improves the ability of the slope of the Treasury yield curve to predict recessions.

The existing literature linking bank lending and economic activities find inconclusive evidence of a “credit crunch” (e.g., Bernanke and Lown 1991; Kashyap and Stein 1994). One of the reasons for the inconclusive results is that, for reputational reasons commercial banks act as a buffer for long-standing customers with pre-arranged credit lines, an off-balance sheet bank activity (e.g., Thakor 2005). Thus, the evidence in the literature suggests that we investigate the impact of bank off-balance sheet activities on the role of economic development. In particular, it is important that we investigate bank on-balance sheet activities prior to recessions since banks’ inability to manage their balance sheet is believed to be the root cause of the most recent financial crisis. However, to our knowledge, a comprehensive study on the relationship is rare.

Berger and Bouwman (2009) propose an innovative measure of bank liquidity creation, an all-inclusive measure of bank output factoring in both banks’ on- and off-balance sheet activities such as loans, deposits, equity, derivatives and loan commitments etc.¹ Bank liquidity creation in essence measures bank output. While measuring bank liquidity creation is important, investigating its impact on the real economy is central to monetary policy.

Berger and Sedunov (2015) investigate the relationship in the U.S. state level and find that higher bank liquidity creation in the present quarter leads to higher per capita GDP for the next quarter. The authors further show that liquidity creation of small banks rather than that of large banks has higher impact on economic growth. While their results are important of their own, large banks create over 90% of aggregate bank liquidity (e.g., Berger and Bouwman 2009), and hence one would expect that large banks have higher impact on the economy. The authors further find inconclusive evidence that during crises banks create less liquidity. For instance, the authors do not find any relationship between bank liquidity creation and per capita GDP during the 2007-2009 sub-prime crisis. However, the literature finds that during the last crisis banks were unable to provide liquidity (e.g., Acharya and Mora 2015). Importantly, Berger and Sedunov (2015) do not investigate whether lower bank liquidity creation leads to recessions; a variable that predicts real GDP may not forecast recessions. For example, the Treasury termspread (the difference in yields on 10-year and 3-months Treasuries) is found to be a robust predictor of recessions (e.g., Estrella and Hardouvelis 1991), but it has limited predictive power for real GDP (e.g., Næs, Skjeltorp, and Ødegaard 2011).

Berger and Bouwman (2014) investigate the relationship between bank liquidity creation and crises, and their crises definition includes the NBER recession quarters and events, such as the Long-Term Capital Management (LTCM) bailout and the Russian debt crisis. The authors show that higher aggregate U.S. bank liquidity creation relative to a linear trend leads to crises, but their results contradict that of Berger and Sedunov (2015). Given the disagreement between the findings in the literature, this paper revisits the relationship between bank liquidity creation and economic growth. In particular, we investigate whether bank liquidity creation forecasts the NBER recessions. While predicting recessions with precision is one of the objectives, we are particularly interested in investigating the dynamics of bank on- and off-balance sheet liquidity creation prior to and after recessions since this knowledge may help formulate monetary policy.

¹ Banks exist to create liquidity and transform credit risk (e.g., Diamond 1984; Diamond and Rajan 2001; Berger and Bouwman 2009) and monetary policy is generally altered to change bank liquidity creation. Banks not only create liquidity on the balance sheet by activities, such as providing loans to businesses and individuals funded by deposits (e.g. Diamond and Dybvig 1983; Berger and Bouwman 2009), but also create liquidity off the balance sheet by activities, such as extending standby letters of credit and loan commitments to their customers (e.g., Holmstrom and Tirole 1998; Kashyap, Rajan and Stein 2002; Thakor 2005; Diamond and Rajan 2005; Berger and Bouwman 2009).

Our study differs from that of Berger and Bouwman (2014) in several ways. *First*, we investigate recessions, but not exogenous shock-driven crises, such as the Russian debt crisis. We argue that liquidity creation of the U.S. banks cannot possibly cause such one-time extreme events. *Second*, following the literature (e.g., Estrella and Hardouvelis 1991), we employ a probit model to forecast recessions, while the authors use a logit model. Estrella and Hardouvelis (1991) argue that probit models are perhaps better when the dependent is a recession binary variable. *Third*, the authors use *de-trended* bank liquidity creation data, while we use bank liquidity creation *growth* data.² *Fourth*, we augment the benchmark Treasury term-spread model with bank liquidity creation growth data. Berger and Bouwman (2014), however, do not use the

Treasury term-spread neither as a benchmark nor as a control variable. *Finally*, their model predicts crises one quarter ahead of the events, while we forecast recessions one to four quarters into the future.

Using the Berger and Bouwman (2009) bank liquidity creation measures, our results show that it is an important predictor of recessions. In particular, we show that bank on-balance sheet liquidity creation decreases at about four quarters prior to recessions and continues to fall leading to recessions. We further show that on-balance sheet liquidity creation of large banks rather than that of small and medium ones decreases before recessions. This set of results is robust to the exclusion of the recent 2007-2009 recession. The interpretation is that a downward sloping or a flat yield curve prior to recessions forces banks, particularly large banks, to contract their on-balance sheet activities as such activities are no longer profitable.

By contrast, if the 2007-2009 recession is excluded, we find that bank off-balance sheet liquidity creation increases four quarters prior to recessions, and banks continue to create liquidity through off-balance sheet activities up to three quarters before recessions. The results suggest that banks shift their preference towards off-balance sheet liquidity creation while contracting on-balance sheet activities at approximately four quarters before recessions, thus supporting the existing view that banks extend liquidity through off-balance sheet activities prior to economic downturns. However, with the 2007-2009 recession in the sample, we do not find any such relationship. One possible interpretation of the results is that the relationship between bank off-balance sheet liquidity creation and recessions is not robust. An alternative interpretation is that banks did not create as much off-balance sheet liquidity before the 2007-2009 recession as they did prior to other recessions. This potentially explains the severity of the recent recession in that banks could not provide enough liquidity to its long-standing customers through off-balance sheet activities.

However, irrespective of the sample choice, in the quarter leading to recessions off-balance sheet liquidity contracts in tandem with on-balance sheet liquidity creation and aggregate liquidity creation falls. Our results further suggest that the fall in aggregate, on- and off-balance sheet liquidity creation continues for up to five quarters after recessions. By contrast, at some point between one and two quarters past recessions, the relationship between the term-spread and recessions turns positive. The results thus imply that, while monetary policy is loosened around recession quarters or market participants expect such accommodating policies (resulting in an upward sloping yield curve), banks continue to shrink their balance sheet for another five quarters. We further do not find any evidence that bank liquidity creation increases even eight

² Berger and Bouwman (2014) use Hodrick-Prescott (1997) (HP) filter to extract the cyclical component of bank liquidity creation under the assumption that the original series has a trend component and a cyclical component. However, the HP filter is known to be sensitive to the endpoints, and hence we avoid this sensitivity of transformed data by using the log difference of bank liquidity creation, which is standard in the literature (e.g., Næs, Skjeltorp, and Ødegaard 2013, among others).

quarters post-recessions. This relationship between the term-spread and bank liquidity creation (before and after recessions) is not investigated in the existing literature.³

The term-spread-augmented bank liquidity creation models have Pseudo R-squared values of about 16%, 16%, 23% and 32% at one to four quarters forecast horizons, respectively. By contrast, the benchmark term-spread model has Pseudo R-squared values of about 1%, 6%, 19% and 30% for the same forecast horizons. At the four quarters forecast horizon, while the term-spread model assigns a peak average recession probability of approximately 54% for the past three recessions, the on-balance sheet-augmented term-spread model assigns that at about 68%. The recession probability estimates at the four quarter forecast horizon are shown in Figure 2 for a visual comparison. Out-of-sample results further show that our models outperform the Survey of Professional Forecasters' estimates of recession probabilities at higher (two to four quarters) forecast horizons.

Our findings contribute to two strands of the literature. Since Bagehot (1873), the importance of banking to spur economic development and future growth has been debated. The connection between the components of bank liquidity creation and economic growth has both theoretically and empirically argued in the literature (e.g., Bencivenga and Smith 1991; Boot,

Greenbaum and Thakor 1993; Jayaratne and Strahan 1996; Bernanke and Blinder 1988; Kashyap, Rajan and Stein 2002). Our study contributes to this strand of the literature by showing that lower bank liquidity creation leads to recessions. The Levine (1991) model shows that liquid stock markets accelerate growth by allowing investors to trade ownership of firms without disturbing such firms' productive ability. By conducting a cross-country analysis, Levine and Zervos (1993) empirically support the view that liquid stock market and bank loans are important determinants of economic development. However, in this paper, we show that stock market liquidity has limited forecasting power for recessions when we control for bank liquidity creation. Nevertheless, our findings strengthen the view that bank activities and economic growth are related.

The relationship between an inverted Treasury yield curve and recessions is widely investigated in the literature.⁴ Estrella and Mishkin (1996, 1998) confirm that the term-spread is the single best predictor of recessions at higher forecast horizons. Rudebusch and Williams (2009) show that the enduring power of the term-spread to forecast recessions. Lahiri, Monokroussos, and Zhao (2013) report that the term-spread remains the best predictor.⁵

The link between the above two strands of the literature, while implied, is not empirically tested. The traditional explanation for the recession-forecasting power of the Treasury yield curve is the forward looking information content of the yield curve. An inverted yield curve may reflect future expectations about the states of the economy such as lower future inflation. This paper provides a plausible alternative explanation of the forecasting power of the yield curve.

Our results imply that, when an inversion of the yield curve materializes, banks create less liquidity, thereby ushering in economic contractions.

The findings presented in this paper have important monetary policy implications. *First*, our results suggest that bank on-balance sheet liquidity creation is an important feedback to regulators about the efficacy of the credit tightening policy. We show that such feedback is

³ Estrella and Hardouvelis (1991), among others, investigate the relationship during and up to eight quarters prior to recessions.

⁴ An incomplete list includes Laurent (1988); Harvey (1988, 1989); Stock and Watson (1989); Chen (1991); Estrella and Hardouvelis (1991).

⁵ Erdogan, Bennett and Ozyildirim (2014) show that stock market liquidity is a leading indicator of recessions at one quarter forecast horizon. As discussed earlier, we find stock market liquidity has limited forecasting power for recessions at any four quarters prior to recessions if we control for bank liquidity creation.

available four quarters before recessions. This knowledge, along with other feedback signals such as employment and inflation could be used to smooth out the business cycle by restraining the credit tightening cycle. *Second*, our results suggest that expansionary monetary policy measures during or after recessions come too late to have a real impact on the economy. While the term-spread turns positive right after recessions, possibly because of the loosened monetary policy, banks are reluctant to expand their balance sheet and create more liquidity for five quarters after recessions. *Finally*, we show that policymakers and professional forecasters should place a proper weight on observable variables such as bank liquidity creation when forecasting recessions.

In this paper, we do not investigate how banks manage components of their balance sheet during economic downturns. Future research may investigate whether or how banks shift their assets (e.g., cash, semi-liquid assets and loans) and liabilities (e.g., deposit and non-deposit borrowings) composition before and after recessions.

The paper proceeds as follows. Section 2 describes bank liquidity creation and other data, reports data sources and investigates data characteristics. Sections 3 and 4 presents the main empirical results and conducts robustness checks, respectively. Section 5 discusses monetary policy implications and Section 6 concludes.

2. Data and Sample Construction

The sample under investigation dates from the first quarter of 1984 to the fourth quarter of 2010 since the Federal Deposit Insurance Corporation (FDIC) call report data is only available from 1984.⁶ Since we augment the Estrella and Hardouvelis (1991) Treasury term-spread model with bank liquidity creation measures, which are described in sub-section 2.1, one of our primary predictor variables is the term-spread (TERM). TERM is computed as the difference between the yields on the 3-month Treasury-bill and the 10-year Treasury bond index.

We further use real GDP, stock market returns (RET), stock market volatility (VOL) and the Federal funds rate (FED) as other predictors as is standard in the literature (e.g., Estrella and Mishkin 1998). Stock market variables are computed using all NYSE stocks. Since the literature finds that asset market liquidity and credit-spreads are important indicators for bank liquidity creation, we use those variables as controls. We obtain the Moody's corporate AAA and BAA rated bond indices yield data to compute credit-spreads (CREDIT), the difference between the yields on 10 year AAA and BAA rated corporate bonds. Asset market liquidity measures are described in sub-section 2.2.

We compare the estimates of recession probabilities of our models with that of the Survey of Professional Forecasters' (SPF), and hence we use the SPF estimates in the analysis. Every quarter the SPF asks its participants to provide estimates of the probability of negative real GDP for the current and next four quarters.

Unless noted otherwise, all data are collected from the U.S. Federal Reserve Bank. The Treasury bonds and stocks trading data such as bid-ask spreads are obtained from the CRSP (Center for Research in Security Prices). The GDP and inflation data is obtained from the U.S. Bureau of Economic Analysis.

⁶ The related literature (see, e.g., Haubrich and Dombrosky 1996; Rudebusch and Williams 2009) argues for recent data for reasons, such as lowered inflation expectations in the recent years, to investigate the relationship between recessions and the term-spread.

2.1. Bank Liquidity Creation

Bank liquidity creation (Berger and Bouwman 2009) is computed for almost all commercial banks in the U.S. using the call reports data from the FDIC. We obtain the bank liquidity creation data of individual banks from Christa Bouwman's website.⁷ We use CATFAT and CATNONFAT as preferred liquidity creation measures, where we keep the description of liquidity creation variables as in their paper. CATFAT is the weighted sum of bank on-balance sheet (loans, deposits and equity etc.) and off-balance sheet (standby letter of credits etc.) variables, where weights are assigned based on the liquidity and location (whether on- or off-balance sheet) of each item; CATNONFAT only accounts for bank on-balance sheet items. We further investigate bank off-balance sheet activities and denote this variable as OFFBALANCE since the literature argues that banks may create more off-balance sheet liquidity before recessions. Following Berger and Bouwman (2014), we compute an aggregate measure of bank liquidity creation and Figure 1 graphically presents bank liquidity creation measures. We alternatively investigate CATNONFAT, OFFBALANCE and CATFAT to identify the variable that best forecasts recessions.

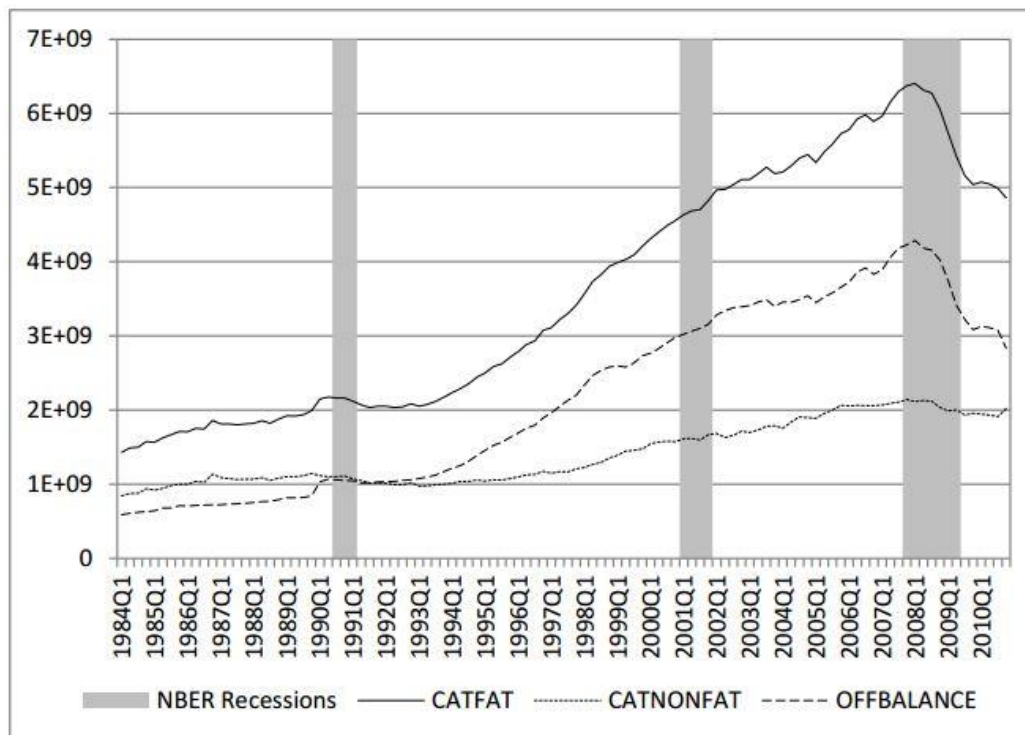


Figure 1 Bank On- and Off-balance Sheet Liquidity Creation

Figure 1 plots bank liquidity creation variables (in US\$) for the U.S. banks. The variables are CATFAT: aggregate bank liquidity creation measure that includes both bank on- and off-balance sheet activities; CATNONFAT: bank on-balance sheet liquidity creation measure that includes bank on-balance sheet activities; OFFBALANCE: bank off-balance sheet liquidity creation measure includes bank off-balance sheet activities.

Berger and Bouwman (2009) do not use the liquidity creation measure by bank loan maturity or the 'mat' measure. Instead, they focus on the 'cat' measure or liquidity creation by bank loan category. There are important reasons for this preference of the 'cat' measure over the 'mat' measure: 1) business loans, while have short maturity, they are not as liquid, and hence maturity based measurements may not capture bank liquidity creation; 2) the 'mat' measure does not include off-balance sheet items or 'fat', and hence 'mat' measure is not consistent with the literature (e.g., Holmstrom and Tirole 1998, Kashyap, Rajan and Stein 2002). In

⁷ We sincerely thank Christa Bouwman for providing the data.

essence, the ‘mat’ measure of Berger and Bouwman (2009) becomes the LT gap measure of Deep and Schaefer (2004).

2.2. Asset Market Liquidity

Chatterjee (2015) shows that asset market liquidity measured by both the Treasury bond and stock market liquidity explains bank liquidity creation. In particular, it is shown that illiquidity of off-the-run T-bills of short-maturity has a higher impact on bank on-balance sheet liquidity creation, and stock market illiquidity computed by Amihud measure (Amihud 2002) explains both on- and off-balance sheet liquidity creations. As a result, we control for asset market liquidity to test the forecasting power of bank liquidity creation.

Stock Market Illiquidity Measure

The Amihud’s illiquidity ratio (ILR) measure is based on the price impact to the order flow and is calculated as the ratio of the price movement to the trading volume of a stock and is defined as:

$$ILR_{i,t} = \frac{1}{D_{i,t}} \sum_{d=1}^{D_{i,t}} |R_{i,d,t}| / VOL_{i,d,t} \quad (1)$$

where $|R_{i,d,t}|$ and $VOL_{i,d,t}$ are absolute returns, the dollar volume of security i on date d , respectively and $D_{i,t}$ is the number of days over which ILR is calculated. It is customary to multiply ILR by 10^6 . Consistent with the literature (e.g., Amihud 2002), we consider stocks that have share prices of more than \$5 and less than \$1000; additionally stocks must be traded for 20 days in a month to be included in the sample. We first calculate the liquidity of each stock based on the ILR proxy. Next, we calculate the equally weighted quarterly average liquidity of all NYSE stocks to get a measure of stock market liquidity, which we denote as ILR. Note that the measure is a proxy for market illiquidity.

Bond Illiquidity Measure

We use off-the-run illiquidity (referred to as OFFSHORT) measure of T-bills with maturities up to one year for the investigation.⁸ Following the literature (e.g., Goyenko and Ukhov 2009), the quoted spread of T-bills is used to measure bond illiquidity. The quoted spread of each bond of specific maturity is calculated daily and the equally-weighted average over each quarter is computed as follows:

$$QS_{i,t} = \frac{1}{D_{i,t}} \sum_{d=1}^{D_{i,t}} \frac{(ASK-BID)_{i,d,t}}{0.5(ASK+BID)_{i,d,t}} \quad (2)$$

where ‘i’ in the above equation is a bond of specific maturity.

We conduct ADF (Augmented Dickey-Fuller, 1979) unit-root tests in conjunction with KPPS (Kwiatkowski et al., 1992) stationarity tests to ascertain that the variables are stationary. Variables that are transformed to attain stationarity are reported with a prefix ‘d’. For example, dCATFAT, and dGDP are the log first difference of CATFAT and real GDP.

⁸ Once a bond of certain maturity is issued, it is on-the-run and older bonds of the same maturity become off-the-run. We investigate but do not report the results for T-bonds of higher maturities for parsimony since the results show higher maturity T-bonds have no information about recessions; the results are available on request.

Table 1 Summary Statistics

Panel A: Summary Statistics											
	CATNONFAT	OFFBALANCE	CATFAT	dCATFAT	dCATNONFAT	dOFFBALANCE	TERM				
	(US\$ Trillion)										
Mean	1.41	2.19	3.59	0.01	0.01	0.01	1.92				
Median	1.17	2.13	3.26	0.01	0.01	0.01	1.95				
Maximum	2.14	4.29	6.40	0.08	0.10	0.20	3.70				
Minimum	0.84	0.61	1.43	-0.06	-0.05	-0.09	-0.45				
Std. Dev.	0.42	1.22	1.62	0.02	0.02	0.03	1.15				
Observations	108	108	108	107	107	107	108				

Panel B: Pairwise Correlation Coefficients											
	RECESSION	dCATFAT	dCATNONFAT	dOFFBALANCE	TERM	FED	CREDIT	RET	VOL	dILR	dOFFSHORT
dCATFAT	-0.40										
dCATNONFAT	-0.19	0.63									
dOFFBALANCE	-0.37	0.83	0.12								
TERM	0.10	-0.32	-0.15	-0.29							
FED	-0.22	0.35	0.08	0.38	-0.42						
CREDIT	0.51	-0.53	-0.19	-0.52	0.33	-0.17					
RET	-0.09	-0.07	0.06	-0.09	0.08	-0.03	-0.08				
VOL	0.44	-0.31	-0.15	-0.29	0.06	-0.21	0.57	-0.46			
dILR	0.11	0.15	0.06	0.16	-0.08	0.07	0.07	-0.50	0.43		
dOFFSHORT	0.17	-0.23	-0.10	-0.22	0.11	-0.15	0.17	0.13	0.11	0.05	
dGDP	-0.65	0.42	0.29	0.35	0.03	0.22	-0.53	0.18	-0.44	-0.08	-0.17

Panel C: Bank Liquidity Creation Auto-correlation Structure			
	Lag 1	Lag 2	Lag 3
dCATFAT	0.12	0.26	0.00
dCATNONFAT	-0.13	0.10	0.13
dOFFBALANCE	0.25	0.03	-0.00

Table 1 Panel A shows the sample summary statistics for two important variables: liquidity creation measures and the term-spread. Table 1 Panel B presents the pairwise correlation among the variables of interests. The correlation analysis shows that bank liquidity creation growth measures are negatively correlated to recessions. We further observe that aggregate bank liquidity creation growth and real GDP are positively related and this correlation is consistent with the Berger and Sedunov (2015) results. While the contemporaneous correlation results may not hold in predictive probit regressions, the correlation analysis highlights the relationship between bank liquidity creation growth and recessions that we expect to see. Table 1 Panel C further shows that bank liquidity creation growth variables have low auto-correlations.

3. In-sample Forecasting of Recessions with Bank Liquidity Creation

Following Estrella and Hardouvelis (1991) and Estrella and Mishkin (1995), we estimate the probability of recessions using the following probit model:

$$(X_t = 1) = \Phi(\alpha + \beta * TERM_{t-l} + \gamma * V_{t-l}) \quad (3)$$

where $X_t = 1$ if the economy is in the NBER recession quarters and '0' otherwise, TERM is the term-spread, V is a vector of augmenting variables that includes bank liquidity creation etc. and

l is the number of lags used for the estimation. We evaluate the model performance using the Pseudo R-squared values.

Table 2 In-sample Probit Estimates of Recessions with Bank Liquidity Creation

Panel A: Bank liquidity creation, the Treasury Term-Spread and Prediction of Recessions: Excluding the recent Crisis (1984-2002 Sub-sample)								
	One-Quarter		Two-Quarters		Three-Quarters		Four-Quarters	
TERM	-0.52 (-3.01)***	-0.64 (-3.11)***	-0.95 (-3.07)***	-1.37 (-2.97)***	-2.32 (-3.52)***	-3.01 (-3.74)***	-3.41 (-3.11)***	-4.59 (-3.06)***
dCATNONFAT		-17.46 (-2.24)***		-35.02 (-2.88)***		-41.04 (-2.50)***		-44.58 (-2.03)**
Pseudo R-Sq.	0.12	0.17	0.27	0.41	0.52	0.62	0.61	0.70
TERM		-0.66 (-3.02)***		-0.91 (-2.84)***		-2.63 (-2.70)***		-6.87 (-2.06)**
dOFFBALANCE		-28.17 (-2.28)***		6.24 (1.02)		14.97 (2.83)***		22.87 (2.96)***
Pseudo R-Sq.		0.22		0.29		0.59		0.74
TERM		-0.79 (-3.05)***		-0.98 (-3.15)***		-2.42 (-2.81)***		-6.22 (-2.24)***
dCATFAT		-35.71 (-3.13)***		-5.16 (-0.31)		14.99 (0.74)		46.52 (1.92)**
Pseudo R-Sq.		0.24		0.27		0.53		0.69
Panel B: Bank liquidity creation, the Treasury Term-Spread and Prediction of Recessions: Full Sample (1984-2010)								
	One-Quarter		Two-Quarters		Three-Quarters		Four-Quarters	
TERM	-0.13 (-1.17)	-0.22 (-1.99)***	-0.33 (-2.47)***	-0.45 (-3.07)***	-0.61 (-3.50)	-0.68 (-3.41)***	-0.88 (-3.38)***	-0.95 (-3.29)***
dCATNONFAT		-17.57 (-2.73)***		-21.81 (-2.86)***		-14.46 (-1.99)**		-14.71 (-1.74)*
Pseudo R-Sq.	0.01	0.07	0.06	0.16	0.19	0.23	0.30	0.32
TERM		-0.31 (-2.61)***		-0.31 (-2.44)***		-0.57 (-3.34)***		-0.84 (-3.22)***
dOFFBALANCE		-20.24 (-3.12)***		0.22 (0.03)		4.42 (0.78)		-14.71 (0.69)
Pseudo R-Sq.		0.13		0.06		0.19		0.32
TERM		-0.37 (-2.88)***		-0.41 (-3.17)***		-0.62 (-3.72)***		-0.88 (-3.56)***
dCATFAT		-28.81 (-4.03)***		-11.08 (-1.17)		-2.01 (-0.21)		4.24 (-0.09)
Pseudo R-Sq.		0.16		0.09		0.19		0.30

$$^9 \text{Pseudo } R^2 = 1 - \left[\frac{\log(L_u)}{\log(L_c)} \right]^{-\left(\frac{2}{n}\right) \log(L_c)}$$

where L_u is the likelihood of the full model and L_c is the likelihood of the intercept only model.

Since the 2007-2009 recession is viewed as “the great recession”, to understand the dynamics between bank liquidity creation and the recent recession, we conduct our studies using the full sample of 1984:Q1 to 2010:Q4 and a sub-sample from 1984:Q1 to 2002:Q4, which includes both the 1990-1991 and 2001 recessions, but not the 2007-2009 recession. In Table 2, we present the coefficient estimates of Equation (3) with different measures of bank liquidity creation for up to four quarters prior to recessions.

First, we present the results for the sub-sample in Table 2 Panel A, where predictor variables of interests are bank on-balance sheet liquidity creation growth (dCATNONFAT) and off-balance sheet liquidity creation growth (dOFFBALANCE) and bank aggregate liquidity creation growth (dCATFAT). Next, we present the results for dCATNONFAT, dOFFBALANCE and dCATFAT for the full sample in Table 2 Panel B. We restrict our

investigation to four quarters before recessions for two reasons. First, the term-spread is shown to have the best performance at that forecast horizon (e.g., Estrella and Hardouvelis 1991). Second, we do not find bank liquidity creation variables have robust predictive power at forecast horizons higher than four quarters.

Table 2 Panel A results show that TERM is an important predictor for each quarter for a four quarters forecast horizon. These results conform to the literature (Rudebusch and Williams 2009; Lahiri, Monokroussos, and Zhao 2013) results that enduring power of TERM as a predictor for recessions persists. The negative signs of the coefficient of dCATNONFAT imply that banks create less liquidity through on-balance sheet activities in all four quarters prior to recessions and the results are statistically significant at least at the 10% level. At each forecast horizon, we find dCATNONFAT-augmented models have higher Pseudo R-squared values relative to that of the benchmark TERM model.

We further observe that dOFFBALANCE is positively (and statistically significant at the 1% level) related to recessions at four and three quarters forecast horizons. However, one quarter prior to recessions, dOFFBALANCE is negatively related to recessions at the 1% level of significance. Thus, we find some evidence that, while bank off-balance sheet liquidity creation compensate for the on-balance sheet liquidity creation in the third and fourth quarters prior to recessions. The existing literature argues that prior to recessions banks create liquidity through the off-balance sheet activities (e.g., Thakor 2005) and we find some evidence to that argument. Eventually, at the one quarter forecast horizon, off-balance sheet liquidity creation catches up with that of on-balance sheet liquidity creation and becomes negative.

We next investigate the relationship between aggregate bank liquidity creation and recessions. Four quarters prior to recessions, the results show that dCATFAT is positively and significantly (at the 5% level of significance) related to recessions. This result suggests that bank off-balance sheet liquidity creation rises more than the fall in the on-balance sheet liquidity creation. For two and three quarters forecast horizons, dCATFAT has no predictive power for recessions. However, for a one quarter forecast horizon, the coefficient estimate of dCATFAT is statistically significant at the 1% level. The negative sign of dCATFAT implies that bank aggregate liquidity creation falls at about one quarter prior to recessions and the result is consistent with the results reported earlier that both on- and off-balance sheet liquidity creation falls one quarter prior to recessions. The overall evidence thus suggests that some point between four and one quarters before recessions, bank aggregate liquidity creation switches from positive to negative since bank off-balance sheet liquidity cannot compensate for the loss of on-balance sheet liquidity creation.

Looking next at Table 2 Panel B, where we present the results for the full sample, we find qualitatively similar results as presented in Table 2 Panel A. dCATNONFAT, bank on-balance sheet liquidity creations falls in all four quarters prior to recessions and the statistical significance of the corresponding coefficients is generally higher than the 10% level and dCATNONFAT-augmented models have higher Pseudo R-squared values than those of the benchmark TERM model. One quarter prior to recessions, both dCATFAT and dOFFBALANCE is inversely related to recessions at the 1% level of significance. However, while the sign of the coefficient of dOFFBALANCE is similar to that of the 1984-2002 sub-sample, none of them are statistically significant at forecast horizons greater than one. Similarly, dCATFAT has no statistically significant relationship at higher forecast horizons indicating off-balance sheet liquidity creation could not compensate for falling on-balance sheet liquidity creation. Since we find that the predictive power of bank on-balance sheet is more robust at higher forecast horizons and the forecasting ability at higher horizons is more valuable for policy measures, we primarily concentrate on dCATNONFAT for the rest of our analysis.

Figure 2 graphically shows the bank on-balance sheet liquidity creation-augmented model implied recession probabilities for a four quarters forecast horizon for the full sample. The figure shows that the dCATNONFAT-augmented model performed better than the benchmark term-spread model for the past three recessions. In particular, the dCATNONFAT-augmented term-spread model did well predicting the 1990-1991 and 2007-2009 recessions, both of which are known to be primarily driven by banking crises.

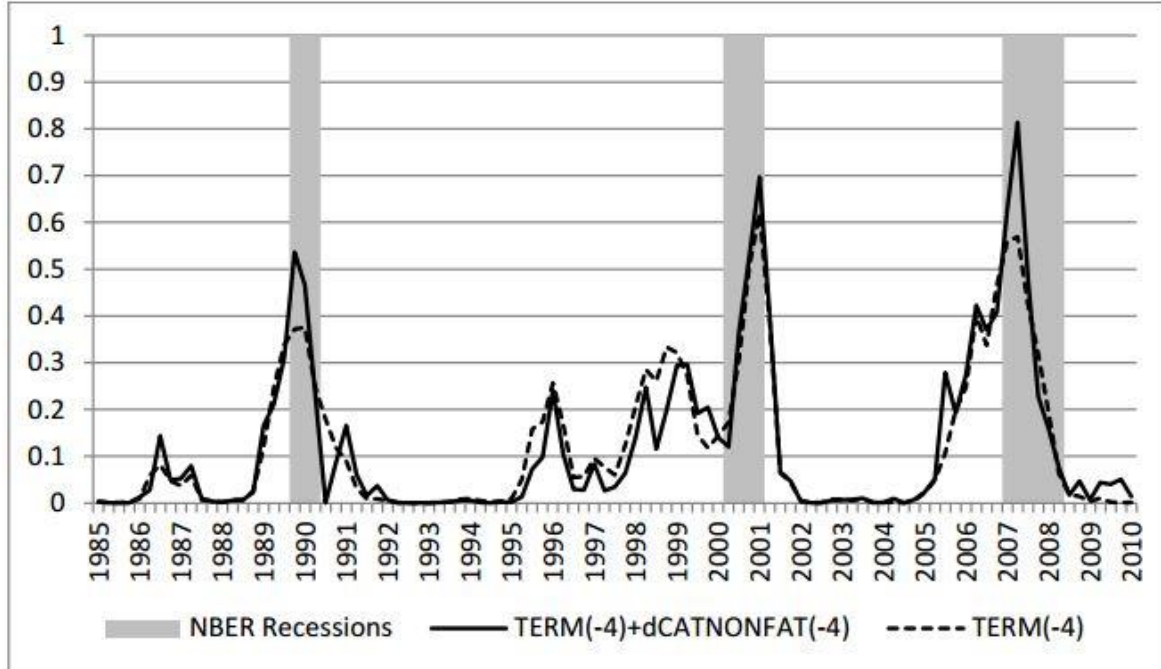


Figure 2 Estimates of Recessions Probabilities at Four Quarters Forecast Horizon

3.1. The Term-Spread and Bank Liquidity Creation

It is well-known that the Treasury term structure is the primary driver of bank on-balance sheet activities since the term structure is one of the determinants of bank short-term borrowing and long-term lending. Thus, for robustness, we first conduct Granger causality tests to investigate whether the term-spread contains information about bank on- and off-balance sheet liquidity creation and *vice versa*. Our focus is on bank on-balance sheet liquidity creation, since the results for this variable is robust to sample selection as shown in Table 2. Next, based on the Granger causality results we use a two-stage approach to estimate robust coefficients.

Table 3 Panel A presents the pairwise Granger causality test results for three variables: TERM, dCATNONFAT and dOFFBALANCE. The optimal lag length for the Granger causality tests is chosen in a vector autoregression (VAR) framework and is based on both the Schwarz information criterion (SIC) and Akaike information criterion (AIC).

Looking from the top in Table 3 Panel A, we show that while TERM Granger causes dCATNONFAT at the 10% level of significance, there is no reverse Granger causality running from dCATNONFAT to TERM. Thus the results suggest that TERM contains information about dCATNONFAT and this is consistent with the fact that the term structure is one of the determinants of bank on-balance sheet activities. By contrast, TERM and dOFFBALANCE do not Granger cause each other. Finally, dCATNONFAT Granger causes dOFFBALANCE at the 5% level of significance, but the reverse is not true.

We next employ a two-stage approach to eliminate any effect of the term-spread on bank liquidity creation may have and this allows for robust coefficient estimates. In the first stage, we estimate the orthogonal (to TERM and other variables) components ($X_t = \theta_t$) of bank

onbalance sheet liquidity creation using Equation (4), where Y is a vector of five variables: TERM, dILR, dOFFSHORT, FED and CREDIT since the last four variables are found to affect bank liquidity creation, c_t is the intercept term, and θ_t is the error term.

$$X_t = c_t + \Phi_t X_{t-1} + \omega_t Y_{t-1} + \theta_t \quad (4)$$

In the second stage, we use the estimates (X_t) of bank liquidity creation to forecast recessions using Equation 3. Table 3 Panel B shows that the results for orthogonalized dCATNONFAT (referred to as dCATNONFAT_hat). The orthoganilization of dCATNONFAT increases the model Pseudo R-squared values at one and two quarters forecast horizon and the Zstatistics for dCATNONFAT_hat is higher than that of dCATNONFAT. However, the results are qualitatively similar to our earlier results and do not change our main conclusion that bank onbalance sheet liquidity creation is an important predictor for recessions. Given the slight variation of the coefficient estimates and Z-statistics, for the rest of the analysis we use the orthogonalized version of bank liquidity creation variables.

Table 3 The Term Structure and Bank On-balance Sheet Liquidity Creation

Panel A: Pairwise Granger Causality of Bank on- and Off-balance sheet Liquidity Creation Growth and the term-spread		
Null Hypothesis:	F-Statistic	p-value
TERM does not Granger Cause dCATNONFAT	2.99	0.09*
dCATNONFAT does not Granger Cause TERM	2.38	0.13
TERM does not Granger Cause dOFFBALANCE	2.37	0.13
dOFFBALANCE does not Granger Cause TERM	2.40	0.12
dOFFBALANCE does not Granger Cause dCATNONFAT	1.90	0.17
dCATNONFAT does not Granger Cause dOFFBALANCE	5.05	0.03**

Table 4 Panel B: Orthogonalized Bank on-balance sheet liquidity creation and the Treasury Term-Spread: Full Sample (1984-2010)				
	One-Quarter	Two-Quarters	Three-Quarters	Four-Quarters
TERM	-0.17 (-1.58)	-0.41 (-2.82)***	-0.65 (-3.33)***	-0.92 (-3.27)***
dCATNONFAT_hat	-19.76 (-3.02)***	-24.78 (-3.18)***	-16.53 (-2.25)***	-16.41 (-1.93)**
Pseudo R-Sq.	0.09	0.17	0.23	0.33

3.2. Two-stage Probit Models with Additional Control Variables

In this section, we investigate whether two-stage method described in the previous section with additional controls has any effect on the forecasting power of bank liquidity creation. Thus, bank liquidity creation variables are orthogonalized version of bank liquidity creation variables: dCATNONFAT_hat, dOFFBALANCE_hat and dCATFAT_hat computed using Equation (4). We use a set of control variables in this specification. Among other control variables, we include real GDP since lags of it in the specification reduces endogeneity issues that may exist between the states of the economy and bank liquidity creation.⁹ The results for the extended probit models are presented in Table 4.

⁹ While Chatterjee (2015) shows that real GDP has no effect on bank liquidity creation after controlling for asset market liquidity and credit spreads, we thank an anonymous seminar participant for suggesting the inclusion of real GDP in our analysis. The inclusion of real GDP is further consistent with the related literature (e.g., Estrella and Hardouvelis 1991). While both TERM and bank liquidity creation measures may have endogenous relationship with recessions, especially during recession quarters, for a four quarters prediction horizon (and

Table 4 Two-Stage Probit Estimates of Recessions with Extended Models

Aggregate Bank Liquidity Creation, Asset Market Liquidity, the Treasury Term-Spread and Recessions: Full Sample (1984-2010)							
	1-Quarter			2-Quarters	3-Quarters	4-Quarters	
TERM	-0.42 (-2.58)***	-0.22 (-1.38)	-0.35 (-2.34)***	-0.58 (-2.46)***	-0.75 (-3.07)***	-0.96 (-3.48)***	-1.05 (-3.07)***
dCATFAT_hat	-36.75 (-3.46)***					-4.36 (-0.32)	
dCATNONFAT_hat		-9.54 (-1.73)*		-20.70 (-2.20)***	-12.05 (-1.70)*		-19.66 (-2.21)***
dOFFBALANCE_hat			-32.16 (-3.03)***				
dGDP	-127.11 (-2.14)***	-116.56 (-1.92)*	-147.77 (-2.61)***	-34.09 (-0.74)	-12.97 (-0.34)	27.48 (0.60)	38.06 (0.92)
RET	-2.07 (-0.75)	-1.44 (-0.54)	-2.59 (-0.87)	-1.53 (-0.52)	-3.12 (-1.28)	-4.52 (-1.63)	-3.91 (-1.36)
VOL	87.84 (1.93)*	102.76 (2.23)***	73.80 (1.66)*	72.71 (1.52)	13.69 (0.39)	-10.59 (-0.27)	-4.09 (-0.12)
FED	-0.05 (-0.67)	-0.12 (-1.35)	-0.03 (-0.43)	-0.12 (-1.34)	-0.11 (-1.06)	-0.07 (-0.64)	-0.05 (-0.56)
CREDIT	0.68 (0.59)	0.78 (1.00)	-0.53 (-0.38)	0.35 (0.47)	1.99 (1.12)	7.40 (2.03)**	5.24 (1.51)
dILR	1.01 (0.67)	0.18 (0.12)	1.15 (0.81)	1.26 (0.73)	0.92 (0.54)	1.16 (0.57)	1.29 (0.66)
dOFFSHORT	-3.87 (-1.52)	-2.86 (-1.19)	-4.55 (-1.64)	-2.70 (-1.12)	-1.05 (-0.39)	2.86 (1.29)	3.48 (1.58)
Pseudo R-Sq.	0.45	0.37	0.47	0.34	0.34	0.38	0.41

Looking from the left, for a one quarter forecast horizon, it is shown that dCATFAT_hat, dCATNONFAT_hat and dOFFBALANCE_hat are negatively related to recessions even after we control for important predictor variables such as real GDP, RET and VOL, etc. We find that real

GDP is an important predictor at shorter forecast horizons and this is not surprising since the NBER recessions are determined by the real negative GDP and is consistent with the literature (Estrella and Hardouvelis 1991). However, we further observe that VOL and CREDIT have some predictive power for recessions, but those two variables are not robust predictors at each forecast horizon.

For a two, three and four quarters forecast horizons, dCATNONFAT_hat is negatively related to recessions and the results conform to those of Table 2. The results for dCATFAT_hat and dOFFBALANCE_hat are similar to the estimates presented in Table 2, and hence except for the four quarters prediction horizon of dCATFAT_hat, the results are not reported. Thus, the overall results with a larger set of control variables show that bank liquidity creation, specifically bank on-balance sheet liquidity creation, is an important predictor for recessions.

4. Robustness Checks

This section conducts robustness checks of the results presented earlier. First, we investigate the relationship between alternative measures of bank liquidity creation and recessions. Next, we conduct out-of-sample tests to ascertain that in-sample results hold.

in a probit framework) we believe such endogeneity, if any, is minimal. Importantly, as in Estrella and Hardouvelis (1991) we are interested in evaluating the recession-forecasting power of bank liquidity creation.

4.1. Alternative Measures of Bank Liquidity Creation

Berger and Bouwman (2009) provide alternative measures of bank liquidity creation and we conduct robustness checks with this measure. In the alternative measures, off-balance sheet activities are computed differently.

Table 5 Predicting Recessions with Alternative Measures of Bank liquidity Creation

Alternative Measures of Bank liquidity creation, the Treasury Term-Spread and Recessions: Excluding the recent Crisis (1984-2002 Sub-sample)				
	One-Quarter	Two-Quarters	Three-Quarters	Four-Quarters
TERM	-0.56 (-2.98)***	-1.14 (-2.76)***	-2.64 (-3.88)***	-3.86 (-3.09)***
dCATNONFATSECADJ	-13.52 (-1.99)**	-25.35 (-2.59)***	-27.98 (-2.14)**	-19.19 (-2.04)**
Pseudo R-Sq.	0.16	0.36	0.58	0.64
TERM	-0.54 (-3.28)***	-0.75 (-3.01)***	-2.55 (-2.34)***	-6.87 (-2.06)**
dOFFBALANCESECADJ	-27.39 (-2.15)***	6.83 (1.10)	16.56 (3.01)***	22.87 (2.96)***
Pseudo R-Sq.	0.22	0.29	0.59	0.73
TERM	-0.75 (-3.03)***	-1.04 (-3.07)***	-2.36 (-3.00)***	-7.92 (-2.40)***
dCATFATSECADJ	-34.45 (-2.98)***	-13.30 (-0.80)	11.15 (0.40)	94.43 (1.98)*
Pseudo R-Sq.	0.23	0.28	0.52	0.70

For example, while CATFAT uses *available* loan commitments and standby letters of credits, CATFATSECADJ (an alternative measure of CATFAT) considers the *likelihood* of usage of loan commitments and standby letters of credits. The reason for this adjustment is that customers may not fully drawdown available loan commitments and standby letters of credit. In Table 5, we present the results for alternative measures of bank liquidity creation and the corresponding forecasting variables are dCATFATSECADJ, dCATNONFATSECADJ and dOFFBALANCESECADJ for the 1984-2002 sub-sample. We find that alternative measures of bank liquidity creation have similar forecasting power as our preferred measure of bank liquidity creation: dCATFAT, dCATNONFAT and dOFFBALANCE. Unreported results for the full sample conform to our previous conclusions drawn from Table 2 Panel B.

4.2. Out-of-Sample Tests

In this section, we conduct out-of-sample tests to verify that the in-sample results that bank liquidity creation contain information about future recessions hold out-of-sample. In addition to comparing our models to the benchmark term-spread model, we investigate how estimates of recession probabilities of our models compare to the SPF estimates. First, we discuss a short description of the out-of-sample forecasts evaluation methodologies. Next, we present the out-of-sample test results.

We use 1984:Q1-1991:Q4 data for estimation, which includes at least one of the recessions, and then predict the recession probabilities for 1992:Q1 through 2010:Q4. Following Rudebusch and Williams (2009), we use MAE (mean absolute error) and RMSE (root mean squared error) as performance measures.¹⁰ We use the Diebold and Mariano (Diebold and

¹⁰ Rudebusch and Williams (2009) also use log probability score (LPS) as an alternative evaluation method. However, the authors show that at forecast horizons greater than one quarter, three evaluation methods produce

Mariano 1995) or the DM-statistics to test for equal MAEs. Since the DM-statistics is not available for the RMSE loss function, we test statistical significance for equal MSEs. The loss differentials at a horizon h for the above two loss functions are as follows:

$$d(MAE)_t = |(error1)_{t|t-h}| - |(error2)_{t|t-h}| \quad (5)$$

$$diff(MSE)_t = (error1)_{t|t-h}^2 - (error2)_{t|t-h}^2 \quad (6)$$

where *error* is the forecast error of the two competing models 1 and 2. Following Rudebusch and Williams (2009), we regress the loss differential on a constant, and test the resulting t -statistics for a zero coefficient and reject the null that models have the same MAE or RMSE based on the differentials with HAC corrections.

Out-of-Sample Performance

First, we test whether bank liquidity creation adds to the predictive power of the term-spread for up to four quarters forecast horizons. That is, we test the out-of-sample performances for the insample results presented in Tables 2 and 4. The corresponding out-of-sample results are presented in Table 6.

Looking at Table 6 from the top, we present MAE and RMSE values of the baseline term-spread model, the term-spread-augmented bank liquidity creation models, the SPF estimates, and the term-spread-augmented extended models, respectively. From the left we progressively present the out-of-sample results for one to four quarters forecast horizons. We show the results for models that are comparable to the term-spread model and the SPF estimates for brevity. At each forecast horizon, bold MAE/RMSE represents that the corresponding model has higher statistically significant (at least at the 10% level) forecast errors than that of the lowest MAE/RMSE model.

Table 6 Out-of-Sample Tests

Panel A: Forecasting Recessions by Bank Liquidity Creation									
Estimation Sample		1984:Q1-1991:Q4							
Forecasts for 1992:Q1-2010:Q4		One-quarter		Two-quarters		Three-quarters		Four-quarters	
Model	Predictor Variables	MAE	RMSE	MAE	RMSE	MAE	RMSE	MAE	RMSE
Model A	TERM	22.02	35.91	20.97	34.29	18.55	33.03	15.46	33.42
Model B	TERM, dCATFAT_hat	19.18	34.24	21.45	34.19	19.13	33.75	12.47	31.09
Model C	TERM, dCATNONFAT_hat	20.14	34.51	17.77	34.01	15.84	32.82	12.94	32.18
Model D	TERM, dOFFBALANCE_hat	20.22	33.97	20.74	34.02	24.35	46.94	13.11	33.77
Model E	SPF	16.83	23.06	19.91	27.02	22.17	30.22	23.61	32.08
Model F	TERM, dCATFAT_hat, RET, dGDP	11.56	23.73	16.87	29.37	17.24	29.71	16.21	28.68
Model G	TERM, dCATNONFAT_hat, RET, dGDP	9.61	23.78	16.23	30.01	12.89	33.95	11.95	33.61

For a single quarter forecast horizon, based on MAEs and RMSEs, all bank liquidity creation augmented models (Models B through D) perform better than a parsimonious termspread model (Model A). Thus, bank liquidity creation-augmented term-spread models have more information than that of the term-spread model.

Based on MAEs, the SPF estimates (Model E) are better than Models A through D.

similar conclusions. Additionally, the authors argue that forecast horizons greater than one quarter is more important for monetary policy purposes. Thus, we prefer the well understood MAE and RMSE loss functions.

However, Models F and G with the term-spread, bank liquidity creation growth, stock market returns and real GDP as predictors are better than the SPF estimates. Based on RMSEs, the SPF estimates are better than Models A through D. However, the SPF estimates are not statistically different from those of Models F and G. Thus, we show that the SPF one quarter estimates, while better than that of the term-spread model, those estimates are similar to the models that include observable variables such as bank liquidity creation, real GDP and stock market returns.

Looking at two and three quarters forecast horizons, we observe that bank liquidity creation models (Models B through D and Models F and G) forecasts recessions better than both the SPF estimates and a parsimonious term-spread model in terms of forecast accuracy measured by either MAE or RMSE. At the four-quarter forecast horizon, we observe similar results.

Overall, we find that the out-of-sample test results confirm our in-sample findings that bank liquidity creation has information about future recessions that is not captured in the term-spread. The out-of-sample results further show that professional forecasts may not have included observable variables such as the term-spread or bank liquidity creation when forecasting recessions.

5. Monetary Policy Implications

In this section we outline monetary policy implications of our results. First, we investigate the relationship between liquidity creation of banks of different sizes. Next, we investigate the dynamics between bank liquidity creation and the term-spread (both of which on theory should be affected by monetary policy) during and after recessions. Finally, we discuss monetary policy implications.

5.1. Liquidity Creation of Large Banks and Recessions

Since the recent crisis much has been discussed about “too large to fail” banks and their role in the economy. This section investigates the relationship between recessions and liquidity creation of banks of different sizes, where bank size is defined by bank gross total assets, which is bank total assets (call report code RCFD 2170) plus allowance for loan and lease losses (call report code RCFD 3123) and the allocated transfer risk reserve (call report code RCFD 3128), a reserve for certain foreign loans losses. Large, medium and small banks have more than \$3 billion, between \$1 billion-\$3 billion and up to \$1 billion gross total assets, respectively, and bank size as defined is also consistent with the literature (e.g., Berger and Bouwman 2014). Furthermore, bank size is shown to be an important factor in the literature (e.g., Carter and McNulty 2005; Berger and Black 2011).

Table 7 On-balance Sheet Liquidity Creation of Banks of Different Sizes and Recessions

On-balance sheet Liquidity creation of banks of different sizes, the Treasury Term-Spread and Recessions								
Excluding the recent Crisis (1984-2002 Sub-sample)					Full Sample (1984-2010)			
	One-Quarter	Two-Quarters	Three-Quarters	Four-Quarters	One-Quarter	Two-Quarters	Three-Quarters	Four-Quarters
TERM	-0.50 (-3.22)***	-1.10 (-3.14)***	-2.96 (-3.85)***	-4.65 (-3.04)***	-0.23 (-2.13)***	-0.47 (-2.58)***	-0.69 (-3.35)***	-0.97 (-3.71)***
Large-Sized	-14.56 (-2.06)**	-30.48 (-2.78)***	-42.23 (-2.33)***	-43.90 (-1.94)*	-17.92 (-2.82)***	-22.27 (-2.97)***	-14.52 (-2.04)**	-15.35 (-1.89)*
Pseudo R-Sq.	0.13	0.35	0.63	0.71	0.08	0.15	0.22	0.32
TERM	-0.45 (-3.29)***	-0.77 (-3.54)***	-2.07 (-3.47)***	-3.43 (-3.26)***	-0.12 (-0.82)	-0.31 (-2.01)**	-0.59 (-3.09)***	-0.87 (-3.47)***
Mid-Sized	4.47 (0.75)	0.22 (0.03)	-6.21 (-0.51)	-8.12 (-0.56)	0.10 (0.02)	-0.93 (-0.19)	-2.37 (-0.44)	-0.52 (-0.09)
Pseudo R-Sq.	0.09	0.23	0.53	0.64	0.01	0.06	0.19	0.30
TERM	-0.50 (-3.28)***	-0.85 (-3.67)***	-2.13 (-3.38)***	-3.46 (-3.25)***	-0.18 (-1.14)	-0.37 (-2.28)**	-0.63 (-3.16)***	-0.91 (-3.48)***
Small-Sized	5.46 (1.80)*	3.04 (0.73)	-1.99 (-0.33)	-2.33 (-0.34)	3.81 (1.30)	2.94 (1.01)	1.22 (0.39)	1.66 (0.49)
Pseudo R-Sq.	0.14	0.24	0.52	0.63	0.03	0.08	0.19	0.30

In Table 7, we show the relationship between on-balance sheet liquidity creation of banks of different sizes and recessions for the full sample. The results show that on-balance sheet liquidity creation of larger banks rather than that of smaller banks forecast recessions. Thus, our findings suggest that the forecasting power of dCATNONFAT for recessions (see, Table 2 Panel B) is driven by the on-balance sheet liquidity creation of larger banks. The results for off-balance sheet and aggregate liquidity creation of large banks are similar to that for dOFFBALANCE and dCATFAT, and hence those are not reported for parsimony.¹¹ Unreported results for off-balance sheet and aggregate liquidity creation of medium and small banks further show that they do not have any forecasting power for recessions. This set of results are not surprising in that over 90% of bank liquidity creation is attributed to large-sized banks as per the literature (see, e.g., Berger and Bouwman 2009). Therefore, the different policy measures targeted at “too large to fail” banks right after the last financial crisis find some support.

5.2. The Term-spread and bank liquidity creation during and after recessions

The efficacy of monetary policy depends on how it affects bank liquidity creation and monetary policy is generally loosened during recessions/crisis so that banks can create more liquidity. To better understand the dynamics, we next investigate the behavior of the term-spread and bank liquidity creation during and for a period of eight quarters after recessions. We use the following probit model:

$$(X_t = 1) = \Phi(\alpha + \beta * TERM_{t+l} + \gamma * V_{t+l}) \quad (7)$$

where $X_t = 1$ when the economy is in recession or ‘0’ otherwise, TERM is the term-spread, V is one of the bank liquidity creation growth measures, and l varies from 0 to 8. For parsimony, we present the results in Table 8 for $l=0, 1, 3, 5$ and 8.

Table 8 Bank Liquidity Creation During and After Recessions

¹¹ These results and all unreported findings are available from the author.

Bank liquidity creation and the Treasury Term-Spread During and After Recessions										
	Excluding the recent Crisis (1984-2002 Sub-sample)					Full Sample (1984-2010)				
	R-Q	Plus 1	Plus 3	Plus 5	Plus 8	R-Q	Plus 1	Plus 3	Plus 5	Plus 8
TERM	0.14 (1.23)	0.42 (2.94)***	1.00 (3.94)***	1.21 (3.94)***	1.47 (2.45)***	-0.19 (-0.99)	0.18 (1.10)	0.57 (2.83)***	0.95 (3.36)***	1.36 (3.13)***
dCATFAT_hat	-31.90 (-3.18)***	-32.02 (-3.13)***	-25.80 (-2.51)***	-15.00 (-1.57)	0.85 (0.55)	-26.25 (-1.84)***	-32.80 (-3.22)***	-36.12 (-3.16)***	-26.43 (-3.22)***	-3.42 (-0.39)
Pseudo R-Sq.	0.17	0.23	0.32	0.33	0.37	0.10	0.28	0.39	0.37	0.35
TERM	0.14 (1.30)	0.38 (2.93)***	0.97 (3.97)***	1.15 (4.19)***	1.49 (2.45)***	0.12 (1.08)	0.36 (2.83)***	0.97 (3.97)***	1.11 (3.19)***	1.43 (3.23)***
dCATNONFAT_hat	-15.88 (-2.04)***	-17.39 (-2.14)***	-22.16 (-2.50)***	-6.03 (-0.80)	5.24 (0.55)	-15.93 (-2.03)***	-17.42 (-2.15)***	-22.31 (-2.56)***	-6.53 (-1.40)	6.78 (1.19)
Pseudo R-Sq.	0.08	0.15	0.33	0.31	0.38	0.07	0.14	0.33	0.31	0.36
TERM	0.10 (0.91)	0.38 (2.65)***	0.92 (4.16)***	1.16 (4.01)***	1.43 (2.53)***	-0.07 (-0.64)	0.20 (1.35)	0.55 (3.01)***	0.94 (3.52)***	1.37 (3.04)***
dOFFBALANCE_hat	-24.49 (-3.23)***	-24.20 (-3.12)***	-18.28 (-2.07)***	-9.98 (-1.50)	-10.05 (-0.87)	-22.00 (-3.56)***	-22.92 (-3.01)***	-21.93 (-2.93)***	-17.69 (-2.93)***	-5.57 (0.81)
Pseudo R-Sq.	0.15	0.21	0.30	0.32	0.37	0.18	0.26	0.33	0.36	0.36

For the 1984-2002 sub-sample, we find that all three bank liquidity creation measures fall for up to five quarters after recessions. By contrast, the relationship between the term-spread and recessions turns positive approximately one quarter after recessions. The coefficient estimates of TERM keep rising in each five quarters after recessions. The results thus suggest that the Treasury yield curve becomes steeper, possibly because of looser monetary policy around recession quarters. By contrast, bank liquidity creation falls to its lowest level around the third post-recession quarter.

The results for the 1984-2010 sample are similar to those of the 1984-2002 sub-sample for bank on-balance sheet liquidity creation. However, both off-balance sheet and aggregate liquidity creation keep falling beyond five quarters after recessions. At eight quarters after recessions with an upward sloping yield curve, we do not find any evidence that bank liquidity creation expands.

5.3. Monetary Policy Implications

One of the goals of monetary policy is to provide financial stability and our findings have important policy implications. First, if contractionary policy is designed to fight against the overexpansion of the economy, our results show that, when the term-spread contracts with tighter such policy, banks, particularly large banks, create less liquidity through on-balance sheet activities. Thus, the results imply that bank on-balance sheet activities before recessions are an important input to regulators concerning the efficacy of the credit tightening policy. Particularly, we show that the feedback is available about four quarters before recessions. This knowledge, along with other signals such as employment and inflation could be used to smooth out the business cycle by restricting the credit tightening cycle.

Second, our results show that while the term-spread turns positive right after recessions, possibly because of looser monetary policy, bank liquidity creation continues to fall for approximately five quarters after recessions. The results suggest that expansionary policy measures after recessions come too late to have a real impact on the economy through bank liquidity creation.

Finally, the out-of-sample results in section 4.2. show that the bank liquidity creation augmented term-spread models display better performance at higher forecast horizons. Our

results thus suggest that policymakers and forecasters should place weight on observable variables such as bank liquidity creation when forecasting recessions.

6. Concluding Remarks

Banks create liquidity on the balance sheet and off the balance sheet. Berger and Bouwman (2009) propose a measure of bank liquidity creation that factors in banks' on- and off-balance sheet activities. While measuring bank liquidity creation is important, investigating its impact on bank liquidity creation is central to evaluate the efficacy of monetary policy. It is well-known that monetary policy changes the slope of the Treasury yield curve and bank liquidity creation.

While there is extensive literature on the relationship between the slope of the Treasury yield curve and recessions (e.g., Estrella and Hardouvelis 1991; Estrella and Mishkin 1998), empirical literature on the relationship between bank liquidity creation and recessions is rare. This paper augments the benchmark term-spread model (e.g., Estrella and Hardouvelis 1991) with bank liquidity creation and shows that it contains information about future recessions.

In this paper, while we find evidence that bank on-balance sheet activities contract prior to and after recessions, we do not investigate whether or how banks manage their balance sheet by rebalancing their asset/liability composition during recessions. Future research may investigate how banks shift their cash, liquid assets and loan portfolios prior to recessions. It is further interesting to investigate whether banks change their sources of borrowing (e.g., deposits versus non-deposits) during recessions.

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Management and supervisory board gender diversity as an indicator of financial institutions' profitability in Croatia

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Abstract. The role of women on the labour market is quite significant in terms of economic growth and sustainable development. However, women are still underrepresented in leading positions in companies. This particularly refers to boardroom positions in financial institutions, such as banks and insurance companies, which are traditionally held by men. Given the above, the paper aims to investigate whether board gender diversity was an important driver of banks' and insurance companies' performance in 2014. Board composition variables used in our model include: share of women on supervisory boards (%), share of women on management boards (%), female members on supervisory board dummy variable, female members on management board dummy variable as well as supervisory and management board Blau index. Accounting measures, namely return on assets and return on equity, were used as company profitability variables. In order to investigate the true relationship between board gender diversity and bank/insurance company profitability, authors employed various empirical research methods, namely; correlation, t-test and ordinary least squares (OLS) regression method. The main finding is that there is a statistically positive relationship between the share of women on management boards and the business performance of financial institutions. Moreover, financial institutions with at least one female management board member performed better in terms of both return on assets and return on equity.

Key words: board gender diversity, profitability, financial institutions

1. Introduction

Gender equality in all aspects of life and business has been increasingly attracting the attention of public, scientists, and legislative authorities. Numerous documents, such as Council of Europe Gender Equality Strategy 2014-2017 and European Commission Strategy for equality between women and men 2010-2015, have been adopted to highlight the importance of gender equality as a focus for protection of human rights, functioning of democracy, and respect for the rule of law and economic growth and competitiveness.

As stated in the Opinion on how to overcome occupational segregation by Advisory Committee on Equal Opportunities for Women and Men of the European Commission, women's access to certain occupational sectors is limited, remaining overrepresented in others. Labour market is marked by segregation, especially vertical one that takes place where opportunities for career progression for a particular gender are narrowed. When women have equal chances as men to be socially and politically active, economies and societies thrive, and overall, women's more balanced participation in decision-making contributes to positive transformative processes for societies (Gender Equality Strategy 2014-2017). This is a largely cited statement in many documents dealing with gender equality. For example, International Labour Organization's Report on Women in Business and Management (2015) underlines the

fact that women's presence in the labour market is increasingly significant for economic growth and development at both national and enterprise levels.

In February 2016, the Council of Europe published the 2015 annual report on the implementation of its 2014-2017 Gender Equality Strategy. Although substantial progress has been made, there is still a lot to be done in order to achieve the main goal of the strategy: de facto gender equality. Given the popularity of the issue, it does not come as a surprise that in many countries there has been pressure for government reforms to foster gender diversity in the boardroom. Today, there are only four EU countries where women account for at least 25% of board members, namely: France, Latvia, Finland and Sweden (Global Center for Corporate Governance 2015, p 33.). The situation is particularly worrisome when speaking in terms of financial sector where major gaps remain.

While female representation in the boardroom is beyond dispute for ethical and social reasons, the performance effects of increasing female representation on boards is still rather ambiguous. While some studies have come to the conclusion that women's participation in decision-making is positive for business performance (Lückerath-Rovers, 2011; Barta, Kleiner, & Neumann, 2012), some indicate a negative link (Bøhren & Strøm, 2007; Gallego-Alvarez, Garcia-Sanchez, & Rodrigues-Dominguez, 2010; Francoeur, Labelle, & Sinclair-Desgagne, 2007) or no link at all (Rose, 2007; Randøy, Oxelheim, & Thomsen, 2006).

Given the above it was the authors' intention to examine if board gender diversity in financial institutions in Croatia affects their financial performance. Although, only banks and insurance companies were covered by the analysis, they accounted for almost 80% of total financial intermediaries in 2014, based on assets. Therefore, several empirical approaches were implemented in order to test the hypotheses that the share of women on both management and supervisory boards has a positive impact on financial institutions' profitability in Croatia.

The remainder of the paper is structured as follows. After the literature review given in the second part, section Sample and methodology proceeds with description of data collection, variables and methodology used. Fourth section deals with descriptive statistics analysis while the findings are reported in section 5 and in the final section we conclude with a discussion of our results.

2. Literature review

The volume of academic literature exploring the influence of gender diversity on performance is increasing, but still there is scarce empirical evidence of this relationship in financial sector, especially when insurance companies are involved. Therefore, the selection of papers the authors give in this literature review is based on the fact whether they show positive, negative or no impact on performance.

Lückerath-Rovers (2011) investigated financial performance of 99 Dutch companies that were listed on the Amsterdam Euronext stock exchange on June 30, 2008 while the analysis covered the period 2005–2007. Performance measures used in the study were return on equity (ROE), return on sales (ROS), return on invested capital (ROIC) and total shareholder return (TSR). Control variables employed in the OLS regression analysis includes board size and firm size (natural log of total assets) as well as a dummy variable for companies operating in the financial sector. The results of the analysis suggest that on average the presence of women on the board is a distinctive feature of companies that perform better in terms of ROE.

On the contrary, Bøhren and Strøm (2007) have found that the firm's performance measured by Tobin's Q is higher when, among other things, the board has low gender diversity. Their analysis was conducted using the panel model on the sample of non-financial firms listed on the Oslo Stock Exchange (OSE) at year-end at least once over the period 1989–2002. Rose (2007) investigated the influence of female board representation on firm performance

measured by Tobin's Q. The paper used a sample of listed Danish firms during the period of 1998-2001 in a cross sectional analysis. In spite of the fact that Denmark has achieved a high level of development in terms of gender diversity, the paper did not find any significant link between firm performance and female board representation.

For a thorough investigation of the literature please see; Joecks, Pull, and Vetter (2013), Pletzer, Nikolova, Kedzior, and Voelpel (2015) and Post and Byron (2015).

3. Sample and methodology

3.1 Sample and data collection

Data on assets, profit or loss, equity as well as data on management and supervisory boards on banks was collected from various issues of Banks Bulletin, a regular publication of Croatian National Bank. As for the insurance companies, the majority of data was collected from annual reports available through official corporate web sites and through the Croatian Financial Agency (FINA) web site. In particular, this refers to data on assets, profit or loss and equity as well as data on supervisory boards. Data regarding insurance companies' management board characteristics were taken from annual publications issued by the Croatian Insurance Bureau (HUO).

The initial sample consisted of all banks (a total of 28) and insurance companies (a total of 25) that operated in the Croatian bank/insurance market in 2014. However, since one bank (Jadranska Bank) reported loss, as well as negative equity, it was omitted from the analysis for having a false positive return on equity (ROE). In addition, when initial descriptive statistics data analysis were performed, it turned out that two more banks should be omitted from the sample for data on ROE and return on assets (ROA) was found to be non-normal. In order to make data more normal (which is extremely important when dealing with rather small samples such as this one) we further omitted: Tesla Savings Bank (ROA: -37.75, ROE: -68.87) and Croatian Postal Bank (ROA: -3.66, ROE: -75.23) for those two banks had extreme ROA/ROE values. By eliminating those two banks, ROA and ROE sample variances were reduced by more than 50%. The remaining banks still cover the vast majority of the market (95%). Therefore, the results obtained on basis of selected data should be representative. Finally, our sample comprised 25 banks and 25 insurance companies (reinsurance companies were not taken into consideration), i.e. a total of 50 financial institutions.

3.2. Variables

3.2.1. Dependent variables

Since only a small fraction of financial institutions covered by the analysis is listed on stock exchange, the authors opted for accounting measures of performance following approach by Moscu (2013), de Cabo, Nogues, and Nieto (2009).

Firm's performance is represented by ROA – return on assets and ROE – return on equity variables. ROA ratio is calculated by comparing net profit or loss to total assets, and is expressed as a percentage. ROA indicates how profitable a company is relative to its total assets i. e. it illustrates how well management is employing the company's total assets to make profit. ROE indicator is determined by dividing annual profit or loss after taxes by equity (capital and reserves). It measures a company's profitability by revealing how much profit a company generates with money shareholders have invested.

3.2.2. Independent variables

As proxies of gender diversity of management and supervisory boards we use several measures. The first variable used is the share of women on management board (W_MB),

calculated as the number of female board members divided by the total number of management board members. Using the same principle we also calculated the share of women on supervisory boards; W_SB .

Additionally two dummy variables were calculated; MB_D1 and SB_D1 . Dummy variables take a value of 0 if there are no women on the board (management or supervisory) and 1 otherwise (if there is one or more female board members).

Lastly, Blau index is calculated, as a true measure of board gender diversity for it has been suggested as an optimal measure of diversity to capture variations within a group of people (Miller & Triana, 2009). Blau's index is calculated using the following formula:

$$1 - \sum (p_k^2) \quad (1)$$

where variety can take k possible categories and p represents the proportion of the members in the k -th category. The minimum index value is always zero while the maximum depends on the number of categories of a particular variable. The theoretical maximum can be calculated as: $(K - 1) / K$, where K refers to the number of categories of the particular variable (Biemann & Kearney, 2009). In this case the maximum of Blau's index is 0.5 for there are only two possible categories for the variable gender; male or female. If we assume that 20% of board members are female, and the rest are male, the calculation of the Blau index would be as follows: first, share of female board members is 0.2 which should be squared ($0.2^2=0.04$), and the same should be done with the share of male board members ($0.8^2=0.64$). After that, the sum of the squared shares of male and female members ($0.04+0.64=0.68$) is subtracted from 1 ($1-0.68=0.32$), and the result is Blau index. As the board gender diversity increases, Blau index gets larger; closer to its maximum value; 0.5. It should be noted that if the Blau index value is 0, this means that the board is homogenous in terms of gender, meaning all board members are of the same gender, but it does not tell us if the board members are male or female. On the other hand, if Blau index value is 0.5, this means that both genders are equally (50%: 50%) represented within the board.

Apart from proposed independent variables we also use a set of control variables, specifically: EMP - number of employees (natural logarithm), $SIZE$ - size (natural logarithm of assets) and AGE - number of years operating in the market (natural logarithm). As our preliminary correlation analysis proved, it is logical to assume that the board size increases as the firm grows bigger (in terms of size, number of employees and/or the number of years operating in the market). When boards get bigger this should affect, among other things, board gender diversity, i.e. as the board size increases the likelihood of at least one board member differing in gender also increases.

3.2.3. Methodology

For the purposes of statistical analysis the majority of related studies relied on conventional approaches such as ordinary least squares (OLS) regression and correlation methods. Other than pre mentioned methods, t-test as well as ANOVA – analysis of variance will be employed where possible.

As mentioned earlier, three gender diversity measures will be tested in relation to ROA and ROE as firm performance variables. Given the relatively small size of the sample ($N=50$), we constructed three (3) regression models for the construction of a single regression model with a large number of independent variables that would provide results with no statistical significance. The following models are estimated:

$$Y = \beta_0 + \beta_1 EMP + \beta_2 SIZE + \beta_3 AGE + \beta_4 W_SB + \beta_5 W_MB \quad (2)$$

$$Y = \beta_0 + \beta_1 EMP + \beta_2 SIZE + \beta_3 AGE + \beta_4 SB_D1 + \beta_5 MB_D1 \quad (3)$$

$$Y = \beta_0 + \beta_1 EMP + \beta_2 SIZE + \beta_3 AGE + \beta_4 SB_Blau + \beta_5 MB_Blau \quad (4)$$

where:

Y: dependent variable; ROA, ROE,

EMP: number of employees, ln (control variable),

SIZE: firm assets, ln (control variable),

AGE: number of years operating in the market, ln (control variable),

W_SB: share of women on supervisory boards (%),

W_MB: share of women on management boards (%),

SB_DI: female members on supervisory board dummy variable,

MB_DI: female members on management board dummy variable,

SB_Blau: supervisory board Blau index, and

MB_Blau: management board Blau index.

SPSS statistical software, version 17.0., was used for empirical research.

4. Descriptive statistics

Empirical analysis includes both banks and insurance companies (in the same sample). However, it is the authors' opinion that a detailed descriptive analysis of separate groups could be beneficiary in terms of noticing similarities and/or differences among them.

Looking at financial performance, specifically ROA and ROE, it is obvious that, even though we excluded two extreme cases of negative ROA and ROE, the range of both variables is quite large, especially for insurance companies. This is why the standard deviation is quite large for both (for ROE in particular) highlighting relatively high variances of financial performance indicators round mean value, within both groups.

Comparing bank and insurance company results, a few things can be seen: the minimum size of boards is equal in both samples (2 for management board and 3 for supervisory board) however, the maximum size is grater for banks (7 for managerial and 10 for supervisory board). The share of women on management boards is 36.66% on average in insurance companies and 32.20% on average in banks; with number of board female members ranging from 0 to 2, while the number of male members range from 0 to 4 in insurance companies and from 1 to 6 for banks management boards i.e. there are no bank management boards without at least one male member. If we look at the range of male supervisory board members, it varies from 1 to 7 in insurance companies and from 1 to 10 in banks, meaning that none of the analysed companies has all female supervisory board i.e. the all have at least one male supervisory board member.

Gender structure of management and supervisory boards is quite diverse. When analysing gender diversity descriptive statistics in more detail (based on the data in Appendix I) it is evident that there are over 30% of insurance companies with no female management board members, while the majority (44%) has only one female board member. If we take a closer look at banks, it is evident that there are only 5 (20%) of them with no female management board members, while the majority of bank management boards has just one female member (15 in total or 60%). Women are most underrepresented in bank supervisory boards; the majority, or 52% to be exact, has no female members, and 32% have only one female member. Another interesting fact is worth noting when bank supervisory boards are taken under consideration, the maximum number of female supervisory board members is 3 (only in one bank) while the size of board ranges from 3 to 10 members; with 0.7 average female members and an astonishing average of 4 male members per board.

In addition to previous gender diversity variables, Blau index analysis also indicates higher level of gender diversity in management boards (average value of 0.25 and 0.36), while gender inequality in supervisory boards is lower (more homogenous, i.e. male

overrepresentation) and quite similar among bank and insurance companies supervisory boards (average value of 0.18 and 0.19).

Table 1: Descriptive statistics

Variable	Insurance companies (N=25)				Banks (N=25)			
	min	max	mean	S.D.	min	max	mean	S.D.
ROA	-32,8	8,47	-0,560	7,92	-2,4	1,14	-0,055	0,88
ROE	-52,7	23,34	1,906	16,72	-20,4	8,97	-0,878	7,83
Share of women on Management board (%)	0	100	36,66	33,33	0	66,67	32,20	20,43
Management board female members, number	0	2	0,84	0,75	0	2	1,00	0,62
Management board male members, number	0	4	1,60	1,04	1	6	2,33	1,36
Total number of management board members	2	4	2,44	0,71	2	7	3,33	1,52
Share of women on Supervisory board (%)	0	80	20,81	20,82	0	75	15,20	18,65
Supervisory board female members, number	0	4	1,04	1,02	0	3	0,70	0,82
Supervisory board male members, number	1	7	4,00	1,44	1	10	4,00	1,71
Total number of supervisory board members	3	7	5,04	1,13	3	10	4,70	1,61
Management board female members dummy	0	1	0,64	0,49	0	1	0,81	0,39
Supervisory board female members dummy	0	1	0,68	0,48	0	1	0,52	0,51
Management board Blau index	0	0,5	0,25	0,25	0	0,5	0,36	0,18
Supervisory board Blau index	0	0,5	0,25	0,18	0	0,5	0,19	0,19

5. Empirical research

As our primary interest is not only to show that board gender inequality in Croatian financial sector exists, but how it affects financial performance, we next turn to analysing ROA and ROE in respect to various gender diversity variables.

The first step is to test for correlation between the selected variables. Due to space limitations, we provide the correlation matrix with financial performance indicators and gender diversity variables (control variables excluded). From the correlation matrix (Table 2) a few conclusions can be drawn, the most important being that both ROA and ROE are positively correlated with the share of women on management boards, and ROE positively correlated with management board dummy variable (meaning that firms that have female management board members have, on average, higher ROE values). Correlation coefficients are not very high but are statistically significant at 5% level. Apart from these findings an interesting notion should be made regarding a statistically significant correlation between the share of women on management boards and the share of women on supervisory boards.

Table 2: Correlation matrix

	1.	2.	3.	4.	5.	6.	7.	8.
1. ROE								
2. ROA	0,883***							
3. Share of women on MB	0,291**	0,235*						
4. Share of women on SB	-0,058	-0,046	0,344**					
5. Dummy SB	-0,027	-0,119	0,207	0,751***				
6. Dummy MB	0,315**	0,237	0,780***	0,338**	0,282**			
7. MB Blau index	0,195	0,133	0,487***	0,240	0,252	0,848***		
8. SB Blau index	-0,043	-0,122	0,242	0,829***	0,953***	0,336**	0,330**	

***, **, *, correlation is significant at; 1%, 5%, 10%, respectively

As the correlation matrix indicated, the importance of the share of women on management boards as opposed to supervisory boards, we next turn to generating a clustered bar chart with number of female management board members (ranging from 0 to 2) as grouping variable. The analysis showed that (a total of 14) firms with no female management board members had a negative ROA/ROE average, as opposed to the rest (with 1 or 2 female members) that had positive ROA/ROE average values.

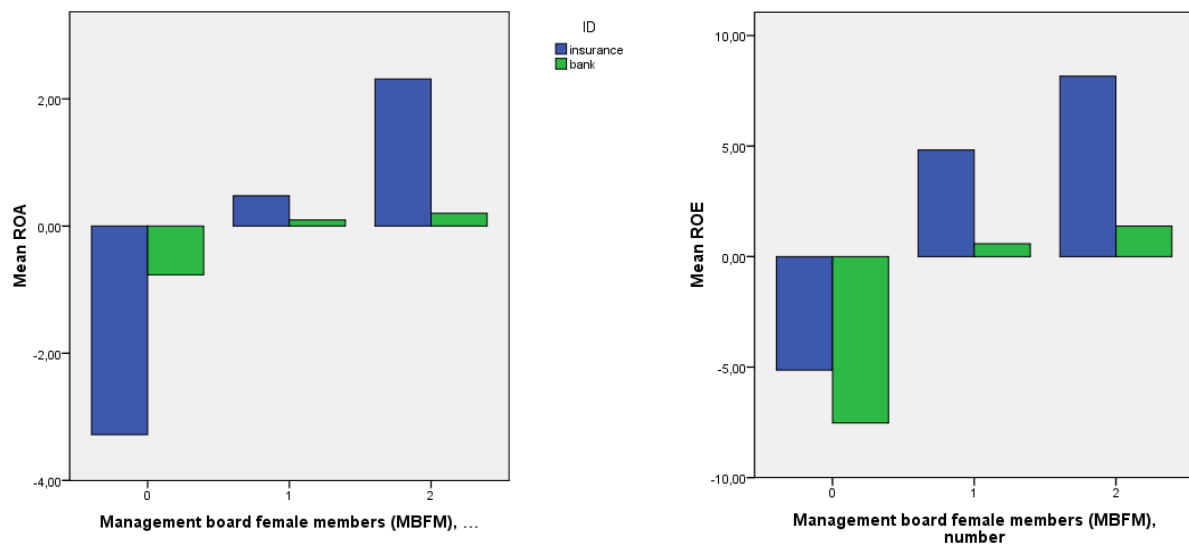


Figure 1: Mean ROA and ROE values; grouping variable: management board female members (number)

Afterwards, an Analysis of variance (ANOVA) was performed as to determine if the ROA/ROE mean difference between these groups was statistically significant. ANOVA analysis can be used if homogeneity of variances assumption is satisfied. The computed Levene statistics in Table 3 indicate that (both for ROA and ROE) variances within the groups, as noted earlier, are too big for ANOVA analysis to be adequately used.

The next step is to analyse if ROA/ROE mean difference between firms that have no female management board members and those who do is statistically significant, as correlation matrix results indicated. MB_D1 is a dichotomous variable with 0 values if there are no female management board members and 1 otherwise, so the appropriate test to employ is independent samples t-test. Independent samples t-test is used to determine if the mean difference between two (independent) groups is statistically significant by comparing average values (means) of selected variables. A mean difference is more likely to be statistically significant; if the difference between group means is large, if the sample size is large (which

is not the case with our samples) and/or if the standard deviation is low (indicating responses are not widely spread out but rather consistently close to average values).

Table 3: Test of homogeneity of variances

	Levene Statistic	Sig.
ROA	4,067	0,023
ROE	4,857	0,012

As group statistics in Table 4 suggest, both ROA and ROE mean is negative (-2.38 and -5.99 respectively) for firms with no female management board members, while positive for others (0.53 and 3.04 respectively).

Table 4: t- test group Statistics

Dummy MB		N	Mean	Std. Deviation	Std. Error Mean
ROA	none	14	-2,384	9,54796	2,5518
	else	36	0,535	2,7117	0,45195
ROE	none	14	-5,988	18,25913	4,87996
	else	36	3,042	9,44465	1,57411

Independent samples t-test results indicate that mean difference for ROA is not statistically significant, while for ROE it is, but at the 10% level. Such results are primarily a consequence of: high variances (high standard deviations) indicating widely spread ROA and ROE values around mean values, as well as rather modest sample size.

Table 5: t-test for Equality of Means

	t	df	Significance (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval	
						Lower	Upper
ROA	-1,126	13,823	0,279	-2,91876	2,59151	-8,48368	2,64616
ROE	-1,761	15,783	0,098	-9,02999	5,12755	-19,9121	1,85212

Finally, we turn to OLS regression analysis. It is important to point out that the expected predictor values of regression coefficients will not be interpreted in the traditional sense. As we have already proven, our data on ROA and ROE show high variability. Also, the sample, though covering almost entire banking and insurance market, is quite small; therefore making predictions about future ROE/ROA values based on gender diversity variables and/or control variable values would be imprudent. The reason we do continue with regression analysis is to double check our previous results, i.e. prove that the share of women on management boards positively influences bank/insurance company performance.

We employed 3 different regression models as presented earlier, or 6 to be precise, for each of them was computed with ROA and ROE as independent variable. The results of our regression analysis, namely regression coefficients (t values in brackets), are given in Table 6, with r squared and model significance data in the bottom of the table.

It should be noted that all of the models have rather low r-square values which is quite expected; in general, the higher the r-squared values are, the better the model fits the data. However, if r-squared value is low but predictors are statistically significant, we can still draw important conclusions about the nature of the connection between the predictor (gender diversity) value and the response value (ROA and ROE). Regardless of the low r-squared, the significant coefficients still indicate the mean change in the response of ROA or ROE for one unit of change in the gender diversity predictor while holding other predictors in the model constant, which is extremely valuable information.

Table 6: Regression analysis summary

	Model 1		Model 2		Model 3	
Variables	ROA	ROE	ROA	ROE	ROA	ROE
Constant	-11,754	-24,467	-6,112	-11,802	-7,585	-15,245
	(-1,624)	(-1,448)	(-0,835)	(-0,686)	(-1,010)	(-0,855)
Number of employees (ln)	-0,754	-0,665	-0,609	-0,245	-0,762	-0,656
	(-0,848)	(-0,320)	(-0,670)	(-0,115)	(-0,817)	(-0,297)
Size (ln assets)	0,550	1,222	-0,023	-0,380	0,250	0,345
	(0,651)	(0,620)	(-0,025)	(-0,179)	(0,272)	(0,158)
Number of years operating in the market (ln)	2,262	2,50	2,885	4,786	2,636	4,136
	(1,299)	(0,615)	(1,612)	(1,138)	(1,422)	(0,941)
Share of women on supervisory boards (%)	-0,190	-0,077				
	(-0,453)	(-0,781)				
Share of women on management boards (%)	0,057*	0,171**				
	(1,906)	(2,444)				
Management board female members dummy			3,469*	10,00**		
			(1,828)	(2,242)		
Supervisory board female members dummy			-1,498	-1,909		
			(-0,888)	(-0,481)		
Supervisory board Blau index					-2,571	-2,828
					(-0,545)	(-0,253)
Management board Blau index					4,238	12,732
					(1,067)	(1,352)
R-squared	0,172	0,167	0,169	0,152	0,127	0,093
Significance	0,127	0,147	0,136	0,186	0,292	0,490

** , *, coefficient is significant at; 5%, 10%, respectively

In all estimated models our control variables (number of employees, size and number of years operating in the market) turned out to be statistically insignificant. Model 1 results double checked our previous results regarding the importance of share of women on management boards. β_5 coefficient estimates indicate a statistically positive relationship between share of women on management boards and company performance (ROA and ROE). Model 2 indicated management board female members dummy as statistically significant for both ROA and ROE. Lastly, model 3 showed Blau index, a measure of gender diversity, as not being relevant to ROA and ROE variability.

To sum up, a few key conclusions can be drawn from our research results:

- ⇒ t-test group statistics suggest that both ROA and ROE means are negative for firms with no female management board members,
- ⇒ independent samples t-test results indicate that mean difference only for ROE is statistically significant, at the 10% level,
- ⇒ regression analysis coefficient estimates indicate a statistically positive relationship between share of women on management boards and company performance (ROA and ROE),
- ⇒ management board female members dummy is statistically significant for both ROA and ROE indicating that financial institutions with at least one or more female members perform better.

6. Concluding remarks

The paper deals with board composition in terms of gender diversity in financial institutions including both banks and insurance companies. Despite the attention it attracts, this issue remains largely unexplored. The authors focus on Croatian banking and insurance industry and investigate whether share of women on supervisory and management boards (%), female representation in supervisory and management board introduced as dummy variable as well as supervisory and management board diversity measured by Blau index influence corporate performance in terms of profitability.

The results of the analysis proved the importance of female participation on management boards in positively influencing financial performance of banks and insurance companies, measured by accounting indicators (both ROA and ROE). However, women are underrepresented in both management and supervisory boards with the problem of gender inequality being most evident in supervisory boards, in banks in particular.

The reasons behind female board underrepresentation are rather complex and range from traditional gender roles to prevalent political and corporate cultures, to name just a few. So the issue of gender equality should be addressed at national level. Unlike some EU members, Croatia has not yet imposed any quotas on the subject.

Given the importance and relevance of the topic under investigation, it might be interesting to extend this research taking into account other financial institutions operating in the Croatian market such as housing savings banks, leasing companies etc.

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Appendix I: The number of insurance companies and banks with N female board members

Management board female members			
N	Insurance companies (% of total)	Banks (% of total)	All (%of total)
0	9 (36%)	5 (20%)	14 (28%)
1	11 (44%)	15(60%)	26 (52%)
2	5 (20%)	5 (20%)	10 (20%)
Total	25 (100%)	25 (100%)	50 (100%)
Supervisory board female members			
N	Insurance companies	Banks	
0	8 (32%)	13 (52%)	21 (42%)
1	11 (44%)	8 (32%)	19 (38%)
2	4 (16%)	3 (12%)	7 (14%)
3	1 (4%)	1 (4%)	2 (4%)
4	1 (4%)	0 (0%)	1 (2%)
Total	25 (100%)	25 (100%)	50 (100%)

The Concept of Economic Efficiency Gains in Assessing the Mergers in the Financial Market

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Abstract. Mergers in the financial market may create premises to increase the efficiency in the sector by improving the quality of the products and services provided, thus reducing production and distribution costs, ensuring risk diversification and improving the quality of management. As a result of efficiency gains, the main beneficiaries are the final consumers. In assessing the merger, a great deal of attention is given to the features of economic efficiency as a result of corporate restructuring, because they can be used as arguments in favor of diminishing the anticompetitive effects on consumers caused by the merger. In this paper, we intend to analyze the concept of economic efficiency in assessing the mergers in the financial market, the methods used to evaluate the economic efficiency gains by the competition authorities, the results of empirical research, and the international practice in this field.

Key words: *competition, efficiency gains, financial market, data envelopment analysis.*

1. Introduction

Competition requires financial institutions to streamline the service delivery and improve the quality of financial products provided. The phenomenon of globalization has been a catalyst for the increasing number of mergers in the financial markets. Among the reasons for financial institutions to merge is to increase efficiency, especially through achieving the synergy effects. If there is a financial synergy, cost of capital should be reduced. Financial economies of scale will take the form of lower transaction costs, better access to financial market and lower capital costs. Another advantage of mergers is linked to the benefits of economies of scope, so inputs can be shared in order to provide a broader spectrum of services. Also, another form of efficiency gains are from the combination of back-office operations, information systems and administrative functions.

Mergers on the financial market that lead to the creation/strengthen of a dominant position are subject to the provisions of competition law and controlled in order to avoid instances of anticompetitive practices. Arguments on efficiency are often claimed in order to authorize an economic concentration. Thus, the analysis of the efficiency gains is an integral part of the merger assessment process in the financial market. In this paper, we intend to analyze the concept of efficiency gains covered by the competition law, methods of efficiency gains analysis in assessing economic concentrations, international practice in this area and assessment of the Moldovan banking system efficiency using Data envelopment analysis.

2. Approaches about efficiency concept in the merger analysis

The goal of the competition law is to protect competition through the most appropriate methods in order to ensure an efficient allocation of resources, which will help to increase market efficiency in a free market economy (Kolasky & Dick, 2003). If there is competition in the market, which is not affected by anti-competitive practices, economic entities initiatives to overcome rivals by offering low prices, high quality and new products, inevitably will streamline the economic activity. According to these statements, efficiency, not competition, is the ultimate goal of the legislation. In this context, economic theory outlined several core objectives of the economic concentrations regulation (Röller et. al., 2000):

- i) Consumer surplus - in this case, the consumer's gain is the central point in the assessment of mergers and it is closely linked to price development, especially if the merger would reduce the price of goods.
- ii) Total surplus - refers to the consumer and producer surplus and address the effects of the merger on the economy as a whole. Even if the merger leads to higher prices, which would harm consumers, the merger may be authorized due to the surplus of producers.
- iii) Other objectives: promoting European integration; regional balance; employment; the competitiveness of the national firms on international arena, etc.

The concept of efficiency refers to an event that increases the total value of all economic measurable assets in a society. There are several ways to classify the efficiency gains generated by a merger, but the most important categories are: allocative efficiency; productive efficiency; dynamic and transactional efficiency (Lindsay, 2006).

Allocative efficiency occurs when manufacturers produce goods and services that satisfy consumer's needs and the last pay a certain amount of money. According to the theory, in case of allocative efficiency, the value of a good to consumers at the margin is equal to the value of resources expended in supplying the product. For example, when the price could not be reduced and output could not be increased without producers making economic losses.

Productive efficiency is achieved when goods and services are produced at the lowest possible cost. Productive efficiency occurs when input could not be reorganized to increase output by at least one unit and keep the output of all other products constant. Mergers may increase efficiency through more productive ways, including promoting economies of scale, economies of scope and synergies.

Dynamic efficiency includes technological changes that lead to the improvement over time in products and production techniques, and learning-by-doing when the unit cost is decreasing because the manufacturer has more experience in the production process.

Transactional efficiency shows to what extent the cost of purchasing can be reduced. Transactional costs tend to be higher when it is likely the opportunistic behavior or extensive coordination is required among producers to achieve a cooperative agreement. Transactional efficiency is the most extensive of all types of efficiency and usually facilitates companies' efforts to achieve allocative, productive and dynamic efficiencies.

Another approach of the efficiency classification is based on the production function. Thus, there are five categories of efficiency (Röller et. al., 2000):

- i) Rationalization of production, which refers to the cost savings from reallocation of production between firms without increasing technological capacity;
- ii) Economies of scale, namely the average cost savings associated with increases in the total output;

- iii) Technological progress, which can be achieved through R&D investment and know-how;
- iv) Purchasing economies or savings in factor prices such as intermediate goods or cost of capital;
- v) Reduction of slack (managerial and X-efficiency).

Also, efficiency gains can be classified into: i) real cost-savings, which refers to economies of productive resources (ex.: economies of scale, rationalization, technological progress); ii) redistributive cost-savings, which refers to cost savings that companies may obtain in the form of lower taxes (Röller et. al., 2000).

3. Efficiency gains in economic concentration legislation

In Moldova, by the adoption of the new law on competition in 2012 was launched the competitive environment reform in accordance with the European Union practices and experience. The new law transposes the art. 101-106 of the Treaty on the Functioning of the European Union signed on 25 March 1957, the Council Regulation on the implementation of the rules on competition laid down in Articles 81 and 82 and partially the Council Regulation on the control of concentrations between undertakings. Also, the assessment of the economic concentrations in the country is done under the Merger Regulation approved in 2013 by the Competition Council. In assessing mergers, the authority responsible for supervising the competition examines the efficiencies that result from the merger of economic entities. According to the regulation, the economic concentrations susceptible to raise significant barriers to effective competition on the market or in a substantial part may be authorized if the parties to the concentration demonstrate the fulfillment of the following conditions: i) the concentration shall contribute to increasing the economic efficiency, improving the quality of production, distribution or technical progress or to increasing export competitiveness; ii) favorable effects of concentration shall compensate the negative effects of restricting competition; iii) consumers benefit to a reasonable extent from resulted advantages (Regulation on economic concentrations of 2013).

Within the European Union, efficiency analysis in the context of mergers was included in the draft regulation on mergers in 1989, which specifies that a merger would be approved if it contributed to achieving the objectives of the Treaty, so that the economic benefits will prevail over dangers on competition. However, these provisions were excluded from the final version of the regulation because the Council of Europe was unable to resolve the differences between Member States that are in favor of social, regional and industrial policy considerations (ex.: Spain, Portugal, France) and Member States that support a competition analysis system similar to the US (ex.: Germany, UK). Some Member States didn't agree on including provisions on the efficiency in the regulation because they would be used as a complement to industrial policy. Thus, it was considered that EU industrial policy, which aimed to protect and ensure the competitiveness of the industry would be supported by efficiency provisions and would contribute to the creation of industrial champions that would dominate the market and impede effective competition in the market (Butorac Malnar, 2008).

Subsequently, the economic efficiency analysis of the mergers returned to the attention of the European Commission as a result of blocking a merger amounting to 42.0 billion USD of General Electronics and Honeywell, after it was approved by the US Department of Justice (Butorac Malnar, 2008). Thus, it was initiated the Merger Regulation review. Article 4 of the EU Merger Regulation states that reorganisations are encouraged to the extent that they are in line with the requirements of dynamic competition and capable of increasing the competitiveness of European industry, improving the conditions of growth and raising the standards of living in the Community. Also, article 29 states that in determining the impact of

a concentration on competition in the common market, it is necessary to take into account any substantiated and likely efficiencies put forward by the undertakings concerned. It is considered that the merger will not raise significant obstacles to effective competition where the efficiencies generated by the merger counteract the anticompetitive effects on competition, in particular the potential harm to consumers, as a result of the creation or strengthening of a dominant position (Council Regulation on the control of concentrations between undertakings, 2004). These provisions changed radically the Commission's view on efficiency gains. Thus, a merger leading to major efficiency gains shall be authorized, even if there is a risk of rising significant obstacles to effective competition in the market. Also, among the reforms was the introduction of a new chapter on efficiency analysis in the Merger Guidelines.

The efficiency gains issue is addressed differently in the law worldwide. Thus, many countries in the world have followed the example of the United States approving provisions of the merger assessment based on the US model. In the United States the debate on the role of efficiency in merger assessment began in 1968 when Oliver Williamson argued that the cost savings generated by the merger of two institutions could justify anti-competitive effects. After, US law has changed consecutively, and currently the model applied in the analysis of the relationship between efficiency and market competition is a hybrid, aiming at both consumer surplus, as well as total surplus (Butorac Malnar, 2008). Practice and experience of the United States in integrating the analysis of efficiency gains in competition law were adopted widely by the other states, according to their economic characteristics.

In Canada were promoted advanced policies in the analysis of the link between ensuring market competition and efficiency gains. Thus, the Competition Court approved a merger based on economic efficiencies, even if it led to the monopolization of the market. Among the basic arguments of the Court were the small size of the Canadian economy, compared to the US and thus a high level of market concentration may be necessary to achieve the results economies of scale and increasing economic efficiency (Kolasky & Dick, 2003).

4. Mechanism of efficiency gains analysis in the assessment of economic concentration

According to the legislation, economic concentration includes all those operations that result in lasting change in the control of undertakings involved and market structure. The change of control on a lasting basis results from: i) the merger of two or more previously independent undertakings or parts of undertakings; ii) the acquisition, by one or more persons already controlling at least one undertaking, or by one or more undertakings, whether by purchase of securities (social shares) or assets, by contract or by any other means, of direct or indirect control of the whole or parts of one or more other undertakings (Regulation on economic concentrations, 2013).

Moldovan law on competition stipulates the incompatibility of the competitive environment with economic concentrations that could raise significant obstacles on the effective competition in the market or in a substantial part of it, especially as a result of the creation or strengthening of a dominant position. A dominant position means holding a relevant market share that exceeds 50%. However, mergers that could raise significant obstacles to effective competition on the market or in a substantial part of it would be authorized if the parties involved in the concentration demonstrate that: i) the concentration shall contribute to increasing the economic efficiency, improving the quality of production, distribution or technical progress or to increasing export competitiveness; ii) favorable effects of concentration shall compensate the negative effects of restricting competition; iii) consumers benefit to a reasonable extent from resulted advantages.

Thus, the merger that raise obstacles in the competitive environment will be authorized by the relevant authority only if efficiency gains will compensate the anti-competitive effects and these benefits will be passed on to consumers. The evaluation of the efficiency gains, as well as anti-competitive effects resulting from the merger of financial institutions are carried out by the merging entities and it is part of the notification form of economic concentrations.

In order to facilitate the evaluation process of the efficiency gains and anti-competitive effects resulting from a merger it is proposed to complete 3 steps: 1. screening the economic concentration; 2. measuring efficiency gains and anti-competitive effects; 3. balancing the efficiency gains and anti-competitive effects (Kastberg Nielsen et. al., 2006).

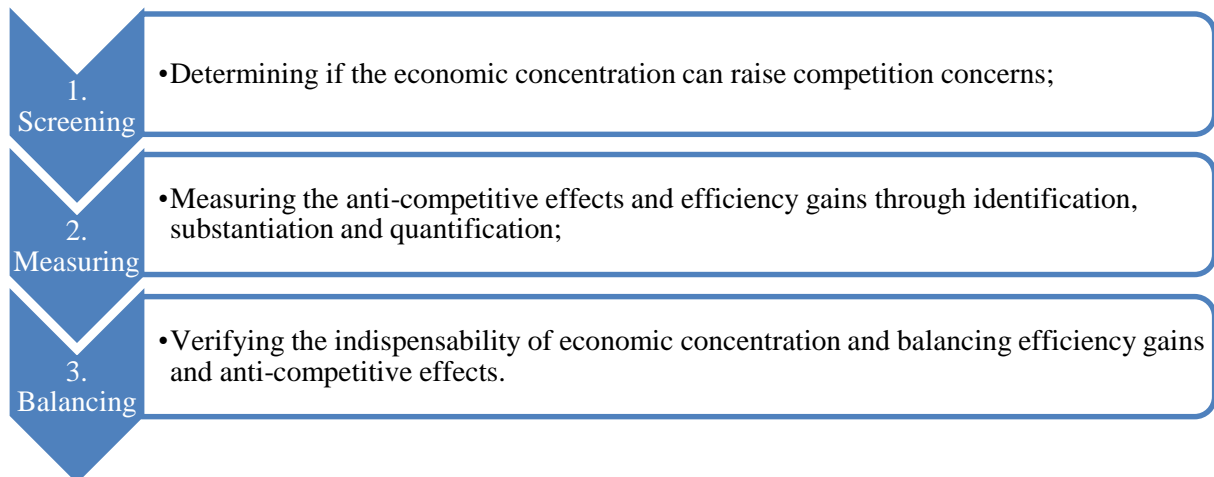


Figure 1 Mechanism of efficiency gains and anti-competitive effects assessment in the evaluation of economic concentration

The starting point in the efficiency gains analysis is to determine whether it is necessary to initiate proceedings in this regard. The regulation on the control of economic concentrations developed based on the EU legislation contains certain conditions that establish what types of merger fall under the law and what conditions should be met in order to get the authorization from the relevant authority.

The first step in the assessment of efficiency gains is screening, which aims to clarify the probability of rising barriers to competition in the market as a result of the merger. If the merger does not present any harm to the competitive environment, it is excluded the relevance of efficiency gains and anticompetitive effects assessment. Screening consists of 3 stages. First, the assessor should verify if the merger will result in the emergence of obstacles to effective competition in the market or it is automatically exempt from control. In this context, the legislation sets certain thresholds as turnover. Once the thresholds are exceeded, the participants to the concentration are obliged to get the approval of the competition authority. Afterwards, the assessor should verify if the merger does not generate unacceptable restrictions, which have a particularly negative impact on competition. Unacceptable restriction means strengthening or creation of a dominant position and it is considered a dominant position, holding a market share exceeding 50% of the relevant market. If the merger doesn't have a particularly negative impact on market competition, the assessor may initiate the procedures for determining the efficiencies and anti-competitive effects in order to balance them.

Once the assessor has finished the screening process and identified the need for determining the efficiency gains and anti-competitive effects, he should initiate the measurement. This stage aims to measure the size of anticompetitive effects and the efficiency gains by

identification, substantiation and quantification. The identification has the aim to conclude a list of all anti-competitive effects and efficiency gains.

According to the EU experience, in merger evaluation, the competition authority will take into account the efficiency gains only if they are in favor of consumers, merger-specific, verifiable and timely. The efficiency gains are merger-specific if they are a direct consequence of it, unable to be obtained at a similar level through less anti-competitive alternative procedures. Also, the competition authority should ensure that the alleged efficiencies could materialize and are significant enough to counteract the possible harm to consumers (Guidelines on the assessment of horizontal mergers, 2004).

Substantiation refers to determining whether the anti-competitive and efficiency gains are large or small, and quantification determines the magnitude of the concentration impact. The measurement is a complex and expensive process, involving the use of advanced techniques, as well as comprehensive statistical information on the market. Among the most popular methods of determining the size of the anticompetitive effects and efficiency gains are: diversion ratio; market simulation; event study analysis; engineering studies; regression analysis; Data Envelopment Analysis (Kastberg Nielsen et. al., 2006).

The diversion ratio measures the lost share of sales if the price will rise. This indicator can be calculated as the share of price-elasticity and cross-price elasticity estimates. More particularly a diversion ratio would be used to assess the extent to which an increase in price of one brand of 5 to 10 percent would lead the consumers to switch to the second brand. The calculation of the ratio involves holding reliable data on price and quantity of products/services on the market, which constitute a significant barrier in using this indicator.

Market simulation is a mathematical model showing the real market, where anti-competitive effects of market changes can be simulated and calculated. They are usually developed for oligopolistic markets and are used to quantify the effect of horizontal mergers on the price. Market simulation models are complicated and require the construction and interpretation of complex data about the market. A simulation market includes 3 steps: estimating the elasticity; building the model and merger simulation.

Event studies aim to determine how asset prices would change as a result of the company's merger announcement. The price difference before and after the announcement is interpreted as efficiency gains or losses. However, it is a tool for calculating indirect efficiency gains.

Engineering studies are studies that analyze the variation in costs depending on the volume of production, studying the economies of scale in the enterprise and show the implications of economies of scale on industry structure. Based on these studies, it is possible to calculate the minimum efficient scale, elasticity of scale, the average cost, marginal cost, variable costs, fixed costs and particularly the cost function, using internal company data.

Regression studies are econometric analysis of production or cost functions for a particular industry. The aim is to identify the average level of production costs at a certain level of quantity for all companies in the sector and this type of analysis shows how efficient is a particular company against the industry average. Regression studies can provide information on the estimated size of cost savings and identify some cases where it is possible to make these savings.

Data Envelopment Analysis is a tool used to estimate the relative level of efficiency for different companies. Unlike regression studies, which compare companies at a hypothetical average of the industry, this method compares the company with the most efficient enterprise on the market.

Once the evaluator measured the value of efficiency gains and anti-competitive effects, he should initiate the balancing phase, which aims to determine whether the efficiency gains

compensate the anti-competitive effects. In consequence, the assessor concludes one of the following statements: i) efficiency gains are greater than anti-competitive effects, and the merger would be submitted for approval to the competent authority; ii) suggestions to amend the economic concentration in order to mitigate the impact on competition in the market; iii) the merger would raise significant obstacles on competitors in the market.

Also, at this phase the assessor should verify if the merger is necessary and its results cannot be obtained by other way. Simultaneously, the assessor should check whether the merger will not create a significant impediment of effective competition in a substantial part of the market and if the efficiency gains are transferred to a sufficient degree to consumers.

5. Analysis of the banking system efficiency of Moldova using the Data Envelopment Analysis

The banking sector contributes to the growth and welfare of the society. In circumstances where the private sector is facing the lack of financial resources for development and the public sector is characterized by a high level of public debt, ensuring an effective banking system will create prerequisites for sustainable economic development.

The Moldovan banking system has the tendency for instability and fragility. At the end of 2015, the banking sector consisted of 11 commercial banks, including 4 branches of foreign banks and financial groups. During 2015 was initiated the liquidation proceedings for 3 commercial banks. Moreover, the banking sector is characterized by a moderate level of competition. Thus, in 2015 the share of five commercial bank's assets in total banking sector assets was equal to 83.96%, increasing by 8.11 pp compared to 2014.

Table 1 Moldovan banking sector indicators for 2013-2015

Name	2013	2014	2015
Assets, million MDL	76190,12	93909,15	69095,55
Liabilities, millions MDL	64753,21	81545,14	57330,03
Loans, million MDL	42177,28	40841,98	38187,61
Deposits, million MDL	51889,94	65462,51	50201,51
Total banking system assets / GDP, %	76,28	84,03	57,68
Assets of the 5 largest banks / Total assets, %	70,43	75,85	83,96
Nonperforming loans ratio, %	11,56	11,73	9,95
Total number of bank employees	10933	10231	7621
Number of bank subdivisions	1287	1339	814

Source: developed by the authors based on the reports of the National Bank of Moldova

The Moldovan banking sector is facing the tendency for deposit reduction and the risk of worsening the loan portfolio quality. During 2015, the National Bank of Moldova promoted a tough monetary policy, due to the acceleration in inflation, which at the end of the third quarter of 2015 was equal to 11.1%. In these circumstances, the central bank has taken steps to combat inflationary pressures and currency depreciation by increasing the basic rate applied to the main short-term monetary policy operations by 5 pp and required reserves in MDL by 2 pp. Increased rates on the monetary policy instruments did not have an impact on bank deposits in national currency. In 2015, deposits decreased by 23.3% compared to 2014. This decrease was due to the reduction of deposits in foreign currency by 11.8% and in national currency by 11.5%. Moreover, total loans recorded a downward trend, which in 2015 decreased by 9.5% compared to 2013. The population reluctance on placement of funds as deposits in MDL and reduced access to credit was due to the depreciation of national currency against the USD by 25%, harsh monetary policy promoted by the central bank and economic uncertainty.

The bank efficiency analysis continues to be an extensively discussed topic by the economic researchers. Given the lack of data on bank mergers in Moldova, which makes it impossible to assess their impact on the efficiency of the banking system, we intend to analyze the efficiency of each bank in the banking sector, using the non-parametric methodology "Data Envelopment Analysis".

The concept of Data Envelopment Analysis was first used by Charnes, Cooper and Rhodes in 1978 to measure the efficiency of each decision-making unit. They defined the methodology of data envelopment analysis as a nonlinear programming model that provides a new definition of efficiency for use and a new way for estimating external relations from observational data (Charnes et. al., 1978).

DEA provides a comprehensive analysis of the relative efficiency for situations with multi-input, multi-output in order to assess and measure the performance of each company compared to its envelope surface determined by other companies. Companies that belong to this area or draw it in DEA terminology are cited as being effective and those that are not placed on the surface are named as inefficient. DEA methodology can measure the efficiency depending on the input or output. Measuring the technical efficiency by input-oriented approach tends to answer to the question: "How much input can be reduced without changing the amount of produced outputs?". In case of measuring efficiency by output-oriented approach the tool will answer to the question: "How much the output can increase keeping the same amount of inputs?" (Roman, 2003).

Data envelopment analysis addresses two types of returns to scale, either constant returns to scale (CRS) or variable returns to scale (VRS). In this paper, we used DEA with variable returns to scale, which is an extension of the DEA model with constant returns to scale. The assumption of constant returns to scale is possible only when companies operate at an optimal scale. Imperfect competition, financial constraints may influence a company not to operate at an optimal scale. The use of constant returns to scale specification when not all companies operate at an optimal scale, result in measuring technological efficiency (TE) that can be confused with scale efficiency (SE) (Roman, 2003).

DEA assesses N firms; each firm uses K inputs to produce M - different outputs. The company i is represented by the column vectors of inputs x_i , and outputs y_i , and X and Y are input and output matrices. Thus, the model will take the following form:

$$\left\{ \begin{array}{l} \min_{\theta, \lambda} \theta \\ -y_i + Y\lambda \geq 0 \\ \theta x_i - X\lambda \geq 0 \\ N_I \lambda = 1 \\ \lambda \geq 0 \end{array} \right. \quad (1)$$

In the model, θ is a scalar, λ is a constant vector of dimension $N \times 1$, and N_I is a vector of elements equal to 1 for the dimension $N \times 1$. The program should be solved N times for each firm and get a θ value for each company.

This model doesn't specify whether the company operates in an area where returns to scale are increasing or decreasing. For this reason the restriction $N_I \lambda = 1$ was replaced with $N_I \lambda \leq 1$, whereby was added the non-increasing returns to scale (NIRS).

$$\left\{ \begin{array}{l} \min_{\theta, \lambda} \theta \\ -y_i + Y\lambda \geq 0 \\ \theta x_i - X\lambda \geq 0 \\ N_i \lambda \leq 1 \\ \lambda \geq 0 \end{array} \right. \quad (2)$$

The nature of inefficiency for a given company, due to increasing or decreasing returns to scale, can be determined by comparing the technical efficiency in case of non-increasing returns to scale with variable returns to scale. If they are not equal, the company operates in conditions of increasing returns to scale, and if the conditions are equal, then the firm operates under decreasing returns to scale (Roman, 2003).

The DEA model shown above is an input-oriented model, which aims to identify technical inefficiency as a proportional reduction in input use, maintaining the output level constant. Also, it is also possible to measure the technical inefficiency as a proportional increase in output, maintaining the level of input. The technical inefficiency must be equal under constant returns to scale, but different in case of variable returns to scale.

In the DEA Model used for the analysis of the Moldovan banking system efficiency, we used two inputs and three outputs, namely: Y1: total loans; Y2: interest income; Y3: non-interest income; X1: total deposits; X2: share capital. The descriptive statistics for the variables are shown in the table below.

Table 2 Descriptive statistics of the variables used in DEA model

Name	2013	2014	2015
Total loans, million MDL			
Min	161,49	174,79	191,30
Max	9184,87	10826,03	11225,70
Mean	3134,45	3329,04	3471,60
Standard deviation	3048,44	3468,08	3658,51
Interest income, million MDL			
Min	22,98	22,10	35,90
Max	922,13	1062,31	1464,02
Mean	352,96	375,27	497,11
Standard deviation	323,45	363,03	491,43
Non-interest income, million MDL			
Min	11,38	12,31	14,14
Max	205,76	234,65	305,20
Mean	78,37	88,64	106,26
Standard deviation	70,38	83,26	104,97
Total deposits, million MDL			
Min	90,41	99,57	254,82
Max	9517,40	11487,72	14022,84
Mean	3499,99	3804,54	4563,77
Standard deviation	3705,22	3974,98	4670,76
Share capital, million MDL			
Min	100,00	100,00	100,00
Max	1000,00	1250,00	1250,00
Mean	323,39	359,59	359,59
Standard deviation	272,63	339,24	339,24

Source: developed by the authors based on the reports of the National Bank of Moldova

In the analysis of the banking system efficiency based on data envelopment analysis, we used the DEAP program (Coelli, 1996). The estimates of banking technical efficiency have been calculated using the input-orientation and variable returns to scale. The data has been entered into the DEAP program for three years and the results are shown in the table 3.

In the table below are reflected data for the 11 banks, which function in Moldova. Moreover, the abbreviation “OE” stands for overall efficiency, “TE” is the abbreviation for technical efficiency and “SE” means scale efficiency. According to calculations, the most efficient commercial banks in the banking system received an indicator value equal to 1,000.

Table 3 Summary of mean efficiency levels of Moldovan banks

Name	2013			2014			2015		
	OE	TE	SE	OE	TE	SE	OE	TE	SE
BC „MOLDOVA - AGROINDBANK” S.A.	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
B.C. „COMERTBANK” S.A.	0,619	0,794	0,779	0,654	0,888	0,736	0,730	0,920	0,794
BC „EuroCreditBank” S.A.	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
B.C. „ENERGBANK” S.A.	0,900	1,000	0,900	0,994	1,000	0,994	0,976	1,000	0,976
B.C. „EXIMBANK - Gruppo Veneto Banca” S.A.	0,990	1,000	0,990	0,778	1,000	0,778	0,760	0,885	0,859
B.C. „FinComBank” S.A.	1,000	1,000	1,000	0,966	1,000	0,966	1,000	1,000	1,000
BC „MOBIASBANCA - Groupe Societe Generale” S.A.	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
BC „Moldindconbank” S.A.	0,830	0,957	0,867	1,000	1,000	1,000	0,992	1,000	0,992
B.C. „ProCredit Bank” S.A.	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
BCR Chisinau S.A.	0,586	0,685	0,855	0,653	0,742	0,880	0,963	0,982	0,981
B.C. „VICTORIABANK” S.A.	0,881	1,000	0,881	0,855	1,000	0,855	1,000	1,000	1,000
Mean	0,891	0,949	0,934	0,900	0,966	0,928	0,947	0,981	0,964

Source: elaborated by the authors using the DEAP Program

According to the results, the overall efficiency of the Moldovan banking system has improved in 2015 compared to 2013. The banking sector recorded an overall efficiency level of 89.1% in 2013, 90.0% in 2014 and 94.7% in 2015. The analysis of overall efficiency suggests that the improvement in 2015 compared to 2013 was due to the increase of both the technical efficiency and scale efficiency. During 2013-2015, the scale inefficiency was bigger than technical inefficiency, which suggests that although banks have effectively controlled its costs, they operated on a wrong scale.

The results of DEA analysis showed that during 2013-2015, four commercial banks operated efficiently. In 2013 and 2014, this number was equal to 5, and 6 commercial banks operated efficiently in 2015.

During 2013-2014 the bank BCR “Chisinau” S.A obtained the lowest ratio of overall efficiency compared with other banks in the sector. According to the results in 2013, BCR “Chisinau” SA could reduce inputs by 41.4% and 34.7% in 2014 to achieve the same level of output. In 2015, it increased its efficiency up to 96.3%, the waste of input being equal to 3.7%.

In 2015 the overall efficiency of the banks ranged between 73.0% and 100%, suggesting that banks worked relatively efficient in performing the basic functions, the waste of resources being equal to 5.3%. Also, the decomposition of the total efficiency in technical efficiency

and scale efficiency suggests that inefficiency in the banking sector is mainly due to the inefficiency of scale (3.6%) compared to technical inefficiency (1.9%).

6. Conclusions

Competition law aims to protect the competition by ensuring the efficient allocation of resources, which will help to increase the market efficiency. Thus, efficiency, not competition, is the ultimate goal of the legislation. Furthermore, according to economic theory, the expected results of mergers are the increase in consumer or producer surplus. In this context, the efficiency generated by the mergers in the financial market could contribute to financial sector development, given that they provide better access to the financial markets and will contribute to lower costs of capital and transactions. However, the economic concentration legislation provides the incompatibility of the competitive environment with mergers that could significantly impede the effective competition in the market or in a substantial part of it, especially as a result of the creation or strengthening of a dominant position. Thus, in order to allow a merger that could have a significant impact on market competition, the efficiency gains should be greater than anticompetitive effects and the beneficiaries should be the consumers. There are a lot of ways to classify the efficiency and the most used is allocative, productive, dynamic and transactional efficiency.

The evaluation mechanism of efficiency gains is complex and costly. In the assessment of efficiency gains should be undertaken 3 steps: 1. Screening the economic concentration; 2. Measuring the efficiency gains and anti-competitive effects; 3. Balancing the efficiency gains and anti-competitive effects. The first step in assessing the efficiency gains is screening, which aims to clarify the probability of rising barriers to competition in the market. Measuring aims to quantify the anticompetitive effects and efficiency gains and balancing to determine whether efficiency gains will compensate the negative impact of anti-competitive effects. The competition authority will take into account the efficiency gains only if the gains are: consumer-oriented, substantial, merger-specific, verifiable and timely.

There is a multitude of methods to quantify the efficiency gains, but they are quite costly and involve the use of advanced techniques, as well as comprehensive statistical information on the market. Among the most popular methods of determining the size of the anti-competitive effects and efficiency gains are: diversion ratio; market simulation; event studies; engineering studies; regression studies; data envelopment analysis.

Given the lack of data on bank mergers in Moldova, which makes it impossible to assess their impact on the efficiency of the banking sector, we applied the "Data Envelopment Analysis" tool to assess the Moldovan banking sector efficiency. According to the results, the banking sector's performance has improved during 2013-2015. The banking sector recorded an overall efficiency of 89.1% in 2013, 90.0% in 2014 and 94.7% in 2015, loss of resources being equal to 10.9% in 2013, 10.0% - 2014 and 5.3% in 2015. Also, in 2015 six commercial banks have worked efficiently of 11 banks. Also, if we decompose the overall efficiency in technical efficiency and scale efficiency, we conclude that inefficiency in the banking sector is mainly due to the scale inefficiency. This suggests that although banks have effectively controlled its costs, they operated on a wrong scale.

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IMPROVING CAPITAL STRUCTURE

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Abstract. In the analysis of financial statements, the amount and structure of equity is an extremely important category that stakeholders use in the process of evaluating the going concern assumption sustainability. The existence of fair value in accounting regulation is conceived as a corrective to fluctuations in the value of certain assets. However, when considering its characteristics, fair value has inherent inability of establishing stable measures which would contribute to the standardization of this category. It is precisely this mentioned inability that paves the way for manipulation using asset revaluation. Therefore, when conducting a financial analysis of the business operations of a company, share of revaluation reserves and other positions in the capital structure of the company should be explored. Statistical analysis of financial data will be carried out on the sample of companies that are listed on the Zagreb Stock Exchange.

Keywords: *capital structure, revaluation reserves, public limited company, statistical analysis, Republic of Croatia*

1. Introduction

Fair value has always occupied the attention because of its subjectivity. It is a necessary compromise between subjectivity of valuation and objective statement of asset value because there is no other way to continuously adjust actual state of property with the accounting records. Since these are the items of equity, their value can have a significant impact on capital structure. Because of that, it will also be analyzed whether investors evaluate capital structure using aggregate values or also pay attention to its structure in detail. The research will include analysis of share price movements which are mainly determined by relation of supply and demand in the market. Financial analysis of annual reports is one of the most influential factors that contribute to the demand for a certain share.

2. Capital structure and fair value

From historical point of view, definition of capital is not unambiguously defined. Its interpretation varied among different authors. Considering different capital theories, Schumpeter gave an explanation that is still actual. He has explained term equity as "sum of money or its counter value, which the partners have invested in company, the total amount of assets etc. It is essentially a monetary term which means real money or a claim in money or goods estimated in cash"¹. Lubhan and Frankenberg, the authors of the German professional

¹ Brkanić, V: *Optimalizacija bilančne strukture*, RRI plus, Zagreb, 2002., p. 7.

literature, express accounting concept of capital as part of funding sources: "The account of capital serves for demonstration of own funds, own equity of a company. When there are multiple owners, individual accounts of capital which provide information on property relations must exist in bookkeeping for each owner of the company."²

Modern economic theory confirms that authors are not unique in defining capital. One part of them relate capital to assets. From accounting perspective, capital is residual value of total assets which remains after deducting liabilities. In the Croatian economic thought, definition of capital is less frequent. Veselica, V. explains how equity represents an owner of a company who is entitled to the profit of a company and earnings from its sales.³ Numerous authors in the field of financial science identify capital with the funds disposable for investment.

Companies use a variety of sources in financing their business. Basic structure of funding sources can be viewed from aspect of ownership (owner's and borrowed) and aspect of maturity (long-term and short-term). Combination of different, long-term and short-term sources, which companies use to finance their operations, are called financial structure. Financial structure shows, therefore, a way of financing entire assets of a company.

Capital structure policy determines which proportion and type of debt to combine with equity. Structure of long-term capital, i.e. total equity and long-term sources borrowed from banks and other creditors and investors who are not owners or shareholders, as well as obligations for issued long-term securities, is usually called capital structure. In other words, the policy of capital structure includes management of owner's and borrowed long – term capital.

There are numerous ways in which companies achieve improvements in capital structure, for example, by equity issuance, borrowing from banks or issuing corporate bonds and selling them to various institutional and individual customers. There is an increasing number of financial instruments which companies use to raise capital (funds) and finance its operations.

Economic theory, in a certain way, has set theoretic relations of capital structure which are considered optimal. Optimum is a goal and purpose of a number of procedures that should lead activities of a company to effective economic positions of assets, including the capital structure.

In a struggle of achieving competitive edge, companies have possibility of adopting new standards of efficiency regarding capital structure management. Considering the global cash flows, value creation and requirements that fundamental positions of corporate financial reporting should demonstrate fair value, accounting and financial science and profession introduces new models of assets and liabilities valuation. The consequence of abovementioned has resulted in introduction of fair value as the model for evaluation of assets and liabilities in companies. This has led to new capital structure positions.

In the capital structure different positions appear such as share capital, capital reserves, reserves from retained earnings, revaluation reserves and profit or loss. Revaluation reserves are part of the equity which is consequence of asset reassessment that exceeded purchasing costs (of tangible and intangible assets). Asset measured at fair value is an amount at which an asset could be exchanged between informed unrelated parties that are willing to carry out a transaction. Liability measured at fair value is the amount for settlement of the liability between informed, unrelated parties that are willing to carry out a transaction.

Thus, the application of revaluation model introduces fair value in measurement of fundamental tangible assets positions, so companies have an opportunity to change capital structure.

² *Ibidem*, p. 8.

³ Veselica, V.: *Financijski sustav u ekonomiji*, Inženjerski biro d.d., Zagreb, 1995., p. 61.

3. Data, methodology and hypotheses

Data used for calculating financial ratios was obtained from Zagreb Stock Exchange's (ZSE) official website and consists of 75 companies listed on ZSE's regulated market in 2013. Only requirement which had to be fulfilled was that share of a certain company was traded on ZSE in last month of two years included in research.

Revaluation reserves to equity ratio and provisions to total assets ratio were used to represent two frequently assessed accounting positions – revaluation and provisions. Accounting standards are flexible regarding these categories and they provide broad opportunities for creative accounting which consequentially results in embellishment of financial statement's "bottom line" which can be misleading to investors. High relative values of these categories are often considered as "red flag" and reason to perform a deeper and more focused financial analysis. Footnotes can be very abundant source of information in analysis of structure and values of these positions.

Other two categories included in research are retained earnings and net profit of the period. Net profit is one of the key categories which investors on stock market expect to be high because it is more likely that the profitable company will perform dividend payout to their shareholders. Also, company retains better position in negotiations with creditors as well as improved public opinion and increased public interest. Downside of this category is that it can be misleading if creative accounting techniques are applied. Retained earnings are part of annual profit which is kept in company instead of allocating it to shareholders. It is logical that this position is not popular by the vast majority of shareholders who prefer dividend payout. If this category is negative it means that there are accumulated losses instead of retained earnings for observed financial year.

Table 1. Abbreviations used in analysis

Abbrev.	Ratio
RR/EQ	Revaluation Reserves to Equity
P/TA	Provisions to Total Assets
RE/TA	Retained Earnings to Total Assets
NP/TA	Net Profit to Total Assets

The aim of this research is to analyse relationship between aforementioned positions which are reported in balance sheet and market valuation of a company, i.e. price of a company on stock exchange. Statistical techniques will be applied in order to reach conclusions on research hypotheses which are established as follows:

Hypothesis 1 – there is statistically significant negative relationship between revaluation reserves to equity ratio and change of market price of a company,

Hypothesis 2 – there is statistically significant negative relationship between provisions to total assets ratio and change of market price of a company,

Hypothesis 3 – there is statistically significant negative relationship between retained earnings to total assets ratio and change of market price of a company,

Hypothesis 4 – there is statistically significant positive relationship between net profit of the period to total assets ratio and change of market price of a company.

4. Research results

Table 1. presents descriptive statistics for all analyzed ratios (mean and standard deviation). Every activity has it's own specificity regarding these financial positions. "Agriculture", Forestry and Fishing", "Manufacturing", "Construction" and "Professional, Scientific and Technical Activities" have very high revaluation reserves to equity indicators due to a fact that they are capitally intensive activities and need significant investment in non-current

assets. When comparing provisions to total assets, “Manufacturing”, “Construction”, “Accommodation and Food Service and Arts”, “Entertainment and Recreation” are above average.

Table 2. Descriptive statistics

	Revaluation reserves to equity (RR/EQ)			Provisions to total assets (P/TA)			Retained earnings to total assets (RE/TA)			Net profit of the period to total assets (NP/TA)		
	N	Mean	S.D.*	N	Mean	S.D.*	N	Mean	S.D.*	N	Mean	S.D.*
Agriculture, Forestry and Fishing	3	0,35	0,2781	3	0,002	0,003	4	-0,025	0,152	4	-0,038	0,029
Manufacturing	26	0,46	1,7645	26	0,025	0,060	23	-0,475	2,263	23	0,022	0,140
Construction	4	0,48	0,5558	4	0,020	0,019	3	-0,068	0,068	3	-0,019	0,070
Retail and Wholesale Trade	4	0,12	0,1210	4	0,005	0,005	5	0,001	0,229	5	0,014	0,045
Transport and Storage	8	0,002	0,0275	8	0,007	0,007	8	-0,115	0,307	8	0,001	0,142
Accommodation and Food Service	19	-0,05	0,9110	19	0,022	0,063	22	-0,018	0,314	22	0,005	0,073
Information and Communication	2	-0,0001	0,0001	2	0,007	0,004	1	0,050		1	0,008	
Real Estate	1	0,0000		1	0,000		1	0,254		1	0,033	
Professional, Scientific and Technical Activities	7	0,7002	1,4470	7	0,018	0,015	6	-0,254	0,548	6	-0,001	0,029
Arts, Entertainment and Recreation	1	0,0000		1	0,034		1	0,013		1	0,040	
Total	75	0,2574	1,2294	75	0,019	0,048	74	-0,186	1,284	74	0,008	0,100

* S.D. - Standard Deviation

It is notable that average net profit values of all analysed activities do not go over 4 percent (there are no activities that are, on average, extremely profitable in relative terms), and some are (on average) even unprofitable. Regarding retained earnings, highest average values are in „Real Estate“ activity (25,4 percent), while highest average loss was achieved in „Manufacturing“ activity (47,5 percent).

Table 3. Correlation table

		P_delta	RR/EQ	P/EQ	RE/TA	NP/TA
P_delta	Pearson Correlation	1	-0,087	0,012	-0,441**	0,486**
	Sig. (2-tailed)		0,463	0,921	0,000	0,000
	N	74	74	74	74	74
RR/EQ	Pearson Correlation	-0,087	1	-0,003	0,016	-0,177
	Sig. (2-tailed)	0,463		0,978	0,893	0,130
	N	74	74	74	74	74
P/EQ	Pearson Correlation	0,012	-0,003	1	0,014	0,200
	Sig. (2-tailed)	0,921	0,978		0,904	0,088

	N	74	74	74	74	74
RE/TA	Pearson Correlation	-0,441**	0,016	0,014	1	-0,406**
	Sig. (2-tailed)	0,000	0,893	0,904		0,000
	N	74	74	74	74	74
NP/TA	Pearson Correlation	0,486**	-0,177	0,200	-0,406**	1
	Sig. (2-tailed)	0,000	0,130	0,088	0,000	
	N	74	74	74	74	74

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Correlation analysis (Table 2) indicates that there isn't statistically significant relationship between change of company's market price and revaluation reserves to equity ratio. Same can be applied to relationship between change of company's market price and provisions to total assets ratio. On the other side, retained earnings to total assets ratio and change of market price of a company as well as net profit of the period to total assets ratio and change of market price of a company are significantly correlated. Retained earnings to total assets ratio has moderate negative correlation with market price change, while net profit of the period to total assets ratio has moderate positive correlation with the same variable.

Table 4. Model Summary

a. Predictors:	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
(Constant), RR/EQ	1	0,087	0,008	-0,006	0,490
(Constant), P/TA	1	0,012	0,0001	-0,014	0,492
(Constant), RE/TA	1	0,441	0,195	0,184	0,441
(Constant), NP/TA	1	0,486	0,236	0,226	0,430

Table 5. ANOVA

Dependent Variable:	Predictors:	Model		Sum of Squares	df	Mean Square	F	Sig.
P_delta	(Constant), RR/EQ	1	Regression	0,131	1	0,131	0,545	0,463
			Residual	17,290	72	0,240		
			Total	17,421	73			
P_delta	(Constant), P/TA	1	Regression	0,002	1	0,002	0,010	0,921
			Residual	17,418	72	0,242		
			Total	17,421	73			
P_delta	(Constant), RE/TA	1	Regression	3,393	1	3,393	17,412	0,0001
			Residual	14,028	72	0,195		
			Total	17,421	73			
P_delta	(Constant), NP/TA	1	Regression	4,119	1	4,119	22,296	0,0001
			Residual	13,302	72	0,185		
			Total	17,421	73			

Table 4 shows how much variation is explained by certain regression model. Linear regression model which includes the retained earnings to total assets ratio, and a model which

includes the net profit to total assets ratio are statistically significant, while linear regression models for the revaluation reserves to equity ratio and the provisions to total assets ratio were not statistically significant (Table 5).

Table 6. Independent Variables Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Dependent Variable: P_delta		B	Std. Error	Beta		
1	(Constant)	0,101	0,058		1,735	0,087
	RR/EQ	-0,034	0,046	-0,087	-0,738	0,463
1	(Constant)	0,090	0,061		1,463	0,148
	P/TA	0,120	1,203	0,012	0,100	0,921
1	(Constant)	0,061	0,052		1,175	0,244
	RE/TA	-0,168	0,040	-0,441	-4,173	0,0001
1	(Constant)	0,074	0,050		1,480	0,143
	NP/TA	2,381	0,504	0,486	4,722	0,0001

The independent variables coefficients of linear regression models are positive for the provisions to total assets ratio and the net profit to total assets ratio, which means that the increase in these ratios will be accompanied by an increase in the dependent variable (changes in market price of share), while the coefficients are negative for revaluation reserves to equity ratio and the retained earnings to total assets ratio, which means that the increase in these ratios will be accompanied by a decrease in the dependent variable (Table 6). The coefficients for provisions to total assets ratio and the revaluation reserves to equity ratio are not statistically significant at the statistical significance level of 5 percent, while the net profit to total assets ratio and the retained earnings to total assets ratio is statistically significant at the statistical significance level of 5 percent.

5. Hypothesis acceptance

Table 7 summarizes the overall results of research in form of hypothesis acceptance or rejection. It was confirmed that the revaluation reserves to equity ratio and the provisions to total assets ratio compared to the price movements in the market were not statistically significant in terms of correlation as well as independent variable coefficients in regression, so their algebraic signs will not even be considered. According to the mentioned facts, hypotheses 1 and 2 are not accepted.

Table 7. Hypothesis status

No	Hypothesis	Status
1.	There is statistically significant negative relationship between revaluation reserves to equity ratio and change of market price of a company.	NOT ACCEPTED
2.	There is statistically significant negative relationship between provisions to total assets ratio and change of market price of a company.	NOT ACCEPTED
3.	There is statistically significant negative relationship between retained earnings to total assets ratio and change of market price of a company.	ACCEPTED
4.	There is statistically significant positive relationship between net profit of the period to total assets ratio and change of market price of a company.	ACCEPTED

Source: Author's creation

On the other hand, the retained earnings to total assets ratio and the net profit to total assets ratio were significantly correlated in relation to the price movements of company's shares,

and coefficients of independent variables in regression are also statistically significant. Direction of the relationship corresponds to that predicted in the hypotheses so hypotheses 3 and 4 are accepted.

6. Conclusion

Capital management model should be adapted to current conditions in which companies operate. It can be assumed that managers bring decisions in sphere of capital management determined by the current situation in capital markets, as well as the efficiency standards of existing capital structure, and the adoption of new asset pricing models with application of fair value. However, efficient capital management should be the goal of managers and company owners for a series of reasons such as the achievement of investment optimum, strategic decisions for future operations (business continuity, acquisition of another company, selling company, merger with another company), maximizing the value of quoted companies and achievements of business efficiency standards in order to increase competitiveness of a company for entering a meaningful economic integration. Furthermore, the application of the fair value can embellish the image of capital structure, but will not significantly affect the change in the market price of the company. Improvements of capital structure are related to more efficient resource management, because a significant impact on market price changes of a company is established on that basis.

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SMA usage in (post) transitional economy's public sector organizations – A Field Study

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Abstract. The concept of Strategic Management Accounting, is still vague and undefined idea after more than 30 years of development, and has a number of development areas lacking valuable researches. One of these areas is the public sector, which many authors believe has been overlooked in SMA researches and literature, and is thus viewed as an important future research direction. Given the fact that the public sector has been increasingly concerned with the issues of strategy and accounting, the usage of SMA core ideas and approaches should not be something completely new to organizations in this sector. Therefore, the main purpose of this paper is to analyze the characteristics of the SMA treatment and implementation in public sector organizations in a (post) transitional economy, such as the understanding of the SMA concept - its ideas, scope and importance, SMA concept adoption, SMA usage process, SMA techniques usage. The field study research was carried out in several major public sector organizations in Croatia, and the results presented in this paper are an attempt to carry out the above-mentioned overlooked and valuable researches that are absent from the area of SMA usage in public sector organizations.

Key words: *strategic management accounting, strategic management accounting process, strategic management techniques, public sector organization, field study research*

1. Introduction

Today, after more than 30 years of development and growing literature, strategic management accounting (SMA) is still concept modestly developed, having number of deficiencies and gaps, which is why some authors are prepared to see its development as a paradox (Juras, 2014, p. 76). Once a young star with bright future, at this point of time the SMA concept is yet to fulfil the expectations of accounting academics and practitioners. In doing so, there are different streams of research which need to be pursued, with the ultimate goal of clear definition and positioning of SMA concept, establishing its primary methods, techniques, and processes and clarifying the linkages with other, closely related concepts and disciplines. In this sense, Nixon & Burns (2012, p. 240) are suggesting desirable future SMA research streams as being focused on filling the gaps between SMA literature and (1) strategic management literature, (2) practice, (3) cognate strategic-oriented literatures, and (4) the lack of consistency, cohesion and coherence among techniques attributed to SMA. In addition, existing SMA literature and conducted empirical researches have overlooked the important characteristics of public sector, which is increasingly concerned with issues of strategy and accounting (Cuganesan et al., 2012, p. 247).

On the other hand, in the last 20 years the term 'new public sector' marks the movement and concrete pressures in advanced (Western) economies to make their public sectors more efficient and effective (Brignall & Modell, 2000, p. 281). According to the same authors, this led to introduction of various 'private sector' management techniques and the frequent adoption of some form of neo-market system in which the purchasers and providers of public services have been split and are frequently required to contract with each other (p. 281). Mentioned 'new public sector' movement and introduction of 'private sector' management

techniques, by definition, should be most expressed in economies going through large and fundamental transitions from government controlled to market controlled economies. In this sense, accounting practices, especially managerial accounting practices, are typical 'private sector' management techniques that are, among many others, crucial in mentioned reducing costs and increasing effectiveness. According to Vašiček (2009, p. 417) in the Republic of Croatia, a typical (post) transition economy, the growing constraints of available assets, growing public expenditure and even stronger public criticism are constantly pressuring public management to reduce costs and increase effectiveness, wherein appropriate and somewhat customized cost and managerial accounting methods, techniques, instruments, cost concepts and implementation processes play crucial role. Besides just mentioned, the 'end of monopolistic power' and 'giving' concessions to private sector subjects, has led to vast number of public sector organizations now being faced with real competition, a situation completely new for these organizations and for which they now need methods and techniques that are more strategic, market and future oriented.

All previously mentioned contributes to the curiosity and the importance of researches conducted and insights being gained about SMA treatment and usage in public sector organizations, especially having in mind the fact that SMA literature has overlooked public sector and its characteristics in its researches. Therefore, this paper is an attempt to provide valuable insights into SMA usage and treatment, as state of the art discipline of accounting profession (Shah et al., 2011, p. 1), in public sector organizations in (post) transition economy, for which Republic of Croatia is typical example.

2. Theoretical background

2.1 Strategic Management Accounting

The concept of strategic management accounting (SMA), as an approach that tried to give more strategic role for management accounting (Cadez & Guilding, 2008, p. 836), emerged in the beginning of 1980s, due to the general dissatisfaction with current accounting systems and practices on one side and growing awareness of crucial role of accounting information for strategic management processes on the other (Brouthers & Roozen, 1999, p. 311). In this sense SMA concept is seen as an approach that lies at the interface between strategic management and accounting, with accounting techniques and information aimed to support strategic perspective (Tayles, 2011, p. 22).

The concept was first introduced in the literature by Simmons whose definition of SMA concept is still one of the most influential. According to this author SMA refers to:

the provision and analysis of management accounting data about a business and its competition for the use in developing and monitoring the business strategy, particularly relating levels and trends in real costs and prices, volume, market share, cash flow and proportion demanded of a firm total resources (Simmons, 1981 in: Dixon, 1998, p. 273).

Besides just listed SMA definition, there are numerous others, according to the author's starting point, which only further contributes to overall confusion about what SMA concept represents. The purpose of this paper is not to pursue various attitudes in defining SMA, rather to take mainstream approach. In this sense one more influential definition of SMA concept is that it is 'generic approach to accounting for strategic positioning, defined by an attempt to integrate insights from management accounting and marketing management within a strategic management framework' (Roslender & Hart, 2003, p. 255).

During the 30 years of development the concept evolve in various directions, from which two are regarded as literature's essential. These two main research traditions are: (1) the research

that uses label SMA to investigate management accounting that is strategically oriented, and (2) research that examines inter-relationships between strategy and management control systems (MCS) (Cuganesan et al., 2012, p. 245). Depending on the research stream(s) taken, Simmons' cost management approach, Bromwich's approach or some other, less influential approach, the conceptualizations and listings/propositions of SMA techniques differs from author to author. SMA techniques can be described as (management) accounting techniques with clear strategic focus, future oriented stance, explicit external focus, drawing heavily on non-financial measures (Ma & Tayles, 2009, p. 474). Mentioned propositions vary from almost a single-digit number of techniques to 14 or 16 techniques. These techniques are used in various stages of strategic management process, according to the need for and suitability of every SMA technique. In this sense SMA techniques are used in (1) monitoring, (2) decision-making and planning, and (3) controlling (Brouthers & Roozen, 1999, p. 314); or more concretely in (1) collecting information related to the competitors, (2) using accounting for strategic decisions, (3) cutting costs on the basis of strategic decisions and (4) gaining competitive advantage through it (Lord, 1996 in: Shah et al., 2011, p. 3). Subsequently Cadez & Guilding (2008, p. 838-839) state that SMA techniques generally in majority of classifications can be classified in five broad categories: 1) costing, (2) planning, control and performance measurement, (3) strategic decision making, (4) competitor accounting and (5) customer accounting (Table 1).

Table 1 Essential techniques in strategic management accounting toolbox (Juras, 2014, p. 80)

SMA techniques categories	SMA techniques	Guilding et al. (2000)	Cravens & Guilding (2001)	Cinquini & Tenucci (2007)	Cadez & Guilding (2008)	Shah et al. (2011)	Fowzia (2011)
Costing	Attribute costing	✓	✓	✓	✓	✓	✓
	ABC/M		✓	✓		✓	✓
	Life-cycling costing	✓	✓	✓	✓		✓
	Quality costing	✓	✓	✓	✓		✓
	Target costing	✓	✓	✓	✓		✓
	Value-chain costing	✓	✓	✓	✓	✓	✓
Planning, control and performance measurement	Benchmarking		✓	✓	✓		✓
	Integrated performance measurement/BSC		✓	✓	✓	✓	✓
Strategic decision-making	Strategic costing (strategic cost management)	✓	✓	✓	✓	✓	✓
	Strategic pricing	✓	✓	✓	✓		✓
	Brand valuation (budgeting and monitoring)	✓			✓	✓	
Competitor accounting	Competitor cost assessment	✓	✓	✓	✓	✓	✓
	Competitor position monitoring	✓	✓	✓	✓		✓
	Competitor performance appraisal	✓	✓	✓	✓	✓	✓
Customer accounting	Customer profitability/cost analysis		✓	✓	✓		✓
	Lifetime customer profitability analysis				✓		
	Valuation of customers as assets				✓	✓	

The techniques shown in Table 1 are usually used in empirical researches of SMA treatment and usage in companies – the researches shown in Table 1 are among most influential in recent SMA literature. Therefore, listing of SMA techniques in Table 1 also serves as a basis for analysis of SMA technique usage in (post) transition economy's public sector organizations, conducted in this paper.

2.2 Public sector organizations in (post) transition economy and accounting practices

Transition economy by definition refers to an economy that is changing from being one under government control to being a market economy, i.e. one in which companies are not controlled by the government (Cambridge Dictionaries Online, 2015). It is the process which almost all Central and Eastern Europe countries, especially post-socialist ones, went through or are still facing with. Croatia, as typical post-socialist country and a new member of EU, is in number of aspects still transition economy, even though its major transition efforts are behind it. Being pressured by EU Accession Negotiations, global economic crisis and preparing for fierce competition on EU's open-market, Croatia underwent substantial efforts and changes trying to make its public sector to be more efficient and effective.

Public sector structure in Croatia is in accordance with IMF's and UN's definitions (Figure 1). UN's SNA definition of public sector divides public sector to general government and quasigovernment (or public) corporations, whereby public sector covers: (1) all institutional units which belong to central, state/regional or local government, (2) social security funds on all government levels, (3) all non-market non-profit institutions which are under government control and are predominantly finance by it, and (4) public corporations or quasigovernment corporations which are under government control (Bejaković et al., 2011, p. 104). Just listed public sector organizations, although considering and answering to a wider set of stakeholders, due to the need for fundraising bodies to be held accountable to taxpayers, are primarily focused on financial information, despite a long history of calls for use of more non-financial information dating back to Mayston (1985) and Politt (1986) (Brignall & Modell, 2000, p. 282). Public sector units and corporations, for the purpose of this paper called organizations, in carrying out accounting tasks on the individual level (micro level of accounting), are primarily oriented on reporting, budgeting, control, safeguarding public treasury by preventing and detecting graft and corruption and on facilitating sound financial management (Chadwick, 1993). In doing so, they follow national regulations which are harmonized with *International Accounting Standards*, especially *International Public Sector Accounting Standards* (Dimitrić, 2007, p. 1). In this sense, accounting for internal, especially strategic purposes, is highly overlooked, and in some organizations there are only a traces of these practices.

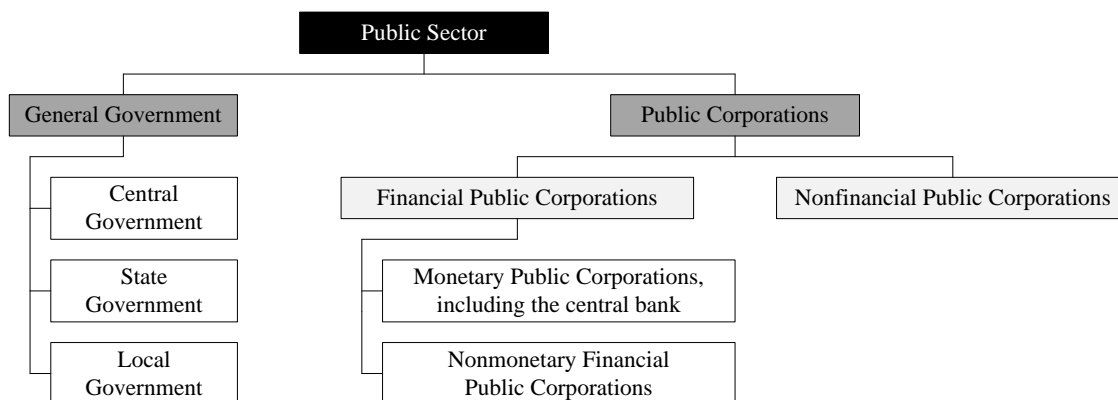


Figure 1 Public sector according to IMF's GFs (Government Finance Statistics) (GFS, 2001, p. 15)

Clearly, despite the fact that pressures and reforms, labelled under the term ‘new public management’, have increased the importance of strategy in public sector, specifics of the public sector context indicate that techniques and processes developed for private sector organizations cannot be simply transplanted into public sector organizations (Cuganesan et al., 2012, p. 246). In this sense, it would be interesting to investigate whether and to what extent do public sector organizations ‘think strategically’ and are they familiar with and do they use SMA techniques and practices, as some of these may or may not be applied to public sector organizations. More concretely the usage of SMA techniques and practices can be for example somewhat expected in public sector corporations, while the same cannot be said for government units (local, state/regional, central), where the expectations for SMA usage are pretty slim, especially in (post) transition economy like Croatia.

3. Methodology

According to Roslender & Hart (2010), Ma & Tayles (2009) and Dixon (1998), a case study methodology is most appropriate in building knowledge of actual business practices, i.e. strategic management practices, and has a comparative advantage in doing so in relation to other empirical research methods like wide ranging questionnaire, etc. Having in mind just mentioned, in order to accomplish stated purpose of the paper, i.e. to investigate the characteristics of SMA treatment and implementation in (post) transition economy’s public sector organizations, field study, a variation of case study methodology, was conducted. Field study, as a research design that embraces a relatively small number of companies or organizations (Roslender & Hart, p. 262) was chosen due to its ability to gain insights into practitioner’s views on and applications of the concept of strategic management accounting (Dixon, p. 274).

The study was carried out in 10 public sector organizations during December of 2015 and January of 2016, and was mainly descriptive in nature, focusing on descriptive characteristics of accounting practices in mentioned organizations, aimed for strategic purposes. As a means of study, interviews and questionnaire, accompanied with detailed written explanation of each SMA practice and technique, were combined to get better picture of SMA usage. Respondents were financial/accounting director in these organizations or theirs deputies. The basis for the interview and questionnaire structuration was the work of Guilding et al. (2000), Cravens & Gulding (2001), Cinquini & Tenucci (2007) and Cadez & Guilding (2008). As a part of consent agreement, no actual names of the public organizations analyzed were to be mentioned in the paper. Therefore, studied public organizations are labeled in the paper with numbers 1-10. Table 2 shows basic information of public sector organizations which constituted research sample.

Not shown in Table 2, all analyzed public sector organizations were in state ownership solely and have been in existence for more than 20 years. The sample was constituted of 5 public companies and 5 general government units (4 local, 1 regional). Organizations’ activities represented in the sample were transportation, health care and public administration. Number of employees ranged from several dozen (local government) to nearly 500 employees in some public companies, while these organizations predominantly have middle-aged employees’ structure. Respondents’ judgement of employees’ qualifications and competence ranged from high to very high, while results (business) accomplished were evaluated from good (only 1 organization) to mostly very good and excellent. Respondents’ evaluation of employees’ qualifications and achieved results in studied public sector organizations were very positive, moreover too positive, implicating somewhat optimistic and subjective perception of own organization’s employees and results. This was somewhat expected, having in mind public pressures for efficiency and effectiveness these organizations are up against and the need their employees have to present better their organizations and results accomplished.

Table 2 Research sample characteristics (field study, N=10)

Public sector organization	Type	Activity	Number of employees	Predominant employees' age (years)	Evaluation of employees' qualifications and competence	Evaluation of achieved (business) results
1	PC	transportation	391	over 50	very high	excellent
2	PC	health care	210	34-49	very high	very good
3	LGU	public administration	under 100	over 50	high	very good
4	LGU	public administration	under 100	34-49	very high	excellent
5	PC	transportation	438	34-49	high	excellent
6	PC	health care	under 100	34-49	very high	excellent
7	LGU	public administration	17	34-49	high	very good
8	LGU	public administration	under 100	34-49	high	very good
9	PC	transportation	100-250	34-49	high	good
10	RGU	public administration	100-250	34-49	high	very good

Legend: PC – public company; LGU – local government unit; RGU – regional government unit

4. Findings

Questionnaire and interviews in the study were combined in a manner that questionnaire was used to collect appropriate quantitative data, while semi-structured interviews were used to gain deeper insights into SMA treatment and usage.

4.1 Strategy treatment in public sector organizations

When it comes to strategy and strategic management in public sector organizations, overall attention given to this aspect of public management can be described as being somewhere between moderate to high. As expected, this attention is higher in PCs than in L/RGUs, i.e. in PCs this attention is high while in L/RGUs is lower and closer to moderate. This difference in strategy treatment is most obvious in an approach to performing various tasks related to strategy. Namely, In PCs this approach is significantly more systematic and comprehensive than in L/RGUs, i.e. in PCs tasks related to strategy are being performed systematically and frequently, while in L/RGUs these tasks are approached systematically only in some aspects, while being performed ad-hoc and improvised in other. Consequently, in L/RGUs these tasks were not being performed so often and constantly as in PCs. Mentioned strategy related tasks in public sector organizations are in domain of their leading officer or director and his/her closest associates, while only in the biggest PC in the researched sample there is a specific department/office or team of people which are responsible for performing majority of strategy related tasks. Finally, no matter who is responsible for performing these tasks, accounting information are highly used during these activities and the accounting department works very closely with person(s) who is dealing with strategy issues. It is interesting that two of three big PCs are seeing accounting information only as (significant) part of overall information needed by strategic management; while in other public sector organizations accounting information are regarded as almost the only information needed.

Just mentioned insights are as expected, having in mind that public sector organizations in Croatia are only just beginning to see strategy as integral and crucial part of their functioning and existence in their environments. This especially stands for L/RGU where years of a specific way of functioning made it difficult now to introduce changes and to see strategy as it is, despite the fact that, for example, all of these organizations need to develop strategic approach for tourism development as they are public administration units which are located in touristic regions.

4.2 Accounting treatment in public sector organizations

Generally, accounting in public sector organizations is being done through specific work places within a bigger administrative department or service or within specific finance and accounting department. Only in the largest PC and the largest LG the accounting work places are organized in specific accounting department. The number of people performing solely accounting tasks varies from 1 to 15 people from organization to organization or in relative terms around 2-5% of total working force in public sector organizations are accountants. According to respondents' opinions, accounting tasks are being performed in appropriate or good manner, and accounting personnel occasionally attends seminars and to some extent follows professional literature about new accounting trends and developments. When comparing PCs and L/RGUs, there is no difference in opinions of respondents regarding the quality of accounting performed. The significance of accounting jobs and information for overall functioning of public sector organizations is very high, as it is considered a very valuable source of information which is being produced in quality manner. Thus, it needs to be emphasized that PCs regard their accounting as much more important for overall company functioning and achieving desired goals than L/RGU, i.e. PCs place lot of attention on accounting and strive to make it even better or excellent, with high quality processes and information, while L/RGUs are satisfied with their accounting being in accordance with law and accounting standards. In doing so, PCs, apart from law and standards' requirements, are performing 'own' analysis and calculations for internal purposes, while this kind of practice can only be found in traces in L/RGUs, and only in two largest ones.

Findings about general accounting practices in public sector organizations reveal different perceptions of respondents about what accounting needs to represent in public sector organization. On one side there are PCs' respondents which are closer to state of mind of private sector accountants and managers, which see accounting as a valuable information service aimed not just for fulfilling external (legal) requirements, but also to be crucial supporting department/office for strategic analysis, formulation, decision making, implementation and control. Quite differently, L/RGUs' respondents see accounting as being information service covering mainly costs and transactions and reporting them to external stakeholders. In this way, both groups in their perception of the quality of accounting practices in their organization mutually do not differ in large extent, but the underlying logic and perception of what accounting needs to represent puts them in opposite side of accounting treatment. This insight is definitely a reason for concern, giving the fact that in transition economy L/RGUs need to be more active and propulsive in creating promised/obligated or desirable outcomes, where good strategic management and accounting information are indispensable prerequisites. This is more than obvious in case of L/RGUs from the sample, as they compete between themselves in number of areas such as touristic attractiveness, withdrawal of EU funds, etc.

4.3 SMA treatment and usage in public sector organizations

The crucial part of the study was to gain deeper insights into accounting practices aimed for strategic purposes. In this sense, respondents were asked to pinpoint accounting practices that are being carried out for strategic purposes and to assess their relative importance and frequency of usage. For start, respondents were unanimous in emphasizing that in their organizations (both OCs and L/RGUs) accounting practices aimed for management's purposes were primarily internally oriented and in some extent related to strategy and strategic management. Thus said, in PCs the preparation and usage of accounting information for strategic decision making is the most important and subsequently most frequent accounting practice followed by exploitation of cost-reduction opportunities. Cutting cost on the basis of strategic decisions is less important and frequent in PCs, while collecting

information related to competitors and gaining competitive advantage through all mentioned practices are present in this manner in significantly lesser degree. In L/RGUs overall importance and frequency of usage of accounting information for strategic purposes is on lower level than in PCs, where mentioned practices are more dominant than others in the same order as in the PCs. Additional questions also revealed that mentioned accounting practices aimed for strategic purposes are being used in larger extent for strategic monitoring and control, compared with usage of the same practices for strategic decision making. The time spent on performing both of these groups of accounting practices is, by respondents' opinion, approximately the same.

Respondents were then confronted with the usage and treatment of specific SMA techniques or their approximate variation, having in mind that public sector organizations have distinct accounting practices when compared to private sector. Both groups of respondents (PCs and L/RGUs) have demonstrated certain level of knowledge about SMA as a field and SMA techniques. They also confessed that there are blind areas when it comes to SMA and SMA techniques. In this sense they admitted that SMA techniques, as presented in the Table 1, were being carried out in some, smaller extent in their organizations, and that those employees who are responsible for SMA techniques usage are familiar with them.

When going through SMA techniques one by one, the results were more and more 'realistic', i.e. pessimistic from the SMA literature point of view. Detailed data and results processed on the basis of this part of study (conversation/observation) are shown on Figure 2. From the results shown it is obvious that the usage of SMA techniques in public sector organizations is, optimistically speaking, on very low level. Namely, for L/RGUs it is difficult even to discuss about SMA techniques usage, having in mind that three of five respondents from these units confessed that them and their associates are not familiar with the listed techniques, while in the fourth unit (RGU) the knowledge about SMA techniques is related to mainly costing techniques, which are not being used or if used, then in rare occasions. Only in last LGU the SMA techniques are not *terra incognita*, but this certainly does not mean that there is a systematic usage of mentioned techniques present. In this LGU, competitor accounting SMA techniques, together with strategic costing, are being used often, while benchmarking and BSC are being used rarely. Average usage of SMA techniques in these public sector organizations is somewhere between non-using and not knowing about techniques at all, an insight which speaks for itself.

On the other hand, contrary to expectations, the usage of SMA techniques in PCs is not much better than in L/RGUs. Four of five respondents from these companies are familiar with all SMA techniques, while for one respondent the SMA techniques are something unknown and by his opinion unnecessary. The usage of SMA techniques in four PCs ranges from never being used to constant usage, depending on SMA technique and particular company. On average, target costing, strategic costing and customer profitability/cost analysis are being used occasionally; value chain costing, BSC and valuation of customers as assets have never been used, while the rest of SMA techniques are being used rarely. These results, similar to L/RGU results, indicate the orientation to costing and pricing techniques.

When analyzed according to the groups of SMA techniques (Figure 3), there are small differences in usage of SMA techniques in public sector organizations. None of the groups of SMA techniques, when considering in average, is being used predominately in public sector organizations. For L/RGUs this usage of groups of SMA techniques is in the zone of unknown, while in PCs mentioned usage varies from non-using to rarely using. In this sense group of planning, control and performance measurement techniques are less used than other groups of techniques, and are on the verge of being unknown to the respondents. Being unknown is the undesirable state of all groups of SMA techniques in L/RGUs. Only in PCs

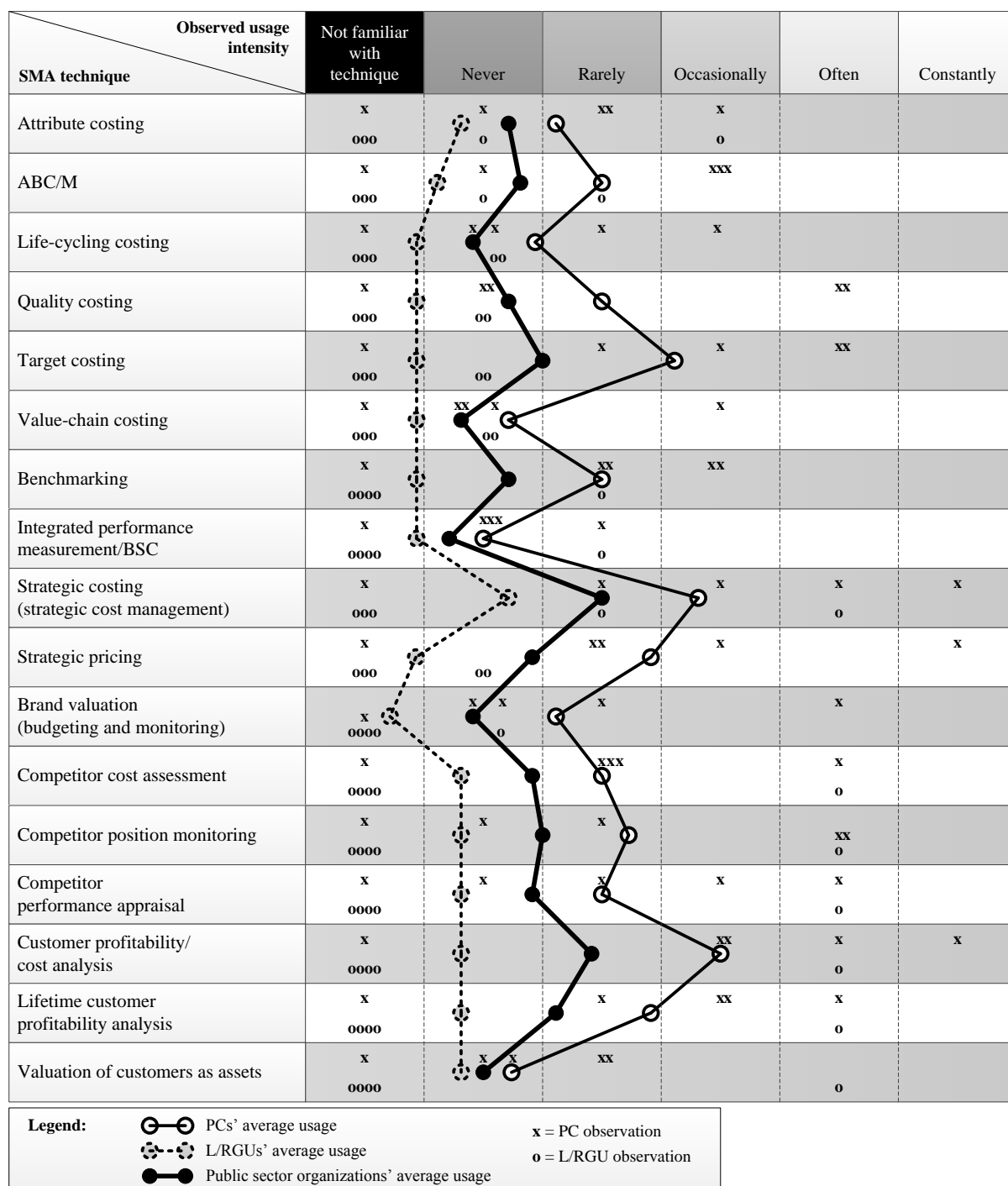


Figure 2 SMA techniques' usage intensity in studied public sector organizations (field study, N=10)

there is a usage of groups of SMA techniques. This usage is closer to non-using for costing and planning, control and performance measurement, while strategic decision-making, competitor accounting and customer accounting are used on rarely basis. From all groups of SMA techniques, the situation is the least unenviable for strategic decision-making techniques, i.e. strategic costing and pricing, and customer accounting techniques, especially in PCs.

Further, respondents were asked to give their additional opinions regarding the various issues of SMA usage. In this sense they think that little is being invested (money, working hours, education) in SMA usage. PCs are investing a bit more than L/RGUs, being closer to

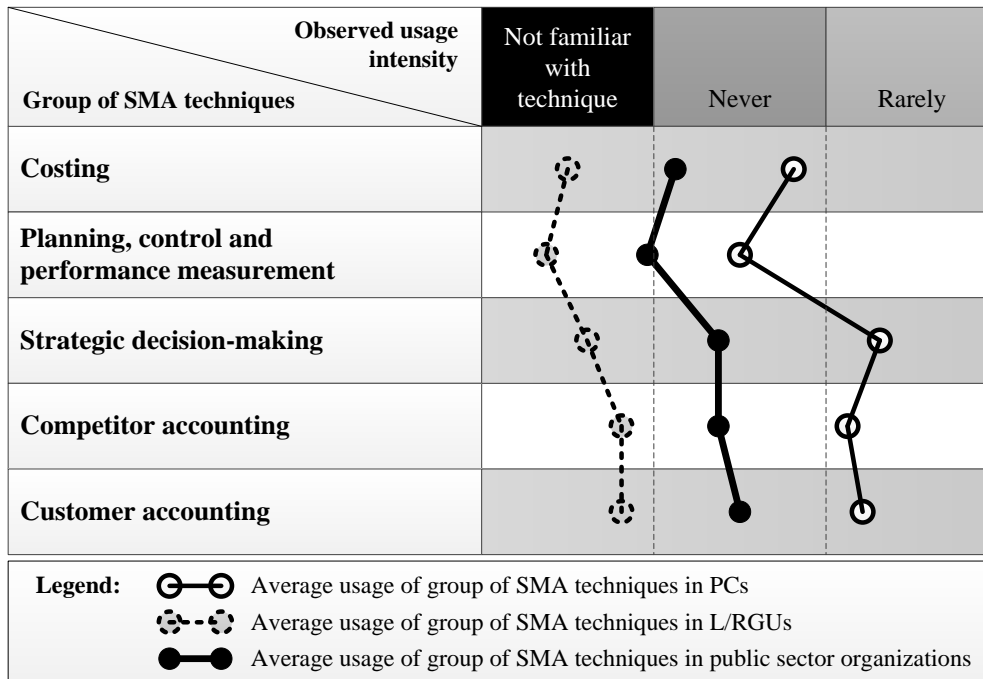


Figure 3 Average usage of groups of SMA techniques in studied public sector organizations (field study, N=10)

moderate degree of investment in SMA usage. When considering who gives incentive for SMA usage and who is carrying out usage itself, the Board of director is the body which usually requests some kind of analysis within the frame of SMA usage and accounting staff carries out required tasks. In other words, there is no autonomous initiative of accounting staff for carrying out some of SMA techniques and no external company or institution is being hired to perform this tasks.

Besides the issues of investment in and incentive for SMA usage, respondents also ranked the importance of particular SMA techniques for business and strategic purposes, and also commented the time needed to use the technique, as well as the systematic and quality of usage itself (Table 3). In this regard, strategic costing is most important SMA technique for business and strategic purposes, followed by target costing, attribute costing and benchmarking. When it comes to L/RGUs, for them attribute costing and ABC/M are more important than strategic costing. Some techniques, like target costing, is considered by L/RGUs important for business and strategic purposes, but their usage still lacks in these units. As for time needed for technique usage, moderate amount of time is usually needed, whereas L/RGU's are less time-efficient than PCs in SMA usage. Similar conclusion can be drawn for the degree of systematic and quality usage, where this degree varies from predominantly moderate to low, again emphasizing the more systematic and quality usage within PCs, when compared to L/RGUs.

Finally, when asked to evaluate the usefulness of used SMA techniques, respondents evaluated them with moderate usefulness, being slightly more useful in PCs than in L/RGUs. One more important insight regarding the SMA usage, which offers a light at the end of the tunnel, is the opinion which respondents had regarding the future usage of various SMA practices, especially the usage of SMA techniques. They are almost unanimous that the mentioned usage needs to be significantly strengthened in their organizations. Again, there is a slightly more proactive opinion within the PCs' respondents, which see SMA usage as high necessity for future strategic and overall functioning of their companies.

Table 3 SMA techniques' usage characteristics (field study, N=10)

SMA technique	Importance for business and strategic purposes (rank)			Amount of time spend for usage			Degree of systematic and quality usage		
	Overall	PCs	L/RGUs	Overall	PCs	L/RGUs	Overall	PCs	L/RGUs
Strategic costing	1	1	3	moderate	small/moderate	moderate	moderate/low	moderate/low	moderate/low
Target costing	2	2	3		small/moderate				
Attribute costing	3		1	moderate/large	moderate	large	low	low	low
Benchmarking	3	3	4	moderate	moderate	moderate	moderate/high	moderate/high	moderate
ABC/M	4		2	small/moderate	small/moderate	small/moderate	moderate/low	moderate	low
Competitor position monitoring	4	2		moderate	moderate	moderate	moderate/low	moderate	low
Competitor performance appraisal	4	2		moderate	moderate	moderate	moderate/low	moderate	low
Competitor profitability/cost assessment		3		moderate	moderate	moderate	low	low	low
Strategic pricing		4			moderate			moderate	

5. Conclusion

The conducted field study, aimed to provide detailed insights regarding the SMA treatment and usage in public sector organizations, offered gloomy picture of the mentioned usage. The respondents from 10 public sector organizations (5 public companies, 5 local/regional government units) were confronted with various questions in the form of interviews and supporting questionnaire. These questioning were more general regarding the overall strategy and accounting treatment in their organizations, and more concrete and detailed regarding the SMA treatment and usage within the same organizations. Naturally, the investigation of SMA usage and treatment, especially specific SMA techniques, was being in significant manner adapted to fit the circumstances and requirements of public sector organizations functioning and conducting strategy and accounting practices.

Findings from the study, as mentioned, are very disappointing from the SMA advocates' and literature's point of view. As for the strategy and strategy treatment in public sector organizations, these findings are not that poor, indicating moderate to high attention being paid to strategy and strategy issues. These tasks are in the domain of leading officer or director, which tries to perform them systematically and frequently, highly using accounting information during these activities. Thus said, situation is better in public companies then in local or regional government units, which was expected, due to the fact that the market pressures are far stronger in case of public companies. When considering treatment of accounting as a whole in public sector organizations, these tasks are being done in appropriate or good manner within some bigger department; the accounting personnel occasionally attends some kind of education and accounting jobs and information are considered as very important for organization. Again, respondents from public companies are closer to the state of mind of managers from private sector, considering their higher attention to accounting practices and information, efforts to make them even better, and attempts to push accounting practices beyond just legal requirements and obligations, i.e. performing various analysis and calculation for internal (strategic) purposes of organization.

Public companies use accounting information for strategic purposes, especially for strategic decision-making and cost-reduction opportunities more frequently than local/regional government units. Within this, strategic monitor and control are primarily purposes for these information usages. Regarding the usage of concrete SMA techniques, the field study revealed the most disappointing insights, dominated by the lack of information and knowledge of respondents about these techniques in local/regional government units. The poor SMA techniques usage that does exist in local or regional government units is primarily oriented to costs. The situation is somewhat better in public companies, but not in a far greater extent, which would be expected, due to the fact that these companies have competition and effectiveness and efficiency requirements as a consequence of competing on the more or less free market. In these companies the usage of majority of techniques is in the zone of rarely using, with some exceptions of occasional or not using at all. In this sense, costing techniques dominate the mentioned usage and are regarded as most important, followed by techniques oriented on competitors and customers. Namely, strategic costing, target costing and customer profitability/cost analysis are SMA techniques most frequently used and are also, together with competitor position monitoring and benchmarking, regarded as most important for business and strategic purposes.

Investment in SMA usage is on low level, being slightly higher in public companies. Director or board of directors usually gives incentive for particular SMA technique usage, which accounting staff carries out. The usage of particular SMA techniques takes moderate time and is being performed in moderate to low degree of systematic and quality. Again, situation is somewhat better in public companies, which are more time efficient and more systematic and which put more quality in using SMA techniques.

Insights from the conducted field study suggest that the SMA treatment and usage in (post) transition economy's public sector organizations is in its initial usage stages. The concept, its practices and especially techniques are largely unknown to government units, while in public companies usage is present, but on a relatively low level, i.e. rare intensity of usage. These results definitely are not optimistic and promising, having in mind the effectiveness and efficiency pressures which are everyday higher on public sector organizations, forcing them to pursue more and more private sector's business and management practices, including SMA practices. Potential ray of light in dark tunnel is the last insight from the study, which suggests that respondents are aware that accounting practices for strategic purposes in their organizations are not on the level on which they should be. It remains to be seen if they will try to improve this situation of largely neglected accounting practices for strategic purposes, especially when the context and circumstances for public sector organizations in (post) transition economies demand more and more systematic and grounded strategic management with each new day.

Finally, insights from the field study conducted in this paper need to be considered with the amount of caution for several reasons. First, conducted field study covered only 10 public sector organizations, i.e. a very small sample having in mind overall amount of public sector organizations in the Republic of Croatia. Also, in the sample there were local/regional government units and public companies, while some types of the public sector organizations were not included. Second, study is significantly based on the subjective opinions of respondents, leading to the problem of subjectivity. Third, having in mind the specificity of public sector accounting and accounting practices, adjustments are necessary in investigated, theoretically proposed SMA practices, especially techniques. However, all this does not decrease the importance of the research aimed and conducted in this manner. Empirical contributions, focused on SMA literature's highly overlooked SMA usage in public sector organizations, with their smaller or bigger shortcomings, are still very important and welcome, due to the lack of empirical researches in this area.

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General public and investment strategies

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Abstract. General public sector in Croatia has various possibilities for the choice of investment strategies. Due to lack of financial literacy, tradition or lack of trust in financial institutions, it seems that Croatian citizens do not use all the possibilities that they have in terms of diversification of their personal portfolio. As in most transitional countries in Croatia, there is the problem of financial literacy of the general public. The financial literacy of the general public is becoming increasingly important due to dynamic and complexity of the financial system, especially if we take in consideration that financial decision usually have long term implications on the financial situation of the individuals. Aim of this paper is to investigate how and where Croatian citizens invest their money and also to investigate performances of investment instruments available to Croatian citizens. The governing of personal finances in Croatia is process in which the citizens are left on their own, meaning that they are not equipped with sufficient skills and knowledge necessary for efficient governing. Based on findings conclusions will be provided with recommendations.

Key words: *personal finance management, investment strategy, general public*

1. Introduction

Since the contemporary banking system, has one main goal, which is of maximization of the profit, this neglects the social responsibility as a goal to achieve. It seems that in such conditions the worst consequences are on general public sector. Social responsibility represents a futuristic concept for all post-communistic countries. During 90-ies of the last century in Croatia, as in majority of post-communistic countries, it was almost embarrassing mentioning of terms such as social responsibility. It was felt that the term itself was tied to the political environment of old times-communism. At a time when creation of new principles of market regulation was carried out there was also very bloody war going on in Croatia and there was a review of terminology and postulates from the former system. Perhaps it is precisely in this period that Croatia lost a unique opportunity of integrating the concept of real social responsibility through adequate legislation frame in order to implement social responsibility into the core businesses of all market operators operating in Croatia. There are some concepts that have only recently infiltrated into the terminology of social sciences in Croatia, and were unjustly expelled because of the existence of the term "social", such term and concept is social capital. (Baker W., 2004) The lack of social responsibility in all segments of modern society becomes very important issue. Many contemporary studies have shown how devastating is the impact of exclusively

profit driven business philosophy. Corporate social responsibility is in the focus of the progress of the wider community through the use of appropriate business policies and investment of corporate resources.(Buljan Barbača D., 2007) In fact, corporate social responsibility is a deliberate inclusion of public interest in the decision making process and respect for the concept of tripartite (3P): People, Planet and Profit.(Kotler P., Lee N., 2005) With a low level of financial literacy that Croatian citizens possess they do not know which are the main advantages and disadvantages of financial instruments that they are using.

In Croatia is still present opinion that the state is obliged to take care of the social status of its citizens in retirement. However, due to the unsustainability of the current pension system, caused mainly by unfavorable demographic trends (increased life expectancy, decreasing fertility rates), responsibility for social status of the individuals in retirement is to be completely transferred to individuals. In the conditions of unfavorable demographic trends, small number of workers bear the high costs of financing pension system with high number of retired persons, and it is visible that this negative trends are only increasing in last two decades. (Buljan Barbača D., Matošević Radić M., 2011)

Making decision on use of a particular financial product depends on the personal preferences, especially risk attitude, of each individual. Risk aversion is very often underestimated in analyzes of investment habits of Croatian citizens, but lot of studies performed in United Kingdom, United States of America, New Zealand and Australia, show that undoubtedly, risk attitude have a lot to do with a choice of investment strategies. The results of the analysis sections suggest risk aversion is time varying, and that a key driver in the change over time is likely driven by changes in future market expectations of investors. If changes in risk aversion affect investing behaviors, time-varying risk aversion could affect the demand for risky assets over time. For example, if investors have positive (negative) expectations about the future return of stocks, the demand for risk assets may increase (decrease). (Blanchett D., Finke M., Guillemette M., 2014)

In order to invest in efficient way investor need to know and understand financial instruments in investors portfolio. In addition, investor needs to be able to determine personal needs, goals and desires. For high quality governing of personal finances, control of the household budget and regulation of costs need to make a part of a clear financial plan. After considering the personal preference and defining financial plan, it is necessary to get informed, from relevant source of information, about financial products and compare them with each other. For doing this kind of analyzes investors in Croatia have a huge possibilities in number of sources of information, such as banks, financial consultants, the Internet, magazines, newspapers, books, people around them and so on. But question of the relevance of the source if usually left unanswered.

In this paper we will investigate which investment financial instruments are available to Croatian citizens and what are the performances of these instruments. Analyzes of financial behavior of our citizens will be performed in order to create relevant data on which conclusions and recommendations will be given.

2. Financial products for Croatian citizens

The problems of personal finances can not be analyzed without analysis of wider environment and parameters that influence level of income in different life stages. One of the most delicate stages in person's life, when it comes to personal finances, is a life stage of individuals that have gone to pension. From statistics we can read that decrees of previous income can be very substantial and sometimes goes beyond 50% of previous salary. Reasons are various but we can underline two most important reasons that lead to this situation and is even getting worst. One group of reasons is negative demographic trends in Croatia and other group of reasons is

increased unemployment in whole population, but particularly in older ages. (Buljan Barbača D., Matošević Radić M., 2011.) Croatian pension reform was conducted in 2002 because of the unsustainability of the current situation within the pension system. Although there are a number of reasons for the implementation of pension reform as the main reason, unfavourable demographical trends, were detected. Unfavourable demographical trends, in terms of efficiency in pension system, are related to the increase of life expectancy and decrease of natality rate Aging becomes a problem because pension funds are financed by working population and exploited by pensioned ones. If we have a situation of continues aging we can predict that our problem of collecting a money for the pension funds will be even greater in the future.(Buljan Barbača D., Matošević Radić M., 2011.) Ratio of the number of insured and retirees of the 90ies of the last century to the present day in constant decline.

Table 1 The ratio of insured and pensioners in Croatia

Year	Insured persons	Retired persons	Ratio
1990	1.968.737	655.788	3 : 1
1995	1.567.981	865.769	1,81 : 1
2000	1.380.510	1.018.504	1,36 : 1
2005	1.498.877	1.080.571	1,39 : 1
2010	1.475.363	1.200.386	1,23 : 1
2013	1.400.631	1.190.815	1,18 : 1
2014	1.411.197	1.130.855	1,25 : 1
2015	1.413.637	1.135.166	1,25 : 1

Source: own work according to the CPIA

From the data presented in Table 1 we can see that the ratio of the number of insured persons and retired from the 90ies up to today is in constant decline. Although the ratio of the last two years shows slight improvement (1.25: 1), we cannot say that problems with lack of efficiency in pension system are solved.

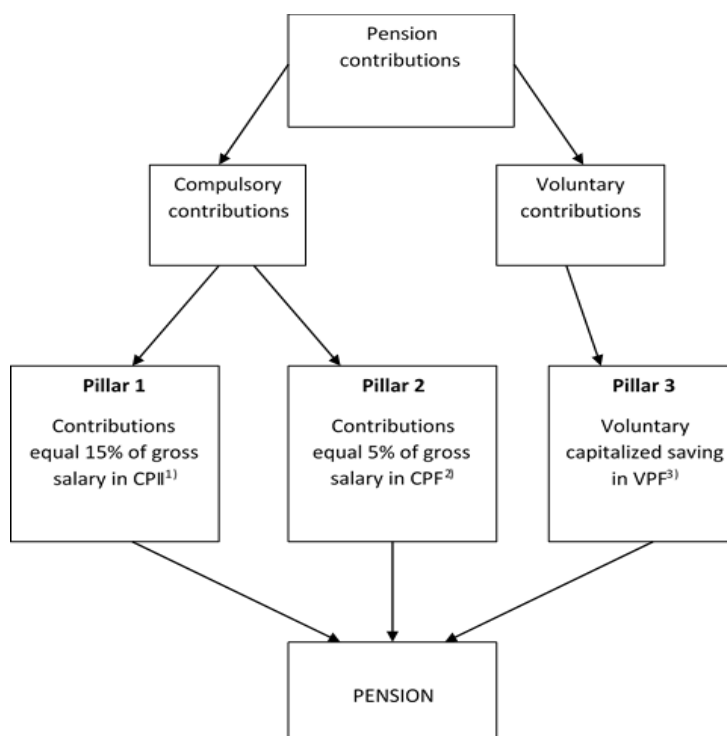


Figure 1 Croatia's pension scheme

Notes: 1) Croatian Pension Insurance Institute, 2) Compulsory pension fund, 3) Voluntary pension fund

Contemporary Croatian pension system consists of three pillars, which represent a combination of compulsory and voluntary pension funds. While the first pillar existed before, and all financial contributions were allocated in this pillar, the second and third pillar are implemented as a part of the pension reform in 2002. The structure of today's Croatian pension system is shown in Figure 1.

From Figure 1 it is clearly visible that the pension contributions are divided into compulsory and voluntary pension contributions. Compulsory pension contributions are allocated in first two pillars. The first pillar is based on intergenerational solidarity and is financed with 15% of employees' gross salaries. The second pillar is the pillar for the individual capitalized savings and amounts of the 5% of employees' gross salaries is to be allocated in it. Voluntary pension contributions are to be allocated in the third pillar which is also based on individual capitalized savings. The projection is that once a person becomes retired, pension will be paid out from all three pillars.

In Croatia is still present paradigm that the state is obliged to take care of the social status of the population. However, due to the changes in social system and problems of the current pension system it is realistic to expect that in the future responsibility for social status of the individuals in retirement age is to be completely transferred to individuals. This means that individuals will have to make decisions on which additional financial instruments will they invest if they want to ensure the social status in retirement. On the Croatian financial market there are is a number of financial instruments available for investment.

The most common financial instruments for investment present on the financial market in Croatia are:

- Current and / or giro account, foreign currency account
- Housing savings
- Bank savings
- Life insurance policies
- Life insurance policies linked with units of investment funds
- Pension funds
- Investment funds
- Shares
- Bonds

If we consider that, the individuals will have to take care of their financial situation in the future it is very important which financial decisions they take today. Individuals are usually uninformed about financial products, and also unaware of financial performances of this products and therefore are not able to take the best investment decision in particular moment. Problem of financial literacy of the Croatian citizens should be approached as a major social challenge that can prevent poverty in the future.

2.1 Performances of investment product

Aim of this sub chapter is to analyse efficiency of financial product in terms of their performances. For some products, like life insurance policy, this task becomes impossible because each policy is individualised. Financial products accessible to Croatian citizens will be displayed with corresponding yield for each year in last ten years.

In table 2 we are displaying data on yields on investment in voluntary pension funds. It is very important to emphasize that this is data on performance of open voluntary funds. Presented data are average yields calculated on the basis of relevant data published on official page of Croatian Agency for Supervision of Financial Services (CFSSA).

Table 2 Yields of voluntary pension funds by years

Year	Yields (%)
2006	8,90
2007	9,69
2008	-10,88
2009	10,70
2010	8,54
2011	-1,16
2012	14,60
2013	3,02
2014	9,78
2015	5,17

Source: own work according to data from the CFSSA-e

From presented data it is clearly visible that performances of this financial product are characterised with volatility.

For the purpose of having continuous data in this paper in table 3, table 4, table 5 and table 6 we have chosen to present relevant data on funds present at Croatian market for at least 10 years.

Table 3 Average yields of equity funds last 10 years

Year	HI Growth (%)	ZB euroaktiv (%)	FIMA Equity (%)	Average
2006	33,36	14,49	63,23	37,03
2007	32,39	-6,42	16,96	14,31
2008	-54,05	-36,77	-61,73	-50,85
2009	13,81	21,04	-17,43	5,81
2010	3,50	2,68	-16,21	-3,43
2011	-8,41	-4,94	-11,68	-8,34
2012	6,37	15,21	-24,25	-2,67
2013	4,85	13,34	13,36	10,52
2014	15,28	-1,00	27,48	12,16
2015	10,00	7,91	21,93	13,28
Average	5,71	2,55	1,17	

Source: own work according to data from the hrportfolio.hr

Table 4 Average yields of balanced funds last 10 years

Year	HI Balanced (%)	ZB Global (%)	PBZ Global fund (%)	Average
2006	24,14	15,25	32,05	23,81
2007	18,53	27,35	24,71	23,53
2008	-33,49	-38,59	-50,88	-40,99
2009	11,16	13,94	9,57	11,56
2010	4,76	7,64	3,98	5,46
2011	-5,50	-14,12	-9,78	-9,8
2012	5,51	7,38	-2,18	3,57
2013	3,73	0,07	0,56	1,45
2014	12,64	7,00	12,49	10,71

2015	7,14	9,26	5,11	7,17
Average	4,86	3,52	2,56	

Source: own work according to data from the hrportfolio.hr

Table 5 Average yields of bond funds last 10 years

Year	HI Conservative (%)	ZB Bond (%)	Raiffeisen Bond (%)	Average
2006	8,72	0,36	1,26	3,45
2007	7,77	2,87	1,05	4,00
2008	-1,46	4,04	0,32	2,90
2009	0,31	11,09	12,31	7,90
2010	5,84	4,75	8,42	6,34
2011	-0,61	2,23	0,76	2,38
2012	5,48	7,41	-6,87	2,01
2013	5,87	-3,58	-5,62	-1,11
2014	7,33	7,21	5,85	6,80
2015	2,19	3,73	2,64	2,85
Average	4,14	4,01	2,01	

Source: own work according to data from the hrportfolio.hr

Table 6 Average yields of cash funds last 10 years

Year	HI Cash (%)	ZB Plus (%)	PBZ Dollar Fund (%)	Average
2006	3,37	3,23	4,59	3,73
2007	4,04	4,13	4,07	4,08
2008	5,39	5,61	6,65	5,88
2009	6,47	8,75	3,55	6,26
2010	2,50	2,33	2,60	2,48
2011	2,76	2,48	1,15	2,13
2012	2,29	2,70	1,17	2,05
2013	1,78	0,95	0,25	0,99
2014	1,39	0,74	1,44	1,90
2015	0,92	0,57	1,10	0,86
Average	3,09	3,15	2,66	

Source: own work according to data from the hrportfolio.hr

The financial instruments presented in table 3, table 4, table 5 and table 6 show volatility in last decade. Equity funds and balanced funds in terms of performances show wider amplitude in yields. Cash funds and bond funds have narrower amplitude in terms of yields.

In table 7 data on interest rates on different kinds of deposits is presented. Relevant data is collected published on official page of Croatian National Bank (CNB).

Table 7 Interest rates on deposits without a currency clause and deposits with currency clause

Year	Short-term deposits (in domestic currency)	Long-term deposits (in domestic currency)	Short-term deposits (with currency clause)	Long-term deposits (with currency clause)
2006	4,00	4,93	3,66	4,67
2007	4,23	5,23	3,76	4,48
2008	4,79	5,51	3,93	4,71
2009	5,28	6,07	3,48	4,09
2010	4,16	5,25	2,78	3,75
2011	3,48	4,59	2,80	3,33
2012	3,47	4,55	2,99	2,91
2013	2,99	4,02	2,53	2,86
2014	2,92	3,53	2,71	3,10
2015	2,55	3,13	1,62	3,02

Source: own work according to data from the CNB

Presented data show as that changes in interest rates in deposits was not so dynamic as in previously analysed data for different funds in focus of our observations. Long term deposits show higher interest true whole period of observation. Deposits with currency clause during last decade have been less awarding than deposits in domestic currency.

In table 8 we are displaying yield on two relevant indexes CROBEX and CROBIS. When selecting stocks that will become part of index CROBEX, are taken into account only shares listed on a regulated market traded more than 90% of the total number of trading days in the six-month period preceding the audit. (The Zagreb Stock Exchange, 2011.) The index CROBIS includes government bonds and bonds government agencies that are listed on the Zagreb Stock Exchange under the following conditions: minimum nominal value of 75 million €, maturity of the bonds is greater than 18 months and bonds have a fixed interest rate, with payment of principal annually. (The Zagreb Stock Exchange, 2002.)

Table 8 The movement of the index CROBEX and CROBIS

Year	Change of the CROBEX (%)	Change of the CROBIS (%)
2006	60,70	-4,50
2007	63,20	-4,50
2008	-67,10	-6,10
2009	16,40	5,80
2010	5,30	-0,20
2011	-17,60	-4,50
2012	0,00	13,70
2013	3,10	-4,42
2014	-2,70	5,80
2015	-2,70	5,80

Source: own work according to data from the web site of the Zagreb Stock Exchange

Deficiency of this two indexes lays in the fact that we can not establish with precision how many investments were made on national stock market by citizens.

2.2 Changes in financial habits of Croatian citizens

In table 9 are presented data on changes in financial habits of Croatian citizens regarding consumption of insurance product. Investigation is performed on data on gross policy income collected by all Croatian insurance companies.

Table 9 Gross insurance premium - insurance companies (in 000)

Year	Life insurance	Non life insurance
2005	1.895.769	5.454.304
2006	2.165.061	6.015.094
2007	2.482.743	6.582.189
2008	2.545.775	7.140.327
2009	2.488.675	6.922.661
2010	2.443.127	6.787.860
2011	2.431.268	6.713.977
2012	2.461.154	6.577.321
2013	2.538.414	6.538.186
2014	2.637.784	5.923.573

Source: own work according to data from the CFSSA-e

Since life insurance policy represents mean of our interest it is appropriate to state that citizens of Croatia have almost constant slow growth of consumption of this financial instrument.

Bank deposits made by general public will be presented in table 10.

Table 10 Bank deposits by years (in millions of kuna)

Year	Deposits on transaction accounts	Savings deposits	Term deposits	Total
2005	29.175,20	26.124,50	116.442,20	171.741,90
2006	37.696,60	26.601,50	138.651,00	202.949,10
2007	45.283,60	26.874,10	160.964,30	233.122,00
2008	41.313,10	25.640,10	180.860,70	247.813,90
2009	34.526,90	24.531,30	197.751,70	256.809,90
2010	37.258,10	26.705,50	205.219,20	269.182,80
2011	39.628,40	26.376,20	215.386,00	281.390,60
2012	47.466,30	21.229,80	207.147,90	275.844,00
2013	54.245,10	21.785,70	206.774,80	282.805,60
2014	67.549,20	18.052,40	200.474,10	286.075,70

Source: own work according to data from the CNB

From presented data is visible that citizens increase investment in deposits on transaction accounts and term deposits, while in same time decrease on saving deposits is visible.

Data of our interest is also data on short-term and long term deposits without and with currency clause. This data are displayed at table 11 and table 12.

Table 11 The amounts of short-term and long-term deposits without a currency clause (in millions of kuna)

Year	Short-term deposits	Long-term deposits	Total
2011	150.809,00	62.857,4	213.666,40
2012	162.383,94	66.899,24	229.283,18
2013	170.401,83	82.716,48	253.118,31
2014	170.352,64	100.837,41	271.190,04
2015	157.834,26	109.385,48	267.219,75

Source: own work according to data from the CNB

Table 12 The amounts of short-term and long-term deposits with a currency clause (in millions of kuna)

Year	Short-term deposits	Long-term deposits	Total
2011	4.328,59	81.511,80	85.840,39
2012	4.097,29	79.720,99	83.818,28
2013	3.318,46	79.096,38	82.414,84
2014	3.335,86	80.414,77	83.750,63
2015	2.348,44	80.207,16	82.555,60

Source: own work according to data from the CNB

From presented data it is visible that our citizens show some changes in saving habits especially when it comes to short-term deposits.

Voluntary pension funds represent opportunity of investment for Croatian citizens since 2002. In table 16 gross contributions collected in voluntary funds will be presented.

Table 13 Gross contributions of voluntary pension funds by years (in 000)

Year	Gross contributions
2006	184.300
2007	261.533
2008	249.457
2009	286.965
2010	289.350
2011	303.814
2012	282.658
2013	292.058
2014	357.339
2015	450.996

Source: own work according to data from the CFSSA-e

In presented data is very clearly visible that Croatian citizens are starting to consider voluntary funds as interesting investment product. Last decade is characterized by continuous growth of investment in voluntary funds.

In table 14 we are analysing level of net assets of different investment funds. Deficiency of this data is in lack of precise data on the structure of investors, meaning that we do not know what is percentage of private investors.

Table 14 Net assets of open investment funds (in 000)

Year	Cash funds	Bond funds	Balanced funds	Equity funds
2006	4.274.744	1.138.589	5.994.698	4.311.043
2007	4.140.206	674.073	10.022.402	14.180.944
2008	3.907.382	510.977	2.150.291	2.753.595
2009	6.044.826	554.761	1.929.278	2.878.020
2010	6.859.559	1.180.904	1.945.398	3.021.862
2011	7.240.022	723.421	1.361.556	2.165.706
2012	9.124.521	446.683	1.107.755	1.936.657
2013	9.797.924	386.430	933.254	1.917.649
2014	9.180.308	934.891	749.768	1.696.259
2015	9.256.527	1.457.602	809.312	1.630.344

Source: own work according to data from the CFSSA-e

We can see that interest in different funds is changing in last decade. Very visible is dropdown of net assets in equity and balanced funds at the beginning of financial crisis.

From data displayed in this subchapter we can see that Croatian citizens show changes in financial habits in terms of change of the level of consumption of certain financial instruments.

3. Research methodology and results

On the basis of data presented in chapter 2 we will try to establish whether Croatian citizens in creating investment strategies follow performances of this financial instruments or they take random choices while selecting investment strategies.

We will try to establish what is correlation between investment in certain financial instruments and performances in these instruments. Because of great volatility before 2011 we will concentrate our research in last 5 years.

Pearson's correlation indexes are calculated on the basis of last 5 years. Correlation is calculated using data presented in subchapter 2.1 with data from subchapter 2.2 for following instruments; long-term deposits with currency clause (LTD-c), short-term deposits with currency clause (STD-c), long-term deposits without currency clause (LTD), short-term deposits without currency clause (STD), voluntary pension funds (VPF), cash funds (CF), bond funds (BOF), balanced funds (BF) and equity funds (EF).

Table 15 Value of Pearson's correlation index for chosen financial instruments

Financial instrument	Pearson's index
LTD-c	0,96
STD-c	0,97
LTD	-1,00
STD	0,22
VPF	-0,07
CF	-0,63
BOF	0,51
BF	-0,93
EF	-0,88

Source: own work according to data from the different relevant sources

Strong correlation exist as positive for both long and short term deposits with currency clause, strong negative correlation exists in investments in balanced funds and equity funds. Absolute, but negative correlation is found for long-term deposits without currency clause. Medium strong correlation exists in positive form for bond funds and as negative for cash funds. Correlation for short-term deposits without currency clause is relatively poor. When it comes to voluntary funds correlation is slight. The results must be observed with caution in terms of absolute relevance, because we based it on observation of data for just 5 years.

4. Conclusions and recommendations

From the results of performed research we can conclude that efficiency in creating a personal portfolio is not something that can describe financial behaviour of Croatian citizens. Lack of financial literacy has been proven by obtained results. Investment strategies used by Croatian citizens could be named random choice strategies with doubtful result.

Future with increase of the level of financial literacy could bring different results. Increase of financial literacy should be imposed as a number one aim for all institutions involved.

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Track 2

Entrepreneurship,
Tourism and Trade

Social entrepreneurship, benefits of networking from the perspective of Croatian NGOs

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Abstract: The concept of social entrepreneurship has attracted a lot of attention in Croatia over the past several years. However, judging by the available information, the implementation of the concept of social entrepreneurship is still not very widespread. Social networks can provide social enterprises with information, support and access to resources.

In this study we have tested the benefits of networking from the perspective of Croatian NGOs with a social component. The assumption was that presidents of NGOs in Croatia do not think that networking can help entrepreneurs to access resources that would otherwise be unavailable or costly to obtain. We also assumed a lack of knowledge about the advantages of networking such as certain legal benefits, facilitated lobbying with national institutions, and increased eligibility for government grants. Our research is based on the sample of 200 NGOs with a social component. The second purpose of this survey was to raise awareness of social entrepreneurship in Croatia and to show the importance of knowledge about network support in the process of developing social entrepreneurship.

Key words: *Non-governmental organization (NGO), social entrepreneurship, networking, entrepreneurship*

1. Introduction

Even if social entrepreneurship is a young term in social science and still lacks a consistent theory to define it, being seen as “a large tent” (Martin et al., 2007) for all kind of activities, the social phenomenon of social entrepreneurship is becoming wider and stronger as ever before. The same is happening with social networking. Social entrepreneurship can strongly benefit from a wise use of social network and networking.

The key difference between social entrepreneurship and commercial entrepreneurs is that in commercial entrepreneurship, the main focus is on the economic return, while in social entrepreneurship is in social return, which means that conventional entrepreneurs look essentially for economic profit (Kirzner, 1973), meaning that their performance is attached to financial return (Austin, Stevenson, & WeiSkillern, 2006). On the other hand, social entrepreneurs search, generally, to accomplish social goals based on the economic sustainability (Dorado, 2006). Leadbeater (1997) defends that many of the traits and behaviors of social entrepreneurs are the mirror of commercial entrepreneurs, including their

determination, ambition, charisma, leadership, ability to communicate their vision and inspire others and maximizing the use of resources; the key difference is that in business entrepreneurship, the main focus is the economic return while in social entrepreneurship is the social return. However, the creation of economic wealth is important for the social entrepreneur, so that he can ensure the sustainability of the organization and for it to become self-sustaining. Profit and wealth creation can be part of the model, but they are only means and not end in themselves (Dees, 1998).

Social entrepreneurship in Croatia is a rather new phenomenon and is still poorly developed. The term appeared in the public discourse rather late, in 2006, and since then has increased to the point where a strategy for social entrepreneurship has been initiated.

Social entrepreneurship refers to innovative and financially sustainable activities focused on solving social issues. A social enterprise's commercial activities do not necessarily have to be in accordance with the social mission; rather, its purpose is to create financial resources to implement social goals (Noya, 2009). Therefore, social entrepreneurship can encompass a rather wide range of organizations and enterprises – from those which generate profit by themselves, to those which procure resources for other organizations which pursue social mission.

The criteria used for classification of social enterprises are the following: (1) pursuit of social (or environmental) goals along with the economic ones; (2) availability of a profit generating strategy and its share in the organization's total profit; and element of innovation.

According to this classification, the first group is composed of traditional non-governmental organizations or associations. These are characterized by a large share of social goals and a non-profit status, and they represent the focus of this paper and the topic of our research.

The second category refers to nonprofit social enterprises. Unlike the classical NGOs, this category entails innovation, i.e. an innovative approach in the achievement of (social) goals.

The third group encompasses the so-called hybrid social enterprises which pursue social goals and whose profit generating strategy is in accordance with the social mission. Finally, the fourth category includes for-profit social enterprises which have a set of social goals, but whose profit generating strategy is not necessarily complementary with them. There is also a fifth category, which largely overlaps with commercial entrepreneurship and which is more closely related to socially responsible business practices (Vidović, 2012).

The aim of this paper is to explore the benefits of networking from the perspective of Croatian NGOs. As a starting point for this research, the assumption was that presidents of NGOs in Croatia do not think that networking can help entrepreneurs to access resources that would otherwise be unavailable or expensive to obtain. We also assumed a lack of knowledge about the advantages of networking such as certain legal benefits, facilitated lobbying with national institutions, and increased eligibility for government assistance.

This survey has been conducted on the sample of 200 associations in the Republic of Croatia in July/August 2015. Our respondents were Croatian NGOs which perceived the social component as an important one, and incorporated it in NGOs core activities.

By means of this research, we wanted to achieve the following objectives: (1) discover the benefit of networking among NGOs; (2) raise awareness of social entrepreneurship; (3) promote and spread the knowledge about social entrepreneurship among Croatian NGOs and the interested public.

In order to examine the aforementioned goals, the remainder of the paper is organized in four sections. The first section provides readers with an introduction into the topic and into the importance of this type of research. The second gives an overview of social entrepreneurship and benefits of networking for social entrepreneurs. In the third section of this paper, research

methodology and research results will be presented. And in the last section, the authors will offer research conclusions.

2. Social entrepreneurship and networking

Socio-entrepreneurship, in literally meaning, consists of two words, which are socio and entrepreneurship. They fuse and create a new word. So, socio-entrepreneurship is entrepreneurship that has social goal and method. Social entrepreneurship begins with a discussion of previous studies of Certo and Miller (2008), which pointed out that there are three ways to look at in social entrepreneurship. First, from the overall mission, social entrepreneurship has a mission to social value creation with profit as an indirect effect. Second, performance measurement is difficult to do because the difficulty of social value measurement. Third, resource utilization, that social entrepreneurship utilizes the resources voluntarily. Social entrepreneurship has profit as the goal and results oriented.

Certo and Miller (2008) define social entrepreneurship as a process that involves the recognition, evaluation and exploitation of opportunities that result in social value which involves the provision of basic needs such as food delivery, health services and education. Social entrepreneurship is an activity with community goals, which hopefully is profitable and the profit is used to reinvest in the organization itself (Steinerowski, Jack, & Farmer, 2008). It is more likely to occur in contexts where there are socio-economic, environmental and cultural issues (Dacin et al., 2010) and promotes a lasting, attractive and sustainable solution for social problems (Nga & Shamuganathan, 2010). Social entrepreneurs are people who identify a failure in society and transform it into a business opportunity; they recruit and motivate others to their cause and build networks with essential people at the same time. Also, they face the obstacles and challenges and introduce their own systems to manage their social business (Thompson, 2002).

Developing and successfully using the social network means to rationalise (Parsons, 1951) the necessity of networking (Blau, 1972). Social networks (that are generating trust – as in social capital) are working as a economic lubricant generating lower transactional costs, new ways of collaborating and business opportunities – prosperity, in general (Fukuyama, 1996), but it needs a sustainable effort in order to “establish or reproducing social networks that are going to be used on long term” (Bourdieu, 1985). The same rule of the “weak ties” that Granovetter (Granovetter, 1973) developed to explain how the way people find a job applies to organizations when it comes to raise funds for their activities, perform better, solve a task faster, find volunteers to involve and so on.

Networks have several useful properties for social entrepreneurs. The first is size. Social entrepreneurs can enlarge their networks to get crucial information and other resources from knowledgeable others. The next is positioning. Entrepreneurs position themselves within a social network to shorten the path to knowledgeable others to get what they need (Blau, 1997; Burt, 1992; Granovetter, 1973). Finally is relationship structure. Social contacts may be related to the entrepreneur or to each other through several types of relations or interactions. In single stranded relations, each person performs only one activity with the entrepreneur and is related to that person through only one type of relation. Multiplex ties, in contrast, have several layers of different content or types of relationships (Scott, 1991). They may play numerous roles in the entrepreneur's support group. Researchers pay special attention to the contribution of multiplex ties to entrepreneurship. They especially note that social network members can contact and organize themselves, expanding the opportunities they make available to the entrepreneur (Burt, 1992; Hansen, 2001).

3. Research methodology and findings

The purpose of this research was to meet research goals, explore the benefits of networking from the perspective of Croatian NGOs, understand and explore the motivations of networking for social entrepreneurs, and answer in research questions: What motivates individuals to network in a social context enterprise?

The structured questionnaire method was applied. In our research, we use closed type questions. The answers are easier to code and quicker to analyses in closed questions. With Google Docs, we created a form which represents the basis of our online survey. Having created the form we sent it as a direct mail to email addresses of members of our target group, leaders of Croatian NGOs¹. The target group of respondents who can best provide the information we need are NGOs in Croatia which also have a social component as a registered part of their activities.

Preparations for the analysis of NGOs also included desk research, and audio scripts that contained a large number of questions significant for the research also proved to be highly valuable for the analysis. Respondents were contacted by e-mail.

The structured questionnaires include 4 questions each. The measuring instrument (questionnaire) for this research consisted of a set of questions that the respondents (presidents or vice presidents of NGOs) were asked to answer and express their agreement/disagreement with the proposed statements, whereby the Likert measurement scale of five degrees was used (1- not at all; 2 – very little; 3 – some, 4 – much, 5 – completely).

The most sensitive part of any social sciences survey is the response rate, especially when the survey is not completely anonymous, as we targeted a specific group of NGOs, and contacted them directly. Also, our survey was conducted in a very sensitive period, between July and August 2015, while most of Croatians used their annual leaves, which we took into consideration, and adjusted our questionnaire to be easy fulfilled by mobile phone or tablet. Out of the total of 200 questionnaires which were sent, 42 were returned, representing a response rate of 21%, which can be accepted as relevant in social surveys (Fombrun and Rindova, 1998).

From the total number of participants, 34 were females (81%) and 9 were males (12.5%). The research was conducted on the entire territory of Croatia. Distribution of the respondents across Croatia was as follows: NGOs operating in Osijek-Baranja County (23.3%), the City of Zagreb (23.3%) and Split-Dalmatia County (20.9%), while the rest were from other counties.

Average age of a Croatian NGO is 13 years. According to the research, the largest proportion of NGOs, up to 40.5% were employers while only 11.9% of respondents were either employees or volunteers in the NGO sector.

The variable " Benefits of networking from the perspective of Croatian NGOs." is a product of a chosen question while the reliability of the measurement scales was analyzed by means of the Cronbach's alpha coefficient. Cronbach's alpha reliability coefficient normally ranges between 0 and 1. However, there is actually no lower limit to the coefficient. The closer Cronbach's alpha coefficient is to 1.0, the greater the internal consistency of the items in the scale George and Mallery (2003) provide the following rules of thumb: "<0.9 is excellent, <0.8 is good, <0.7 is acceptable, <0.6 is questionable, <0.5 is poor, and <0.4 is unacceptable". While increasing the value of alpha is partially dependent up on the number of items in the scale, it should be noted that this has diminishing returns. It should also be noted that the alpha of our survey is <0.7, which is acceptable.

¹ A data base of Croatian NGOs, with the relevant contact details is publicly available on the following link: <https://uprava.gov.hr/o-ministarstvu/ustrojstvo/uprava-za-opcu-upravu/registri/registar-udruga/826>.

Table 1 Benefits of networking for NGOs (mean and std. deviation for each question)

Item Statistics			
	Mean	Std. Deviation	N
Networking can provide certain legal advantages	3,6905	,94966	42
Networking: makes it easily lobbying with national institutions	3,9762	1,04737	42
Networking: makes it easier to receive government assistance	3,7143	,99476	42
Networking: makes it easier to react strongly to the appearance of new social change in society	3,8333	,93487	42

Source: Research results

Table 2 Case Processing Summary

		N	%
Cases	Valid	42	100,0
	Excluded ^a	0	,0
	Total	42	100,0

- a. Listwise deletion based on all variables in the procedure

Source: Research results

Table 3 Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,931	,931	4

Source: Research results

We can see that all (42) of our respondents answered this question. Alpha coefficient for the four items is 0.931, suggesting that the items have high internal consistency.

After a detailed analysis of all four areas of competitive advantage which social entrepreneurs can obtain as the result of networking, it has become clear that the perception of interviewed presidents of NGOs ranges from 3 and 4 in terms of ratings, i.e. from indifference to agreement, as demonstrated in Table 1. It is important to highlight that no presidents expressed complete agreement with any one of the statements, i.e. that no competitive advantage features received the rating 5, which certainly leaves enough room for further work on improving the role of NGOs, both by NGO presidents themselves, and by relevant institutions. Competitive advantage related to national institutions received a high average rating of 3.80. Namely, presidents of NGOs in Croatia mostly agree with the statement that networking can help in receiving government assistance (3,714), and most of them also believe that networking could offer certain legal benefits (3,690). Many interviewees also agreed with the statement that networking facilitates lobbying with national

institutions (3,976). According to our survey, it allows NGOs to respond more easily and more efficiently in the face of new social changes (3.833).

4. Conclusion

Networking of NGOs in the Republic of Croatia is one of the main driving forces of development of NGOs on the local, regional and national level. According to the results of the conducted research, we can see that the interviewed presidents of NGOs are aware of the importance of networking, because joint activities allow them to obtain certain legal benefits (e.g. tax reliefs). All interviewees agree that networking could facilitate lobbying with state institutions and make it more efficient, and that in this way they might receive state assistance more easily and more quickly. The interviewed presidents of NGOs in the Republic of Croatia believe that networking would allow them to respond more efficiently to all social changes that could occur in the global market. NGO networks are not sufficient to overcome all disadvantages NGOs are faced with in their business operations, but if networking becomes a part of their business strategy and policy, it could contribute significantly to the achievement of positive results which could not be achieved by means of NGOs' individual policies.

The conducted research speaks in favour of the claim that NGOs in the Republic of Croatia can obtain great benefits from networking, but there are also numerous areas which require further work so that those benefits could manifest themselves fully. NGO networks are necessary so that the joint contribution could be manifested through social development.

For a further development of this area, it is necessary to prompt research on social entrepreneurship and encourage networking among social enterprises, which would allow dialogue and exchange of experience. Finally, further surveys should be conducted among all NGOs in the Republic of Croatia in order to obtain their view on all the benefits they might receive from networking.

To conclude, we would like to cite Drayton, one of the most quoted authors dealing with the topic of social entrepreneurship, who provided the best outline of what social entrepreneurs should represent: "...There are many creative, altruistic, ethically good people with innovative ideas; however, only one in many thousands of such good people also has the entrepreneurial quality necessary to engineer large-scale systemic social change..."

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Redefining the development policies of consumer cooperatives in Moldova under European priorities

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Abstract: The cooperative system in Moldova is passing a long and difficult period of transition from a statual economy in an economic system. This process may not be perfect, but it ensures a high rate of economic agents involved in competition, thus turning it into a cumulative process of economic and social growth. The strategies, policies, and priorities for the development of cooperatives in the EU member states adhere to high scientific and professional standards, demonstrated over time by obtaining notable performances from technical, scientific, economic and social areas. This article follows the logic and proper steps after the signing of the EU-Moldova Association agreement for the redefinition of the concept and policies of consumer cooperatives in Moldova in order to assimilate with European priorities and practices and use that as a basis for achieving the desired objectives. Rethinking the management system in Moldova's cooperation is a major condition for sustainable economic development.

Keywords: *statual economic system, market economy, economic mechanism, competition, consumer association agreement.*

1. Preface

Cooperative nowadays is a component of the European and global social economy having a significant contribution both in national economies and in local socio-economic development. The cooperation is not only a significant component of the economy, but also one of the main subjects of the social economy in Europe and the world. Being recognized as a legal entity and being treated equally with the other types of associations and foundations, having an autonomous character, democratic values, true cooperative principles relief, personal responsibility, human solidarity, mobilizing human, material and financial resources, organizing economic activity, creating jobs, training of local population or in proximity that prepares professional associates for jobs and then multiplying collective ownership is held together to solve the material needs of the participants. Cooperative enterprises contribute to the training of the unemployed, including the different social groups and disabled people, aging population, immigrants of both sexes, and then by integrating them in social life, and as a result, contribute to the eradication of poverty and hunger.

Cooperative enterprises play an important role in social and economic life because they operate on the basis of fundamental needs, such as job creation, organization of economic and marketing processes in the industry, construction, transportation, adjustment of banking and crediting system to people's needs, performing insurance, health and educational services. Basically, this means that person's needs, his socialization and not profit are put in the center of cooperative activities, because the values and the principles of cooperative business enterprises differ from the ones based on the market economic relations. Economic development of cooperative enterprises is carried out by employees and their basic needs and aspirations.

A key principle of the cooperative to its members is the school of life. Cooperative economic structure, based on the grounds of its founding members' needs and aspirations is not targeting the profit as a main goal. Prominence of a true economy is a social wealth, social relief and joint resolution of local problems, where the financial benefits and material income became instruments for achieving human socialization, development of local infrastructure, schooling of people in need, maintenance and preservation of the environment, eradication of poverty and hunger of native population and migrants.

Viability of millions of cooperative enterprises in the world has been proven by a successful combination of cooperative competition due to a valuable human potential, it has the doctrine that stimulates employees' participation in economic and social life. Implementation of legal responsibility at every stage of production, distribution, exchange and consumption of economic performance of all interested participants, training of new skills and values to meet the needs and solve the problems.

Cooperatives have a significant market share in basic economic sectors, particularly in the areas of agriculture, trade, transport, construction, health, education and insurance, lending and banking systems, pharmaceutical and social service. A wide range of types of cooperatives, cooperative European transnational activities are grouped into different jobs in construction, craft, design, trade, production and realization of bread and bakery products, confectionery, meat and meat products, milk and milk products, footwear, clothing, utilities, etc. This cooperative system as a whole has created millions of jobs, wages and services providing a significant segment of the population in Europe.

Only a few findings that confirm the above. According to United Nations 50% of the population of the planet depends significantly on the activity of cooperative enterprises. One million such businesses have employed over 100 million people and the number of cooperative members is around 1 billion people. Initial rankings of the International Cooperative Alliance for the top 300 cooperatives from 26 countries around the world, called "Global 300", showed great resilience to the global crisis and that the total turnover of these cooperative groups is 2.2057 trillion US dollars (with 11.6% more compared to the period between 2010-2012). Main areas were: insurance (41%), agriculture and food (27%), retail (20%), industry (5%), banking and financial services (4%), healthcare (1%).

The European region of the International Cooperative Alliance - Europe Cooperatives enlists 123 million cooperative members and 160 thousand cooperative enterprises, which employed 5.4 million people. By the number of cooperative enterprises, mainland leaders are Italy with 41 500 cooperatives, Spain with 24 300 cooperatives followed by France with 22 800 cooperatives (2012).

The cooperative movement in France consists of more than 24 million cooperative members, followed by Germany with 20.5 million members and Italy with more than 13 million. These three countries occupy the leading places in Europe by number of employees, therefore - Italy with over a million people, nearly a million France and Germany with a total of over 830

thousand people employed in cooperatives. Italian cooperative enterprises have committed nearly 5%, while the French ones only 3.5% of the working population of these countries. The most important sectors in working cooperatives are industrial services (41%) and agriculture (33%), consumption (3%) and pharmaceuticals (1%).¹

Consumer cooperation in Moldova has a rich experience. Founded 147 years ago, it has gone through various periods of beneficial ascension and hardship.

Since 1991 the cooperative system in Moldova caught in privatization of state property, agricultural collectives, price liberalization, began to lose its values, principles and functions, there were disparities between the social and the economic position, which once made this system most humane and attractive in the country.

Currently a promising market economy creates new processes and forms in the development of cooperatives which justify interest in cooperative enterprises activities experienced in EU countries in solving complex problems of social-economic changes.

The integration of Moldova to the European Union implies the need for comparative analysis of cooperative systems in the country with the European countries, the cooperative legislation that governs these systems form the organizational structure determines function areas of activity, quality management in these systems for continuous modernization of cooperative structures in the country, attracting investment, widening sectors of activity, diversified and dynamic adaptation to the requirements of the national and international market. However, it imperatively requires harmonizing national legislation of consumption cooperation system with the EU acquis, the gradual harmonization of the legislation with the multidimensional European Community of the cooperative system.

This article is one of such attempts. The topic covers a wide European experience on the development of cooperative legislation, given that EU has integrated countries with different cooperative traditions, determined various regulations on multidisciplinary and multidimensional complex issues and had limited space. The authors have proposed to draw a few key coordinates that characterize this topic.

2. Methodology

In order to collect the research data there were used various methods such as analysis and synthesis, normative inference, deductive and comparative study.

3. Systemic Transformation of National Economy in Transition period and their impact on cooperatives

The late 80's and early 90's not only marked as the last years of the XX century, **but also a historical return to a natural market economy** of a Central and Eastern Europe, as well as the union republics of the USSR, including Moldova.

Without giving any details, we point out that in the socialist economy of Moldova as well as of the other countries the monopoly of state property was dominating, but in the agricultural and cooperative system it was collective ownership. The mechanism of realization of the property was conducted through centrally planned development law, and not in accordance to market requirements. Politico-administrative and organizational structures corresponded to the relations of production, but their administration was performed by an oversized and overly politicized Government party. Planned allocation of financial resources created material and human disproportion to the oversized businesses and insufficient development of others.

¹ Revue des etudes cooperatives, mutualistes et Associatives Recma. Trimistriel, april 2015, pag.33

Commanded economy had a system of non-stimulating remuneration, egalitarian and non-convertible monetary system. Export was executed by only specialized state enterprises.

Consequently, socialism was not a natural product and the transition from planned economy to market was one necessary objective. Countries going through these processes are called transition economy countries, including the Republic of Moldova, whose basic components of economy are in a radical systemic transformation.

Social and economic cost supported by the population, the national economy, including the cooperative system in this period, and the implications of the country transition through the entire activity is a special topic. It's worth mentioning that along the distortions and disparities experienced by the Moldavian socialist cooperatives, in the 60's-90's period there were times when the system performed services and produced goods that exceeded domestic consumption, collected and acquisitioned commodities for export, performed activities that reached the volume of several billion dollars annually.

In the early 90s the country was studded by a difficult economic and political context, unpredictable and unstable economic and political context when the industrial and agricultural country entered into a process of decomposition, cooperative system created based on socialist principles could not remain intact. Certainty of consumer's cooperatives was the same as of the system that has undergone degeneration.

In the management report of MOLDCOOP in XI Congress of the consumer cooperative work held on February 4, 1994 stated that "... the economic crisis in the country, the sudden drop in production, reduction of national income, unemployment and poverty population substantially influenced economic activity of consumer cooperatives." There was a significant decrease in the number of retail trade and public food units, which led to a considerable reduction in the volume of sales of goods, procurement and production activity was stopped in most of the cooperatives. The share of their assets in their total volume decreased from 34% in 1989 to 12% in 1993.

As mentioned in the report to the congress, in this period it was characteristic the fact that **"many of the leaders were plunged into so-called market economy, to independence without the psychological, social, economic and legal training, without knowing the proper measure of what that is"**. Consumer cooperatives built on different principles could not cope with the first primitive accumulation of capital and distorted competition terms that appeared at that time in the national economy.

The second wave of economic decline of consumer cooperatives in 1995-2000 resulted in a substantial reduction in the size of the cooperative sector and macro indicators of economic activity. During this time the number of unemployed has reached a significant proportion size, the number of cooperatives and cooperative heritage volume has decreased. Real Estate located in beneficial places was alienated and the remaining Real Estate was only partially used. The number of cooperatives has reduced, and the economic activity has been steadily decreasing.

The beginning of the new millennium is characterized by stopping the fall in consumer cooperation activity. In 2002 came the first signs of recovery in the economic activity, although an overall loss was registered in this segment.

Along with the stable growth followed by an un-uniformed development, a consumer cooperatives since 2005 began working with relative efficiency, and as a result, the economic and financial system in recent years has entered a phase of recovery and economic ascent, even a slow start, but which allowed modernization of material and technical base of the system, expansion of cooperative infrastructure in rural locations that improved placement in accordance with the requirements of the population, upgrading the existing capacities of

ensuring quality services. Expanding commercial infrastructure for bread production in areas where these services are required, including in places where such services are not provided in the previous period of time by reopening commercial establishments and restoring the service, upgrading some of them technologically and in terms of image has allowed in recent years to find not only a revival in trade, public catering, but also a steady increase in economic activities, taken as a whole, and production - which permit an improvement overall.

Gradually the system began to operate profitably despite unfavorable business environment in the country that does not allow attracting foreign and domestic investments in consumer cooperation. Due to lack of financial means, decisive actions needed to renovate and reinstate the entire cooperative heritage; multiplication and diversification of production, provision of services and creation of innovative cooperative units could not take place.

4. Some economic issues on cooperative systems in Moldova, France and Germany

a) The dimensions of consumer cooperatives in Moldova

Systemic changes in the national economy, the emergence of competitive elements in the real economy and trade sectors have given rise to diversification of cooperative systems, and in this case, arose agricultural production cooperatives, entrepreneur's agricultural cooperatives, joint stock companies, limited liability companies. But the size of consumer cooperatives in Moldova remains the most significant in the country. Experienced agriculture corporate organizations increase slightly the number of active agricultural entities as well as the management of agricultural land surface but are only in the beginning. Therefore further reports focus back on the consumer cooperatives, because its dimensions remain the most significant.

In the period of 2012-2015 years, the cooperative system has become multidimensional, diversified economic activities, concentrating efforts in achieving the development program mapped out by the Congress number XV of consumer cooperatives in Moldova.

According to official documents presented and discussed at Congress XVI (February 2016) about the activities of consumer cooperatives in 2012-2015, organizations and enterprises contributed to reanimate the system and the development of traditional activities and new activities, extended coverage in rural activities, rural modernization and upgrading production processes of trade, diversification of the services, infrastructure modernization. In the reference period were reopened 31 commercial units in villages, were modernized commercial technologies in 200 stores, refurbished 54 units of catering. It opened 30 stores of CoopPlus and CoopPrim type. The amount of investment in improving the technical and material support is near 88.6 mln. lei.

All of this allowed the cooperatives at the beginning of 2016 to present the following statistics:

- co-operative members - 144 000;
- Companies - 161, including 98 consumer cooperatives;
- Number of employees - about 4700 people;
- The number of localities in which cooperative provided its services -770;
- markets - 32 with 10850 seats outlets;
- The manufacturing sector comprises 21 factories and bakeries, confectionery sections 14, slaughterhouses -16 and 29 processing units of agricultural products;
- educational institutions - 3.

During the years 2012-2015 there were:

- Marketed retail goods worth of 3.1 billion lei, or 108.4% compared to the previous four years;
- Manufactured goods wholesale total of 383.5 mln. lei indicating an increase of 52.1% compared to the previous period;
- Acquired agricultural products over 315.4 mln. lei compared to 278.6 mln. lei in the period 2008-2011;
- Industry goods, mainly bakeries - breads pastries, sausages, beverages;
- Provided services worth of 589.5 mln. lei or 131.1% compared to 2008-2011;
- Conducted exports worth of 64.8 mln. 19.1 million lei and for imports. lei².

With the support of the majority system entities have reached an economic growth and resulted in a consistent profit worth 30.2 mln. lei. Practically 70% of businesses have turned to profit. Simultaneously, it increased the contributions to the consolidated budget, as well as social and health insurance, representing the total amount of 431.8 mln. lei.

b) Cooperative enterprises in France (as of 2012)

- **Agricultural cooperatives** - 2 850 enterprises in relation with 12,400 companies with common interest in agriculture, the number of employees about 160 000, 83.7 billion euro business figure;
- **Co-operative enterprises using needlework crafts** - 425 enterprises, (partners, members, associates - 59 000), 3,500 employees, 1.2 billion euro business figure;
- **Transport cooperatives** - 46 (partners, members or associates - 816 transport companies), number of employees - 1,655 persons, business figure 0.165 billion euro.
- **Trade cooperatives** - 80 enterprises, (partners, members or associates - 30815 people), number of employees 510 800 people, the volume of achievements - 138.2 billion euro;
- **Marine cooperatives** - 134 enterprises (partners, members or associates – 1230 fishing companies), 1,800 people employed, business figure - 1.2 billion euro;
- **Consumer cooperative** - 35 enterprises, 750 thousand cooperative members, 9,500 employees, 2.65 billion euro turnover and business figure 800 mln. euro;
- **Housing cooperatives (low-cost)** - 171 companies, 56.3 thousand cooperative members, 999 persons employed, turnover - 182 mln. euro;
- **Agricultural Credit Group** includes 39 regional banks, 2523 local savings banks, 7013 branches, 700,000 shareholders, 150 thousand employees.
- **Groups of banks and cooperative credit group:**
 - a) Savings Banks - 136 regional savings banks, 8,600 thousand shareholders.
 - b) The system of popular banks - 19 popular banks, shareholders 8,600 thousand, 117 thousand employees.
 - c) cooperative group - 13 structured cooperatives with 115 branches, 65 thousand shareholders, employees - 2058
- Other types of cooperatives and companies

² Data used from Development strategy of consumers cooperation of Republic of Moldova for 2016-2019 ; Chişinău, 2016; pag. 6-9.

- **Total per country - 23 144 cooperative enterprises, (partners, members, associates - 24,397,196), 1,081,015 employees, 299,11 billions of Euro – business figure³.**

c) Some cooperative sectoral activities in Germany

- **Cooperative banks** - 1101 units, branches 13211 and 750 billion carrying amount. -2 Cooperative central bank with 503 billion carrying amount, 17.4 mln. shareholders and 30 mln. customers;
- **Agricultural cooperatives Raiffeisen** including 19 centers, 51.3 billion euro – equivalent of the amount of goods;
- **Trade cooperatives** - 1960 enterprises, 400 thousand cooperative members, 112.9 billion euro turnover;
- **Consumer cooperative** - 285 enterprises, 500 thousand cooperative members, 2 billion business figure;
- **Housing cooperatives** - 1931 enterprises, 2.8 mln. cooperative members, 2.2 million apartments build⁴.

In conclusion, we find out that cooperatives in these countries create an economic and social system, apolitical and non-government, autonomous and independent carrying out various fields of activities - trade, manufacturing, banking, transport, construction of houses, employment, etc. All these and many other properties, principles, rules, order, control and mutual support are common. The difference between the cooperative system in Moldova and the EU is determined to turn, pointing out that Moldova is at the beginning of the way to master a market economy. It explains the lack of national legal expertise influenced by its contradictions which can not ensure an efficient activity of cooperatives under competitive conditions. Also, we need to mention the management faulty of the taxes' system and the unattractive to foreign investors and domestic businesses corrupted environment. We will study some of this problems below.

5. The need to reassess the legal basis for the development of cooperative system during the transition period in the Republic of Moldova

Moldovan cooperative entities still lack basic and unique legal basis for cooperative development of all forms, coordinated with banking law, customs law, commercial law, tax law, the status of cooperatives (like the German one). Cooperative forms are not diverse and multiple as that of France, Germany or Italy (measured by relative indicators). Constraints arise not only from that cause (as discussed previously), but also from the lack of experience needed in conditions of market economy, competitive unfavorable business environment, chronic shortage of financial resources to organize and develop cooperative activities, competitive both domestically and externally.

During the period of the 90's, the transition of the national economy to market relations, the Parliament adopted the Law of Cooperatives [4], which proved to be the legal base necessary for the development of cooperative system under competitive conditions. New economic relationships based on the private property and directed towards changing imposed by the market have given a rise to economic diversification of this segment as it is the cooperative. In the economy have taken birth also other organizational forms (such as has been mentioned

³ Revue internationale de l'economie sociale RECMA. Cooperatives in France : Issue and challenges at the start of the 21 st century . April 2015, p.32

⁴Data from the Federal Ministry of Catering of Germany, march 2014

above), agricultural cooperative, for which there have been developed the appropriate laws. This is how there appeared the Law concerning cooperatives of production (5), the Law concerning entrepreneurship cooperatives (6) and, of course, the Law of consumers' cooperative (7) which provides the legal basis for the most significant cooperative systems in the country. In addition to these laws there are drawn up special stipulations in the Civil Code (Articles 171-178) (8)) supplementing and providing more legal basis for the structure and operating of the cooperatives' system under market conditions.

The first steps in the development of the piece of legislation have led to the legal, administrative and social basis of cooperatives, for instance the legal limits, appropriate political and economic conditions in the country of cooperative relations during the period of transition, then laws, special stipulations in the Civil Code, as well as other rules and regulations adopted on the setting up, structure and operation of various forms of cooperatives joined in the organization and essence of goods-money relations, which along the way have become more exciting and all-encompassing.

Development and adoption of a package of laws and stipulations in the Civil Code on the setting up and legal, economic and social organization, defining specific property type of a cooperative, its structure, establishing the principles of ruling bodies and association of the co-operatives, as well as the integration of this economic and social segment in the market economy must, on the one hand, match the values, the principles, as well as national and international cooperatives' customs, and the specific needs of the changing economy, on the other hand.

The principles and the values on the basis of constitution of a cooperative are in line with those of non-commercial organization, which does not have the benefit as an aim, but satisfying the needs of those who have in common this cooperative, whereas the requirements of the market economy require cooperatives to operate under competitive conditions corresponding to laws of supply and demand which means obtaining the benefit that provides vitality. The situations that come out require flexibility in management, organization, legislation.

It is necessary to emphasise that the laws governing the system of cooperatives in Moldova, in principle, are flexible and allow the changes necessary in the transition period in some structural problems. Starting with the law of the cooperative system adopted in 1992, then logically developed and other organic, general and special laws, stipulations, pieces of law have formed the legal basis of the current national cooperative system which, in principle, is up to the level of development of relations of production based on private property. Under appropriate legal support, cooperatives of different social, economic sizes and shapes are involved in solving problems and needs generated by the difficulties faced by national economy nowadays.

This does not mean that the system of law governing this socio-economical section is morally perfect and is according to internal and external challenges and is not free of continuity, integrity, rigidity, contradictions and constraints. Consumers' cooperative is a significant part of national economy and social life, which offers viable alternatives through the creation of a different type of economic assets in relation to the companies and organizations that stand at the base of private property and the market economy rules. This explains the fact that the enactment of the cooperative system practically ensures the framework for cooperatives of different shapes in the country, in order to contribute to institutional capacity and development as well as cooperatives association in an territorial union.

More than that, the stipulations of the Law of Consumers' cooperative in the Republic of Moldova regarding the setting up, structure and operating of Consumers' cooperative subscribes to the nowadays trends in the EU.

At the jubiliar congress of the International Cooperative Alliance in Manchester, in 1995, the cooperative identity has been defined as follows: "Cooperative is an an autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly owned and democratically controlled enterprise ' (9)

The definition determines the basic features of the co-operatives: (a) an autonomous association self-contained by the governmental institutions and the companies of capital, which operates in accordance with the laws of the market, as well as individuals ; and (b) created by free, voluntary association of members of their own free will without being subject to any constraints or restrictions; (c) based on the principle of democratic "one person - one vote" election of the members of their management and the adoption of main solutions from everyday activity and perspective; (d) with a system of remuneration that is right, unbiased and fair.

The definition of the Consumers' cooperative in the Republic of Moldova is given by the law of Consumers' cooperative in 2000 by referring to the following editorial: "Consumers' cooperative -an autonomous and independent association of individuals, created on the principle of free consent, through the cooperation of shares of its members, engaged in economic activities to meet their interests and needs of consumption."

By comparing these two definitions of the cooperatives we can conclude that the law of Consumers' cooperative addresses to the principles and values of the constitution and operation of the co-operatives similar or very close to those democratic principles of international cooperation adopted in Manchester, in 1995, at the Congress.

To confirm that has been written above, here are some of Cooperative's principles of the law of Consumers' cooperative in the Republic of Moldova:

- a) **Procedure for establishing consumers' co-operatives** can be carried out without great effort - cooperatives may be located in the area of one or more localities and/or in the same locality where can operate one or more consumers' owned cooperatives (Article 19 (1) and (2) The law C. C.);
- b) **Consumers' Cooperative shall be established by decision adopted by the constituent assembly which must be attended by at least 7 cooperative members.** In Civil Code the number of founding members is 5 (Article 171, paragraph (1));
- c) **Cooperative may be formed with a variable share capital.** The amount of a share shall be determined at a meeting of the constitution and may be amended in accordance with its statute. Without any difficulties, the members of the cooperative or the associated organization are able to withdraw their share (Law C. C. Article 89 (2), Article 90 (1) and (5));
- d) **Individuals may be associated in consumers' owned cooperatives and are able to get out of it voluntarily, freely.** Consumers' cooperative shall be open to all individuals that are capable of performing services and are responsible of their membership, that means they are equal in rights to be promoted within the governing bodies and of control, without there existing discrimination on political criteria, race, nationality, language, religion, sex, wealth (Law C. C. Article 6 (1) and (3), Article 9 (1) and (2));
- e) **Democratic nature of cooperative society** is confirmed by strict observance of the principle of "one member - one vote", regardless of how many shares subscribed and that all decisions shall be taken only in a collegiate way, there shall take part all cooperative members (Law C. C. Article 7 (1) and (2), Article 8 (2)). Regulations of the democratic governing structures operate within the Consumers' cooperative shall be carried out by ensuring the participation of members of the company's management and cooperative collective control activity;
- f) **Cooperative organization is a non-governmental and non-business organization** created in order to meet needs and interests of cooperative members, who participate on an equal foot

in the activity of the cooperative organization, to the formation of social capital, with the result being – the benefit from a fair and equitable distribution. Relations between the cooperative members and cooperative organizations shall be determined under mutually beneficial conditions. Cooperatives serve their members most effectively (Law C. C. Article 4 (4) (1) and (2), Article 11, Article 12). In accordance to the Article 15 of the law of CC, consumers' cooperative works **independently** on the basis of its own development programs;

g) **Cooperative members interests regarding the cooperative's property** is defended by the law of C. C. (Article 89 (1), (2) and (3)) that writes down that the property of the cooperative organization is private property, equally protected by the law, and shall consist of a divisible and indivisible part. The divisible part consists of shares, submitted by cooperative members, and the indivisible includes accumulated assets in the subsequent course of business, without the cooperative divisible part. Liquidation of the Consumers' cooperative provides from the divisible part the releasing accounts payable (if any) and shares - founding members, in accordance with statute, and the indivisible part goes to the territorial union from the area;

h) **In conclusion, consumers' cooperative formed on the basis of the principles referred above is a legal person governed by private law.** On the basis of Article 1 of the law of C. C. it is an autonomous and independent association of individuals, on the principles of free consent, through the cooperation of shares of its members engaged in economic activities to meet their interests and their needs of consumption.

This definition in Article 4 (referred above in paragraph (f) comes with an addition which states that the organization is non-governmental and non-commerce, and the Article 82 (1) specifies the legal forms of organization of consumers' cooperatives are consumers' cooperative, territorial union of consumers' cooperatives and central union of consumers' cooperatives. **Cooperative organizations may set up cooperative companies as independent legal entities with commercial character (Article 82 (2)).**

6. Some Ideas on Enacting of an entrepreneurial cooperatives in EU countries

According to the Document of the European Parliament, the legislation of the cooperative system in the Member States of the European Union is divided in the following way:

- Countries in which the legislative system of the cooperatives is divided into sectors, in accordance to that distinctive sector, as well as social aims (Belgium, Ireland);
- Countries in which cooperative legislation, which would be able to bring under regulation the set up and operation of cooperatives, has not been drawn up. Cooperative business shall be determined by the statute which outlines the nature of their cooperative (Denmark, Great Britain, Luxembourg);
- Countries in which has been drawn up a general cooperative law for the whole economy, which has a legal framework on the basis of which shall be constituted and work the coops of all forms (Germany, France, Italy, Spain, Austria).

The Rome Treaty, establishing the European Community, notes (Article 48) that cooperative entities are recognized as companies or firms, but this determination does not provide, in relation to other forms of businesses, equal and equitable relationships.

In order to facilitate cooperatives to achieve economic potential in compliance with the laws of the market economy, develop relations based on democratic cooperative system, growing social responsibility at European level, the European Council decided to create the **European cooperative societies with transnational character**. To do this, the Council of Europe has adopted Regulation No 1435/2003 of the Council of 22 July 2003 relating to the status of the European Cooperative Society (ECS). Regulation establishes a legal status of ECS and

guarantees equality of conditions of competition between cooperative companies and companies of capital. (10) Regulation provides:

A) Stipulations of ECS: ECS may be formed:

- By at least five individuals **and/or legal persons** residents in at least two Member States of the European Economic Area (EEA), formed in accordance with the law of a Member State of the European Union (EU) and governed by the law of at least two Member States of the EU;
- Through the merge **of cooperatives** formed in accordance with the law of a Member State, which have their registered office and the administration center in the State in question,
- By converting **a cooperative** formed in accordance with the law of a Member State of the EU which it has its registered office and the administration center in EEA, in case this cooperative has for at least two years a unit or a subsidiary company which is governed by the law of another Member State of the EU.

(B) capital of the ECS: share capital of the ECS is represented by the shares of its members. This capital must add at least 30 000 EUR. The laws of a Member State requiring a greater subscribed capital for legal persons who perform certain types of activities (such as banking, insurance, etc.) should apply to those ECSs which have their head office in the Member State concerned. Once a year, the general admission must satisfy itself, in a resolution, that the amount of capital is at the end of that financial year and its demarcations of the preceding year.

If the legislation of a Member State, in which its head office is, allows, ECS may have cooperative members as investors, with voting rights being limited.

(C) the ECS statute: founding members shall draw up the statute of the ECS, in accordance with the stipulations of the establishment of national cooperatives. The statute shall be drawn up in written form and signed by the founding members.

(D) principle of non-discrimination. Subject to these Regulations, an ECS shall be treated in each of the Member States as a national cooperative.

Registration and advertising. Any ECS shall be registered in the Member State in whose territory it has its registered office in a register designated by the law of the Member State in question. Registration and cancellation of registration shall be the subject of a notice published for informative purposes in the Official Journal of the European Union.

(E) structures of the ECS. In the structure of an ECS shall enter, on the one hand, **a general assembly**, and on the other hand:

- EITHER a **body of administration and** a supervisory body (two-tier system);
- EITHER a management (one-tier system), according to the choice referred to in the ECS statute.

In the general assembly, the members have, in principle, equal voting rights. Exceptions may occur in favor of big investors of cooperatives, in certain financial cooperatives.

The governing body or management body, depending on the type of structure chosen, ensure management of the ECS and may represent it in the justice system or third parties.

The statute of the ECS enlists the categories of transactions which require an authorization. This may be awarded to the management body or, administratively, by the supervisory body or by decision of the general assembly.

(F) audit and publication of accounts . ECS shall be subject to the legislation of the Member State in whose territory it is situated regarding the preparation, audit and publication of annual accounts and those consolidated.

(G) The winding up, liquidation, insolvency and cessation of payments. Dissolving ECS is pronounced: either by decision of the general assembly, in particular when it reaches the statute's deadline or when social capital is reduced below the minimum fixed value; or by legal proceedings, for example in case the headquarters of ECS have been transferred outside the EEA. ECS which is the subject of a winding-up proceedings, insolvency or cessation of payments shall be subject to the stipulations of the national legislation of the State in whose territory it is situated.

By drawing your attention and referring to this Regulation, we want to encourage the creation of transnational cooperative societies in the Republic of Moldova to promote an activity at the European level.

Improving legal framework in the field of the cooperative system by the Member States, as well as the European Community institutions consists of establishing the formation and functionality of cooperatives by ensuring compliance with cooperative characteristics in accordance with the principles and values set by International Cooperative Alliance (HERE- The Statement of cooperative Identity developed in 1995 and updated in 1996) and at the same time provides access for cooperatives to the capital market. Principles listed and recommended to all cooperative national systems by the declaration of identity are:

(A) voluntary association, free and open. Association is carried out by a body of people with the same sort of interests. This principle in the law of cooperatives in Germany (1990) is referred to as through free accession, unlimited number of members, as well as the admission of new members regardless of the date of lodging of cooperative. Worker cooperatives in France (1978) and the law of general cooperatives in Spain (1987) also require that the cooperative societies have a variable capital and a structure and democratic management, that assigns, in free accession and voluntary recall, people who have an interest or common socio-economic needs... this principle in Consumers' Cooperative law of Moldova are practically similar to those in Romania. In the notion of the consumers' cooperative, in Moldova as in France, there is no reference to the concept - "open" - which means that every person may join or leave cooperative regardless of the date of formation of the company.

B)democratic control of cooperative members exercised on decisions by the cooperative society. Cooperatives functioning democratically, as well as equal rights of cooperative members, in their management, with no discrimination, shall be carried out by the rules which determine the election procedures and the establishment of bodies to take decisions in the bodies at various levels. This principle is transposed in the laws operating in France, Germany, Italy, Spain, etc. Democratic principles are reflected by the fact that the activity of cooperatives is located under the control of its members.

C) The autonomy and independence in front of the state and public authorities, other individuals or legal persons. This principle is provided in the national law of the countries. It can be generalized in the following way: cooperative societies being autonomous, independent determine all the parameters of their activity, including production of goods, provision of services in order to satisfy the needs of cooperative members in accordance with the stipulations of the law without any interference or constraint from outside the cooperative society.

(D) **Fair economic activity for cooperative members through labor and capital.** This principle is practiced in the same way in all member-states and functions under national law. In addition to this, the Cooperative Law in Italy (1985) stipulates the establishment of funds through the National Bank of Labor which may be allocated to cooperatives in larger stakes than the social funds of the cooperatives.

(E) **cooperation and mutual aid between cooperatives and cooperative members** is an important principle, common to the cooperative system. It is regulated not only in Cooperative law stipulations in the Member States of the EU, but also in the various documents of unions, federations, Confederations, as well as Continental and world organizations, forums which have been associated with cooperative companies in order to protect and promote cooperative movement.

(F) **education, training and information of** cooperative members, employees regarding the essence and the type of the cooperative, awareness of the rights and their collective responsibility for the intended results.

In some countries by law there are provided funds for education.

(I) **concern for the community.** Cooperatives are the result of a free association of some people with the same interests, which may be satisfied most effectively by the cooperative system and this group of persons is a narrow space. Finding a solution for the needs of such cooperative members shall contribute to solving community problems - creating jobs , developing local infrastructure, preserving the environment. The amount of contribution of the cooperatives in solving the problems of community depends on the size and complexity of it. It must be mentioned that the cooperatives have started in England and Germany with such values as self-aid, equality, equity, democracy, and social responsibility and started the 3rd millenium with a real participation in Corporate Social Responsibility, which means maintaining the environment and sustainable development.

7. Conclusions

Solving contradictory issues concerning the path of development of the European cooperative system is viewed by some specialists through the working out of measures which emphasize an extended contribution to community policies through their inclusion on a much larger scale to community objectives. In this context, in various publications appear proposals to carry out reforms in order to shade or weaken the current restrictions on functioning and operating of the co-operatives and thus to widen their access to the capital market and to wider economic activities, including through participation in national community objectives. The followers of the development of the cooperative system, based on the classical principles, are pleading for the inclusion of cooperatives in solving community objectives and believe that shall be done only in accordance with the principles renewed and established by the International Cooperative Alliance. Beyond those discussions, we can highlight several suggestions:

- To allow third parties to participate in the formation of cooperative capital and as a result to provide some members more than one vote.
- To legislate the cooperative transformation into a capital company and issue bonds on the risk capital;
- To create cooperatives with widened economic positions that will gain access to the capital market and economic activities on a larger scale to the national community objectives as well as their contribution to these objectives;
- To reduce the minimum number of persons authorized to form a cooperative.

For the Republic of Moldova we mention :

- NON-commercial character of the consumers' cooperatives legislated is lacking financial support from the state in competitive economy conditions limits these economic entities as compared to other competitors and may lead to a crisis of the system;
- The law of Consumers' cooperatives shades the economic activity of the co-operatives, there are no functions, characteristics, and economic guidelines which may provide benefits, and cooperative members are not motivated to increase the company's share capital . One of solutions can be the given right of cooperatives to participate as a settler, or a shareholder or co-owner in different economic and social structures. This would keep the basic characteristic of the cooperative and the cooperative, at the same time, would have access to capital and development cooperation.
- The definition of a legal private property is expressed by possession, use and disposal. These 3 categories are interrelated and are mutually made use of and determine the legal content of the notion of private property. If the indivisible part of the property cannot be fairly mastered by the cooperative members (Article 89, paragraph (3) The law of C. C.), it means that this property is not private, for example, it may not be put as a mortgage to receive credits necessary for the development. Consumers' cooperative organization transfers to its companies, as a matter of possession and use the necessary property for their activity (Article 94 (1) A law C. C.). How there can be transmitted a property without having the right to dispose on it. Obviously, it is required to change the legal framework of the cooperative societies.
- The arrangements made by european specialists to transform some cooperatives into joint stock companies with issuance of the bonds representing specific risk capital, as well as minimum and the reduction of the number of persons authorized to form a cooperative is also good for the sake of our country.
- It is necessary to elaborate a legal statute (similar to the European Council Regulation N1435/2003 of 22 July 2003 on European cooperative societies) for the purpose of determining legal support, necessary for the establishment and operation of transnational cooperatives. Similar to the European regulations the state guarantees equal competitive conditions of cooperatives and capital societies.
- The Imperative need to strengthen communities by uniting cooperative members of the cooperative membership, Implementing mechanisms of incentive and motivation for economic and development entities.
- It is necessary to optimize the organizational structures of cooperatives by liquidation of economic entities that operate inefficiently and are not in conformity. At the same time, it is necessary to sustain effective cooperative structures by integrating them into specialized areas of cooperative activity and better management of the system at all levels⁵.

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The Analysis of Foreign Trade Activities of the Republic of Moldova and Their Impact on the Country's Economic Development

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Abstract: In the recent years, the Republic of Moldova has focused its trade activities, more to West than East. Lately there has been a decisive trend of external policy directed to the integration of the Republic of Moldova with EU.

In this paper foreign trade activities of the Republic of Moldova are analyzed. The authors explore the dynamics of foreign trade indicators, the commodity structure of exports and imports and the geography of trade flows, which show the tendency of the gradual shift from CIS market to EU market. Particular attention is also paid to the calculation of indicators for valuation of foreign trade activities, which allow estimating the impact of foreign trade on the country's economic development. In conclusion, the authors refer to possible negative effect of signing the DCFTA and offer a number of measures to minimize its unfavorable consequences.

The present research was realized on selected data and processed by the authors based on statistical yearbooks of the Republic of Moldova, National Bureau of Statistics, and other publications that have served as informational sources specific to researched theme.

Keywords: *foreign trade, export, import, foreign trade turnover, foreign trade balance*

1. Introduction

Topicality of the researched topic is determined by the fact that foreign trade significantly affects economic development of the country. Foreign trade relations contribute to economic growth, advancement of scientific and technical progress, formation of country's budget, balancing supply and demand in the domestic market. Presently foreign trade is one of the most developed forms of international economic relations. The goal of this research is to conduct a thorough analysis of foreign trade relations of Moldova and identify the main issues at the current stage.

Objectives of the research:

- analyze dynamics of foreign trade turnover in terms of value, calculate the trade balance, and indicators of valuation of foreign trade activity of the country;
- research commodity structure of exports and imports, and geographic directions of foreign trade flows;
- mark possible negative outcomes of signing the Agreement on Deep and Comprehensive Free Trade Area (DCFTA) and offer a number of actions in order not to allow negative consequences.

2. Dynamics of foreign trade indicators of the Republic of Moldova

The main indicators that reflect dynamics of Moldova's foreign trade development during 2001-2014, are presented in table 1, which shows that the development of foreign trade of Moldova

during the period under examination can be conventionally divided in two stages: I stage – from 2001 until 2008 and II stage – from 2009 until 2014.

Table 1: Dynamics of foreign trade indicators of the Republic of Moldova during 2001-2014 (million U.S. dollars)

Year	Foreign trade turnover	Exports	Imports	Foreign trade balance
2001	1,457.7	565.5	892.2	-326.7
2002	1,681.8	643.8	1,038.0	-394.2
2003	2,192.2	789.9	1,402.3	-612.4
2004	2,753.7	985.2	1,768.5	-783.4
2005	3,383.2	1,090.9	2,292.3	-1,201.4
2006	3,743.6	1,050.4	2,693.2	-1,642.8
2007	5,029.6	1,340.1	3,689.5	-2,349.5
2008	6,489.9	1,591.1	4,898.8	-3,307.6
2009	4,561.3	1,283.0	3,278.3	-1,995.3
2010	5,396.8	1,541.5	3,855.3	-2,313.8
2011	7,408.1	2,216.8	5,191.3	-2,974.5
2012	7,374.8	2,161.9	5,212.9	-3,051.0
2013	7,920.7	2,428.3	5,492.4	-3,064.1
2014	7,656.5	2,339.5	5,317.0	-2,977.4

Throughout the first stage we can see an increase in exports (average annual growth rate – 16.4%), and imports (average annual growth rate – 27.8%). Nonetheless, in spite of growing export deliveries, we have seen a gradual increase in trade deficit, which in 2008 made up 3,307.6 million U.S. dollars (the highest value for all years).

At the beginning of the second stage, in 2009 as a result of world financial crisis the volume of foreign trade turnover had slumped: by 29.7%. In the following years the volume of exports and imports gradually increased.

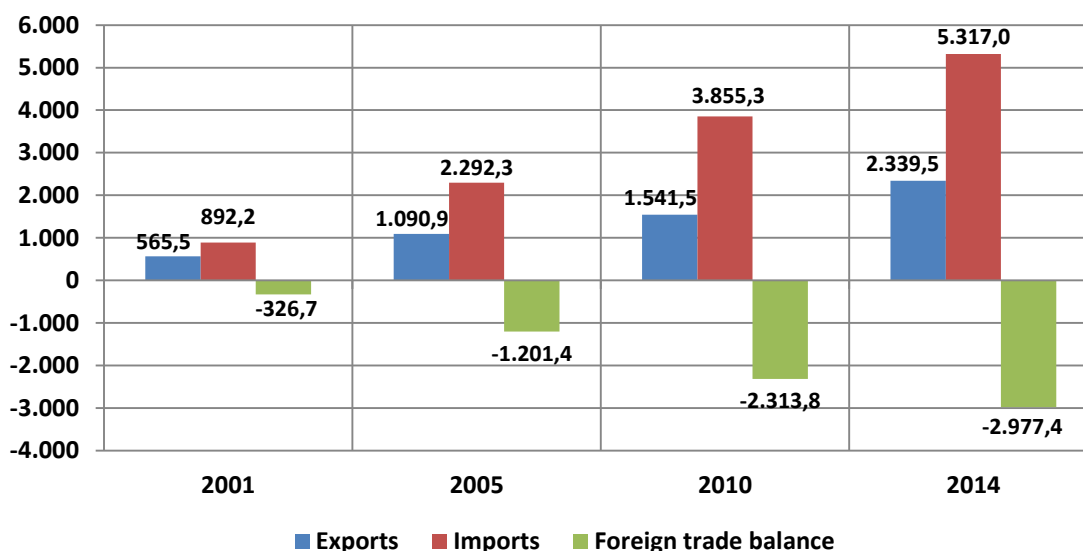


Figure 1: Dynamics of exports, imports and foreign trade balance of the Republic of Moldova (million U.S. dollars)

As can be seen from the data in figure 1, volume of imports by far exceeded the respective volume of exports. In 2014 foreign trade deficit made up 2,977.4 million U.S. dollars. It should be mentioned that often negative trade balance causes concern, because it shows that the demand for imported goods exceeds possibilities of import replacement industries. We believe that the deficit itself, naturally, is a negative factor, but not critical, except for cases when the reason behind growth is diminishing exports. Often growing imports are an indicator of strengthening of economic activity and consumption by producing companies. Growing imports are permitted for

strengthening of competition in domestic economy, are also an indicator of efforts put for participation in the world economy and consumption of more effective foreign technologies.

During the researched period the volume of Moldova's foreign trade in terms of value increased 5.3 times (exports volume – 4.1 times, imports volume – 6.0 times). Relatively fast growth of Moldova's foreign trade turnover to a great extent is determined by inflow of direct and portfolio foreign investments, as well financing (via grants and loans) of projects in key sectors of the Moldovan economy.

3. Basic indicators for valuation of foreign trade activity of the Republic of Moldova

The efficiency of development of foreign trade activity and successful integration of Moldova in the world economy directly depend on the level of development and utilization of foreign trade potential. In this connection, valuation becomes topical. It can be conducted using such indicators as provided in table 2.

Table 2: Basic indicators for valuation of foreign trade activity of a country

Indicator	Standard value	Characteristic	Calculation
Export quota (Q_E)	No standard value	It describes the importance of exports to the country's economy	$Q_E = \frac{E}{GDP} \times 100\%$
Import quota (Q_I)	No standard value	It describes the importance of imports to the country's economy	$Q_I = \frac{I}{GDP} \times 100\%$
Foreign trade quota (Q_{FT})	No standard value	It characterizes the ratio of foreign trade to gross domestic product	$Q_{FT} = \frac{E + I}{2 \times GDP} \times 100\%$
Export over import coverage ratio (R_{EI})	More than 1	It characterizes the level of self-sufficiency of the country's economy	$R_{EI} = \frac{E}{I}$
Rate of involvement of a country in the international system of labour division (RI)	No standard value	It characterizes the degree of involvement of a country in the international system of labour division	$RI = \frac{FT}{GDP}$
International competitiveness ratio (ICR)	More than 0	It characterizes the share of "pure" export in foreign trade turnover	$ICR = \frac{E - I}{FT}$
Exports per capita (E_C)	No standard value	It shows volume of exports per inhabitant of the country	$E_C = \frac{E}{P}$
Imports per capita (I_C)	No standard value	It shows volume of imports per inhabitant of the country	$I_C = \frac{I}{P}$
Foreign trade per capita (FT_C)	No standard value	It shows volume of foreign trade per inhabitant of the country	$FT_C = \frac{E + I}{P}$
Legend: <i>GDP</i> – gross domestic product, U.S. dollars; <i>E, I</i> – exports and imports of a country, respectively, U.S. dollars; <i>FT</i> – foreign trade of a country, U.S. dollars; <i>P</i> – population of a country, persons.			

Table 3 shows values of the basic indicators for valuation of Moldova's foreign trade activity during 2009-2014. The results of our calculations show that during this period indicators of foreign trade, export and import quotas in general had a dynamic growth, despite lower values in 2012-2014.

During the analyzed period shares of exports and imports in gross domestic product of Moldova were in average 28.5% and 68.0%, respectively. Such moderate values of indicators show openness of country's economy and importance of foreign trade activity.

The export over import coverage ratio representing exports in relation to imports in the region made up 0.44 in 2014. This value denotes a low level of self-sufficiency of the country, because exports do not cover imports. During the whole period under examination (from 2009 till 2014) falling negative values of international competitiveness ratio, which represents the difference between exports and imports in relation to foreign trade of the region, – from -0.44 to -0.39 – shows an increase in share of ‘net’ exports in foreign trade.

Table 3: Values of the basic indicators for valuation of foreign trade activity of the Republic of Moldova during 2009-2014

Year	Q_E	Q_I	Q_{FT}	R_{EI}	RI	ICR
2009	23,6%	60,3%	41,9%	0,39	0,84	-0,44
2010	26,5%	66,3%	46,4%	0,40	0,93	-0,43
2011	31,6%	74,0%	52,8%	0,43	1,06	-0,40
2012	29,7%	71,6%	50,6%	0,41	1,01	-0,41
2013	30,4%	68,8%	49,6%	0,44	0,99	-0,39
2014	29,4%	66,8%	48,1%	0,44	0,96	-0,39

The average annual rate of involvement of Moldova in the international system of labour division, calculated as the ratio of foreign trade of the country to GDP, is above 0.9; which means that the Republic of Moldova takes active part in international division of labour.

The dynamics of exports and imports per capita in 2009-2014 is shown in table 4.

Table 4: Dynamics of exports and imports per capita in the Republic of Moldova during 2009-2014

Indicator	Year					
	2009	2010	2011	2012	2013	2014
Average annual population, thousand persons	3565,6	3562,0	3560,0	3559,5	3558,6	3556,4
Exports per capita, U.S. dollars	359,82	432,76	622,70	607,35	682,38	657,84
Rate of increase of exports per capita, in % to the previous year	-	20,3	43,9	-2,5	12,4	-3,6
Imports per capita, U.S. dollars	919,42	1082,34	1458,22	1464,51	1543,41	1495,04
Rate of increase of imports per capita, in % to the previous year	-	17,7	34,7	0,4	5,4	-3,1
Foreign trade per capita, U.S. dollars	1279,24	1515,10	2080,92	2071,87	2225,79	2152,88
Rate of increase of foreign trade per capita, in % to the previous year	-	18,4	37,3	-0,4	7,4	-3,3

The volumes of exports and imports per one inhabitant of the country increased during 2009-2014. The indicator of exports per capita, calculated as a ratio of exports to population of the country, increased from 359.82 U.S. dollars in 2009 up to 657.84 U.S. dollars in 2014. The indicator of imports per capita also increased – from 919.42 U.S. dollars in 2009 up to 1495.04 U.S. dollars in 2014. It is determined by a 14 per cent average annual growth rate of exports and 11 per cent average annual growth rate of imports during the period under examination.

4. Dynamics of Moldovan exports and imports by commodity groups

Let's look at the dynamics of Moldovan exports by commodity groups during 2010-2014.

Table 5: Dynamics of Moldovan exports by commodity groups during 2010-2014, million U.S. dollars

COMMODITY GROUP	2010	2013	2014	2014 / 2010, %
Food products and raw materials	732.2	1,015.5	1,065.4	145.5%
Mineral products	9.4	14.8	11.8	125.5%
Fuels and energy	7.7	26.9	16.1	209.1%
Products of the chemical or allied industries; plastics and articles thereof	100.3	230.6	213.9	213.3%
Raw hides and skins, leather, furskins and articles thereof	24.7	33.4	34.7	140.5%
Wood and articles of wood; paper and	17.5	35.1	28.0	160.0%

COMMODITY GROUP	2010	2013	2014	2014 / 2010, %
paperboard and articles thereof				
Textiles and textile articles	267.7	330.5	330.1	123.3%
Footwear	30.4	35.7	33.5	110.2%
Articles of stone, plaster, cement, asbestos; glass and glassware	33.4	53.4	55.5	166.2%
Ceramic products	1.9	4.7	3.1	163.2%
Base metals and articles of base metal	58.6	124.4	56.6	96.6%
Machinery and transport equipment	192.8	362.8	337.2	174.9%
Other products	64.9	160.5	153.6	236.7%
TOTAL:	1,541.5	2,428.3	2,339.5	151.8%

The results of our calculations in table 5 show that the volume of export deliveries from Moldova increased 1.5 times in the last 5 years. The main reason for this is an increase in volume of exports of food products and raw materials – by 45.5%, machinery and transport equipment – by 74.9%, textiles and textile articles – by 23.3%, products of the chemical or allied industries and plastics – 2.1 times in 2014 as compared to 2010.

It should be noted that the agriculture holds a large share in sectoral structure of Moldovan economy. Agrarian nature of Moldovan economy also appears as a significant part of industry is involved in processing of agricultural raw materials. This is naturally reflected in export commodity structure (figure 2), where food products and raw materials hold the largest share (45.5%).

A fairly large share in the structure of export deliveries from Moldova is held by machinery and transport equipment (14.4%), textiles and textile articles (14.1%), as well as products of the chemical or allied industries and plastics (9.1%).

As compared with 2010 in Moldova's export commodity structure any serious changes did not occur: increase in share of products of the chemical or allied industries and plastics – by 2.6 p.p., machinery and transport equipment – by 1.9 p.p., decrease in share of textiles and textile articles – by 3.3 p.p., food products and raw materials – by 2.0 p.p., base metals and articles of base metal – by 1.4 p.p.

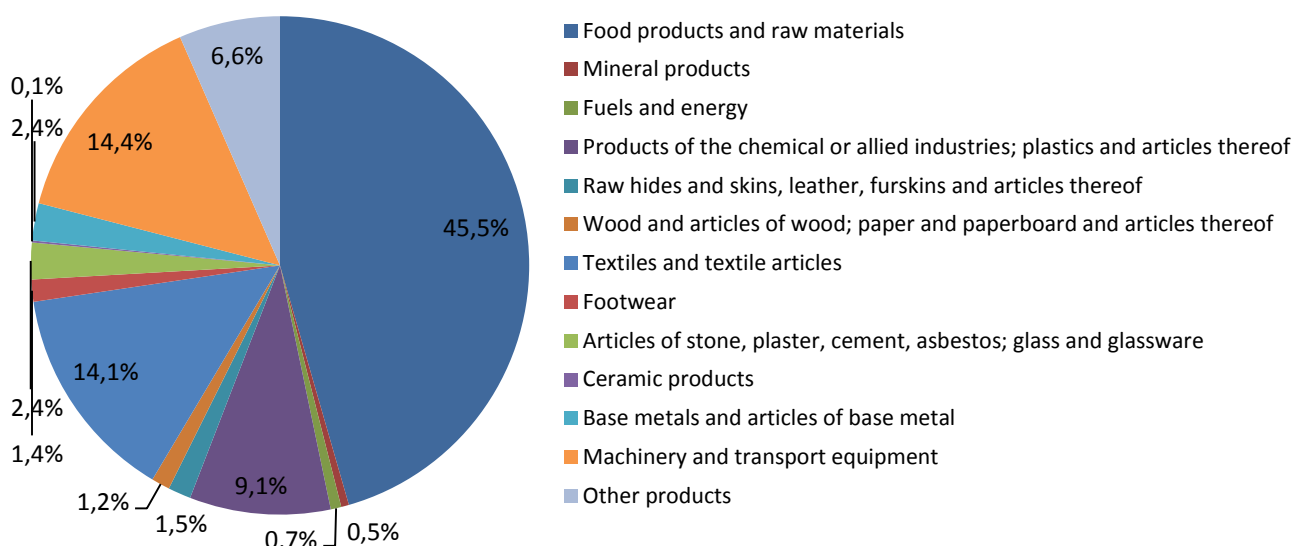


Figure 2: Commodity structure of Moldovan exports in 2014

Now let's look at dynamics of imports coming to Moldova during 2010-2014. The results of our calculations presented in table 6 show that import volume to Moldova increased by 37.9% in the last 5 years. The main reason for such an increase was growth of imports of fuels and energy – by 43.6%, products of the chemical or allied industries and plastics – by 1.5 times, machinery and transport equipment – by 38.9%, food and raw materials – by 21.6%, base metals and

articles of base metal – 42.8% in 2014 as compared with 2010. It should be mentioned that import volume was growing on all main commodity groups.

Table 6: Dynamics of Moldovan imports by commodity groups during 2010-2014, million U.S. dollars

COMMODITY GROUP	2010	2013	2014	2014 / 2010, %
Food products and raw materials	591.5	783.8	719.3	121.6%
Mineral products	16.0	21.1	17.7	110.6%
Fuels and energy	791.1	1,235.6	1,136.1	143.6%
Products of the chemical or allied industries; plastics and articles thereof	632.0	947.6	952.9	150.8%
Raw hides and skins, leather, furskins and articles thereof	27.4	34.2	42.9	156.6%
Wood and articles of wood; paper and paperboard and articles thereof	175.7	222.4	223.5	127.2%
Textiles and textile articles	282.3	386.9	357.0	126.5%
Footwear	20.5	31.2	27.3	133.2%
Articles of stone, plaster, cement, asbestos; glass and glassware	62.1	92.2	84.7	136.4%
Ceramic products	36.6	48.4	49.6	135.5%
Base metals and articles of base metal	248.5	331.3	354.9	142.8%
Machinery and transport equipment	814.4	1,140.1	1,130.9	138.9%
Other products	157.2	217.6	220.2	140.1%
TOTAL:	3,855.3	5,492.4	5,317.0	137.9%

In Moldova's import commodity structure in 2014 (figure 3) the biggest share is held by energy resources (fuel, electric power, coal). It constitutes 21.4% of total import volume. Significant shares are also held by machinery and transport equipment (21.3%), products of the chemical or allied industries and plastics (17.9%). So, an important share of imports includes goods or raw materials that are not produced in Moldova.

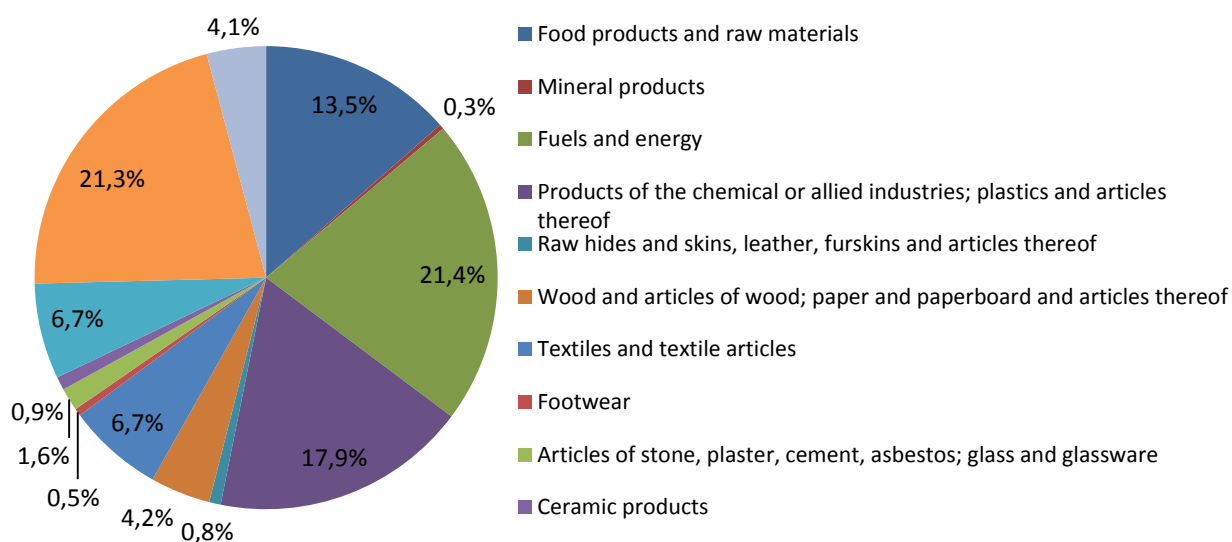


Figure 3: Commodity structure of Moldovan imports in 2014

As compared with 2010, in Moldova's import commodity structure no serious changes occurred: an increase or decrease in share of separate commodity groups did not exceed 1-2 p.p.

In 2014 the share of food products and raw materials in Moldovan imports made up 13.5%. If we compare imports (719.3 million U.S. dollars) and exports (1,065.4 million U.S. dollars) of this commodity group, then we can see positive trade balance. A number of Moldovan companies, however, are concerned about risks arising from Agreement on Deep and Comprehensive Free Trade Area (DCFTA) signed between the EU and Moldova. The thing is that presently Moldovan producers of agricultural products are in unequal conditions with their EU

competitors, considering the amount of subsidies and other aspects of activity. For this reason there were considered actions for protection of the domestic market and sector stimulation. If necessary two levels of protection measures can be used. If annual growth rate of imports of a certain product exceeds 15%, Moldova can on the basis of bilateral agreements promptly introduce protective duties. In case of continuing growth of deliveries from the EU, additional protective measures can be taken. But for this purpose it will be necessary to conduct a special research in accordance with European rules and prove the necessity of taking additional protective measures.

5. Geographical directions of foreign trade of the Republic of Moldova

Geographical directions of foreign trade of the Republic of Moldova present a particular interest. The diversification of markets, strengthening competitive position in traditional markets and establishment of trade and economic relations with new partners are the priority issues.

The directions of export flows from Moldova during 2001-2014 are shown in figure 4. One tendency is clearly visible: diminishing share of exports to CIS countries and growing share of exports to European Union countries. This fact shows that Moldovan exports shift gradually from CIS market to EU market. So, the share of Moldovan exports to CIS countries has decreased almost 2 times, while the share of exports to EU countries has increased more than 1.6 times in 2014 as compared with 2001.

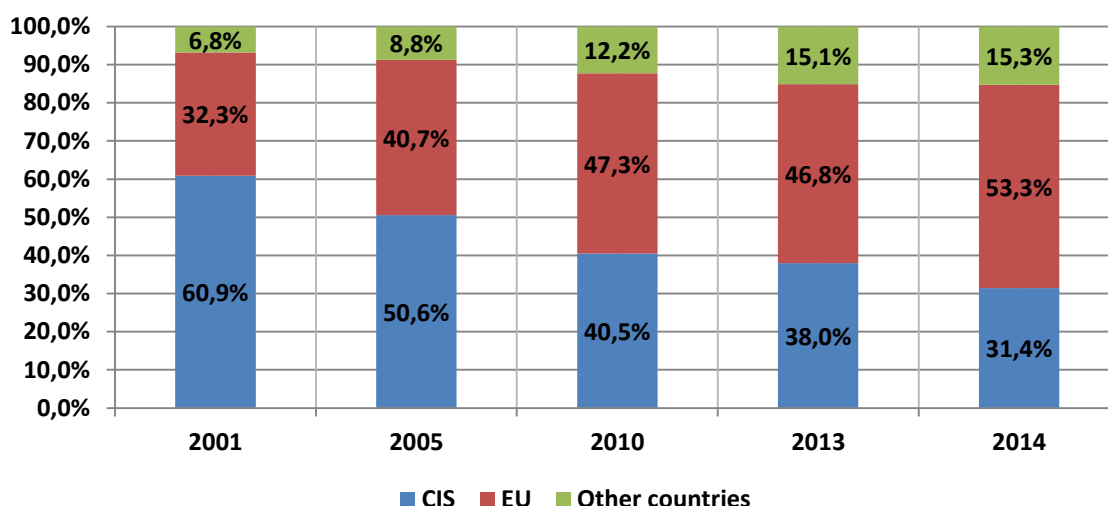


Figure 4: Dynamics of geographic structure of Moldovan exports during 2001-2014

Table 7 shows top 10 countries by imports of Moldovan products. The main buyers of Moldovan products are Romania, Russian Federation and Italy, which in 2014 imported 18.6%, 18.1% and 10.4% of the total Moldovan exports, accordingly.

Table 7: Top 10 countries by imports of Moldovan products in 2014

№	Importing country	Moldovan exports, million U.S. dollars	Share in total exports, %
1.	Romania	434.0	18.6
2.	Russian Federation	423.7	18.1
3.	Italy	243.4	10.4
4.	Germany	137.5	5.9
5.	Belarus	134.7	5.8
6.	Ukraine	109.2	4.7
7.	United Kingdom	108.2	4.6
8.	Turkey	104.7	4.5
9.	Poland	64.4	2.8
10.	Switzerland	49.2	2.1
TOP 10		1,809.1	77.3
TOTAL		2,339.5	100.0

Dynamics of geographic structure of Moldovan imports during 2001-2014 is shown in figure 5, from which one can observe a tendency to reduce import deliveries from CIS countries and increase share of imports from third countries, in particular, from China and Turkey. At the same time, the main group of countries from which Moldova imports products needed for the economy and people are EU countries. The share of imports from EU countries during the entire researched period is relatively stable – at 44-49%.

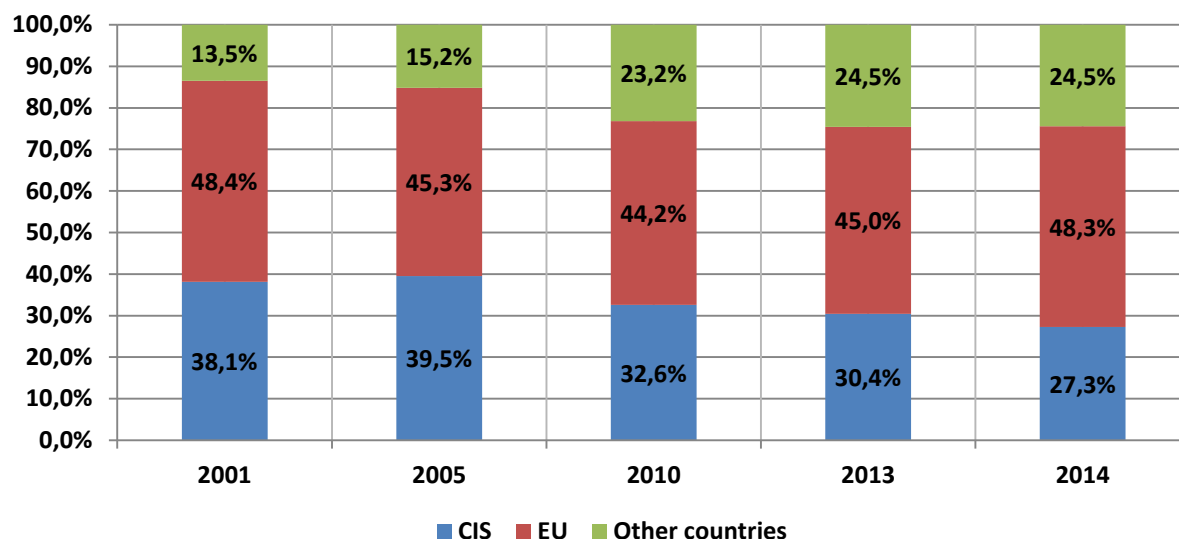


Figure 5: Dynamics of geographic structure of Moldovan imports during 2001-2014

Table 8 shows top 10 source countries of imports to Moldova.

Table 8: Top 10 source countries of imports to Moldova

№	Exporting country	Moldovan imports, million U.S. dollars	Share in total imports, %
1.	Romania	803.1	15.1
2.	Russian Federation	717.2	13.5
3.	Ukraine	546.4	10.3
4.	China	481.2	9.0
5.	Germany	427.0	8.0
6.	Italy	351.3	6.6
7.	Turkey	300.9	5.7
8.	Poland	155.8	2.9
9.	Belarus	142.0	2.7
10.	Austria	110.5	2.1
	TOP 10	4,035.2	75.9
	TOTAL	5,317.0	100.0

So, EU and CIS markets are strategically important for Moldova.

After signing Agreement on Deep and Comprehensive Free Trade Area (DCFTA) between Moldova and EU certain actual premises appeared for intensification of trade with European Union, which means expansion of markets. We believe, however, that in short-term any significant increase in export of Moldovan goods to European market will not occur. It is due to the fact that Moldovan exporters have high non-tariff barriers related to European quality standards, sanitary and phytosanitary norms, certification system and high entry costs to the European market (marketing, advertising, logistics, etc.). It will certainly hamper attempt to increase volume of Moldovan exports to the European market, while European exporters do not or will not have such obstacles in the Moldovan market, or will have much less obstacles.

Besides the aforementioned risks, the following risks should be mentioned:

1. Free trade conditions (no restrictions) cover 70% of imports from EU to Moldova and only 45% of imports from Moldova to EU.
2. Imports of European agricultural food products to Moldova free of customs duties can increase competition in the domestic market. In addition, there is a significant gap in technical and technological development between Moldovan and European production companies. State subsidies for agriculture in the EU countries may reach 40-45% of agricultural products cost, while in Moldova they may constitute only 2%.
3. Application of protective and restrictive measures by Eurasian Customs Union countries in regard to Moldovan products can lead and already causes gradual loss by Moldova of its positions in Eastern markets, which for a number of sectors of Moldovan economy are a priority, in particular, for agriculture, wine making industry and other economy sectors.

6. Conclusion

During the 2001-2014 period the volume of Moldova's foreign trade in terms of value increased 5.3 times. Relatively fast growth of Moldova's foreign trade turnover to a great extent is determined by inflow of direct and portfolio foreign investments, as well financing of projects in key sectors of the Moldovan economy.

The agriculture holds a large share in sectoral structure of Moldovan economy. Agrarian nature of Moldovan economy also appears as a significant part of industry is involved in processing of agricultural raw materials. This is naturally reflected in export commodity structure, where food products and raw materials hold the largest share.

Valuation of foreign trade activity of the Republic of Moldova through a number of basic indicators has allowed revealing the following tendencies: openness of Moldova's economy and importance of foreign trade activity, taking active part in international division of labour, growth of both exports and imports per capita, increase in share of 'net' exports and low level of self-sufficiency of the country.

The directions of Moldovan export and import flows show the tendency of the gradual shift from CIS market to EU market. We could expect that creation of free trade zone would facilitate higher volumes of foreign trade between the Republic of Moldova and EU countries. However, in our opinion EU countries will get the biggest benefits, not Moldova, who may face certain risks. Besides, losing Eurasian Customs Union countries markets cannot be compensated in full by higher exports to EU or other countries.

In order to avoid certain negative consequences of events, we believe that Moldovan companies must promptly take the following measures:

- Improve quality management system in companies in order to increase competitiveness of products in foreign markets, implement and provide a viable system for standardization, metrology and assessment of compliance;
- Carry out technological modernization of production in order to ensure high competitiveness of products based on "price-quality" ratio;
- Conduct a continuous markets diversification. Economic vector chosen by Moldova has focused recent discussions in general on partners from EU and CIS. However it is equally important to preserve and strengthen trade relations with other countries.

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Marketing and sustainable development: theoretical consideration and implications on the case study of JGL d.d. (Jadran Galenski Laboratorij)

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Abstract. Environmental and social problems still remain one of the main interests of theoreticians and practitioners. Air pollution, the greenhouse effect, ecological and social imbalance warn of the need for changes. Regarding this, significant effort is taken in order for progress to be achieved. Efforts in making business more sustainable will confront companies with both opportunities and threats. Companies need to be synchronized and develop a sustainability agenda to catch sight of and react to all challenges in implementing sustainable practices. Marketing as a discipline includes a broad theoretical and practical knowledge and has always been in line with socio-economic development, so this area is not an exception. Sustainability is becoming a growing issue in the current marketing theory and practice, so it is important for marketers to break their traditional frame of reference and reconsider their existing marketing policies. This paper provides a theoretical view of sustainable development from the marketing perspective and outlines concrete implications for creating sustainable marketing practices. Furthermore, as a positive example of managing sustainable marketing practices, the case of a Croatian company - Jadran Galenski Laboratorij - is elaborated, and potential directions for further research are discussed.

Key words: Sustainable development, Sustainability marketing, Sustainable marketing, Societal marketing, Environmental marketing,

1. Introduction

Mainly, marketing has been perceived as one of the principal drivers of consumption, and opposing to the concept of sustainability that originally encourages satisfying people basic needs and better quality of life without compromising the quality of life of future generations (Her Majesty's Government, 2005). Although, there is still much misunderstanding of marketing, the marketing thought has been developing continuously and the interest in the relationship between marketing and sustainability is growing. A growing number of companies are recognizing sustainability as an integral part of their business strategies. This can be explained as a consequence of growing volume of environmental and social legislation and regulation, concerns about the costs of scarcity of natural resources; greater public and shareholder awareness of the importance of socially responsible financial investments; the growing media coverage of the activities of a wide range of anti-corporate pressure groups; and more general changes in social attitudes and values within modern capitalist societies (Jones, P., Clarke-Hill, C., Comfort, D., & Hillier, D., 2008).

The objectives of this paper are, first, to review and understand concepts of sustainable development and interaction between marketing and sustainable development. Furthermore, discuss evolution of sustainability in marketing strategy and the future of sustainability in marketing strategy. The last part of the article gives a positive example of managing sustainable marketing practice, through the case of the Croatian company Jadran Galenski Laboratorij.

2. Sustainable development and sustainability

In the last 20 years attention on ethical, societal and environmental issues has risen dramatically. The term of sustainability has so far been covered by multiplicity definitions. Its core meaning is usually linked with the encouraging awareness about the negative effect of humans on their environment, but integrated concept in development of sustainability claims that is defined as 'A new era of economic growth that is forceful and at the same time socially and environmentally sustainable; an economy is sustainable if it meets the needs of the present without compromising the ability of the future generations to meet their own needs' (Brundtland Report, 1987). Sustainable development is development that is likely to achieve lasting satisfaction of human needs and improvement of the quality of human life." (Allen, 1980) One of the important objectives is reducing the absolute poverty of the world's poor through providing lasting and secure livelihoods that minimize resource depletion, environmental degradation, cultural disruption, and social instability"(Barbier, 1987)

Sustainability has oftentimes been associated with a triple bottom line framework developed by Elkington, which emphasizes the importance of balancing three parts: economic prosperity (i.e. profit), social equity (i.e. people), and environmental quality (i.e. planet) (Elkington, 1997). Nevertheless of the diversity of definitions of sustainability, three dimensions of sustainability can be isolated: economic, social and environmental dimension (Adams, 2006). Economic sustainability represents achievement of growth, efficiency and „fair“ distribution of wealth. An economically sustainable business uses resources in a way which allows the business to operate in the long term while generating profit (Reutlinger, 2012). Social sustainability is engaged with employees, communities and equality. Employees are supposed to be treated well and equally regardless of their race, gender or other characteristics. The working conditions should be in accordance with health and safety standards. It also implies participation in decision making process, mobility and cohesion, realization of social identity, institutional development and other. The companies should take care for local community in a way of minimizing negative impacts like air or sound pollution, but also can give positive contributions in a form of community based programs or donations. Environmental dimension honors the integrity of various ecosystems, their carrying capacity and protection of natural resources, including biological diversity. It incorporates responsibilities in reducing negative impacts on the environment in the whole product life-cycle, even after the purchase considering whether the product can be recycled or it ends up in a landfill (Reutlinger, 2012). All this therefore, indicates how the needs of the market economy and nature's economy are intertwined and economic sustainability must ground on ecological and social sustainability. Sustainable development therefore strives to balance and optimization between itself and with respect to the others areas.

3. Sustainability marketing

According to American marketing association, Marketing is the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large (American Marketing Association [AMA], 2015). Marketing can be defined both as a business philosophy and a collection of

management techniques, orientated towards providing value to consumers, organizations and society.

This definition represents a step forward in relation to traditional marketing. Traditional (transactional) marketing is the creation of and maintenance of consumers and profit. Key actors are profit oriented organizations and customers. Key value is commercial (from the perspective of an organization – selling products at defined prices and gaining profit, and for customers – purchasing products – value, at favorable – acceptable price). It is obvious that this concept is unable to cope with ecological, social and commercial challenges (Peattie & Belz, 2010 referenced in Rakic & Rakic, 2015).

Marketing aspects of sustainability involves the integration of sustainability elements in company's marketing strategies (Baker & Sinkula 2005; Fraj-Andrés, Martinez-Salinas & Matute-Vallejo, 2009), socially responsible purchasing and distribution policies (e.g., Drumwright, 1994; Salam, 2009), pricing tactics (e.g., Menon, Bharadwaj, Adidam, & Edison (1999), the design and development of new products (e.g., Pujari, 2006) and green advertising, promotional, and communication practices (e.g., Banerjee, Gulas, & Iyer, 1995); Maignan & Ferrell, 2004).

Due to the development of the different branches of marketing, there can be identified a few marketing concepts that are concerned with social and environmental issues and represent a step towards sustainable marketing. Societal marketing is one of them which strive to combine the wants and needs of consumers, long term interests of society and companies' profitability (Kotler, 2009). It encourages marketers to build social and ethical considerations into their marketing practices which is a very demanding task seeing that they must balance the often conflicting criteria of company profits, consumer want satisfaction and public interest.

Ecological marketing emerged 1970s (Henion & Kinnear, 1976.) and was oriented towards resolution of environmental problems and reduction of harmful products which have negative impact on the ecosystem. The purpose was to bring round the companies' impact on the environment, but the focus only on energy and resource industries resulted only in reacting on external pressures with no innovations (Emery, 2012). Ecological issues mainly concentrated on producer's will to become environmental friendly and these were not considering consumer demand at all (Dam & Apeldoorn, 1996).

Environmental and green marketing emerged due to increasing concerns of consumers for the environment with aim to make packaging and products more environmentally friendly. (Belz & Peattie, 2009). Green marketing therefore, strives to put all efforts to consume, produce, distribute, promote, package and reclaim products that are environmentally safe and responsive to ecological concerns (Dahlstrom, 2011). Profit of organizations and the survival of environment are the goals of environmental marketing, while the key actors are environment oriented organizations and consumers. Organizations strive to establish and maintain long-term relationships with consumers and environmental organizations.

Apart from environmental effects, consumers also put their concerns about the social impacts of products they buy, but only a minor part of them are ready to pay more for green products. However, consumers expect from the Companies more than just accomplishing legal regulations, yet to be socially responsible and operate environmentally friendly (Reutlinger, 2012). These challenges cannot be solved through conventional marketing practices. The solution could be in sustainable marketing as the last phase of the evolutionary process from conventional to ecological, environmental and green marketing. Sustainable marketing is intended not only towards the satisfaction of consumers and company profits, but also per the goals of the community as a whole.

According to Reutlinger (2012), sustainable marketing is a holistic approach within the aim of satisfying the wants and needs of the customers while putting equal emphasis on environmental and social issues, thus generating profit in a responsible way. It offers an extensive, approach in making products and services more sustainable in order to meet present and likewise new challenges at the same time. Fuller (1999) also gives the comprehensive definition of sustainable marketing defining it as a process of planning, implementing and controlling the development, pricing, promotion and distribution of products in a manner that satisfies the following criteria: 1) customer needs are met; 2) organizational goals are attained and 3) the process is compatible with ecosystems. (Marcel & Dragan, 2014) associates sustainable marketing as a certain form of relationship marketing, that stimulates the capacity of economic entities to provide the best value for consumers, but it also represents a practice of creating long-term satisfying relationships with key partners, customers, suppliers and distributors. It is also oriented towards efficient use of resources, thus /users and other stakeholders, while taking into account long-term interests of society and environment.

Although, the terms sustainable marketing and sustainability marketing are used as synonyms by different researches, Beltz & Peattie (2009) emphasize the differences between these two terms. According to these authors, sustainable marketing refers to something durable or lasting for a long period of time so, sustainable marketing can be understood as a kind of marketing, building long-lasting customer relationships in an effective manner, with no particular reference to sustainable development or issues that are banded to sustainability. On the other side, sustainability marketing more expressly relates to the sustainable development agenda while still building and maintaining sustainable relations not only with customers, but also with social environment and the natural environment (Kumar, Rahman & Kazmi, 2013). Belz and Peattie (2009) emphasize building and maintaining sustainable relationships with customers, the social environment and the natural environment. By creating social and environmental value, sustainability marketing tries to deliver and increase customer value. Also, as in the modern marketing concept, sustainability marketing analyses customer needs and wants, develops sustainable solutions that provide superior customer value, and prices, distributes and promotes them effectively to selected target groups. Hereinafter, the authors will use the term sustainability marketing.

Belz and Schmidt-Riediger (2010) identify five dimensions of strategic sustainability marketing: (1) ecological product quality, (2) social product quality, (3) market segmentation, (4) targeting, and (5) positioning. In accordance to this, sustainability marketing management is the process of development and maintenance of long term relationships (with consumers and other sustainability oriented stakeholders), creating, delivering and communicating sustainable value. It can be seen that sustainability marketing differs from conventional marketing in its holistic approach to decision making, monitoring and evaluating organizational actions and consequences. Further, sustainability marketing is committed to rendering organizational processes transparent to stakeholders; enlisting stakeholders in value creation and, in its concern with product life cycles and value chains wholesome, in their effects on natural and social environments. Finally, the term sustainability marketing applies when an organization operates in accordance with perspective of a finite resource system, and thus has a responsibility to its current and future stakeholders to make strategic decisions for the long term benefit of the entire system (Arnould & Press, 2011).

Marketing has experienced changes and sustainability became one of the key issues which have emerged in marketing strategy over the time. Ascending interest about the sustainability is rapidly transforming the competitive landscape and forcing companies to involve more attention to make their marketing strategies more sustainable.

Table 1 Characteristics of traditional, environmental, societal and sustainability marketing

	Traditional marketing	Environmental marketing	Societal marketing	Sustainability marketing
Goal	<ul style="list-style-type: none"> Survival of organization - profit 	<ul style="list-style-type: none"> Survival of organization - profit Survival of environment 	<ul style="list-style-type: none"> Survival of organization - profit Survival of society 	<ul style="list-style-type: none"> Sustainable development Survival of organization – profit (economic sustainability) Survival of environment (environment sustainability) Survival of society (society sustainability)
Key actors	<ul style="list-style-type: none"> Profit oriented organizations Consumers 	<ul style="list-style-type: none"> Environmental oriented Organizations Environmental oriented Consumers Environmental organizations (local, national, international, global) 	<ul style="list-style-type: none"> Societal oriented organizations Societal oriented consumers Societal oriented population 	<ul style="list-style-type: none"> Sustainability oriented organizations Sustainability oriented consumers
Relationships with consumers and other stakeholders	Transactions between organizations and consumers	Long-term relationships with environment oriented consumers and other stakeholders	Long-term relationships with societal oriented consumers and other stakeholders	Long-term relationships with sustainability oriented consumers and other stakeholders
Lifestyle	Consumption oriented lifestyle	Environmental oriented lifestyle	Societal oriented lifestyle	Sustainable lifestyle
Value	Commercial	Environmental	Societal	Sustainability

Source: Rakic, B., & Rakic, M. (2015). Holistic management of marketing sustainability in the process of sustainable development. *Environmental Engineering and Management Journal*, 14(4), 887-900.

The role of marketing in responding to sustainability will vary among companies depending on their industry, size, corporate culture and whether the style of marketing they practice is classically customer-led, technology (product) led or communication led (Charter, Peattie, Ottman & Polonsky, 2002). The company has to adopt sustainability in strategic marketing practices and marketing mix, and therefore, marketing strategies should be designed and implemented according to established sustainable values and objectives (Kumar, Rahman, Kazmi & Goyal, 2012).

The market is central to the way the world works, but sustainability needs to be understood as a fundamental cultural idea, hence it is necessary to plant a culture of sustainability. The planetary future depends on what kind of culture of consumerism is built, and according to that it is essential to redesign and engineer the global economy in a way that people can get more yet consume less (Adams, 2006). A major challenge for companies is to integrate and balance all aspects of sustainability in a way which enables financial stability and competitive while including ecological requirements and social demands (Belz & Karstens, 2005). Surely, sustainability marketing practice should not be measured as one more marketing approach, but need to give an intensive contribution to environmental, economic and social dimension.

Aforementioned is not easy because is necessary to formulate strategy in such a way, so that profits can still be earned even after reduced impact on environment and society (Charter, 2006). According to Varadarajan (2010), marketing strategy refers to an organization's integrated pattern of decisions that specify its crucial choices concerning products, markets, marketing activities and marketing resources in the creation, communication and/or delivery of products that offer value to customers in exchanges with the organization and thereby enables the organization to achieve specific objectives. The goal of a marketing strategy is to obtain a position that is desirable, different and defensible. Marketing is the process of satisfying consumers' wants and needs, so it is important that position is desirable, because firms compete in the marketplace to offer the most desirable products which will deliver the most satisfaction according to consumer desires. The position must be different in order to achieve competitive advantage, and defensible as well in order to maintain that advantage (Obermiller, Burke, & Atwood (2008).

Considering how to introduce sustainability into practice, it is very important not to fall into a trap of marketing myopia. Sustainability marketing myopia is a term that pertains to a distortion stemming from the overlooking of socio-environmental attributes of a sustainable product or service but prejudicial to customer benefits and values (Cuculeski, N., Mircevska, T. P., & Petrovska, I., 2016). The idea of sustainability marketing myopia is rooted into conventional marketing myopia theory, that is introduced by Theodore Levitt where he characterized the common pitfall of companies' tunnel vision, which focused on "managing products" (that is, product features, functions and efficient production) instead of "meeting customers' needs" (that is, adapting to consumer expectations and anticipation of future desires). Levitt warned that a corporate preoccupation on products rather than consumer needs leads to failure (Levitt, 1960). Sustainability marketing myopia can be avoided by identifying and highlighting the inherent consumer's values of the socio-ecological features of the product and the personal customer benefits that emanates from it or by aligning socio-ecological attributes with core benefits (functionality, performance, design, durability, taste, freshness, uniqueness, aesthetics, fashion) of the product to create "motive alliances" (Belz & Peattie, 2009). Therefore, it is exactly said that companies cannot stay for longer in the market if they will not become truly sustainable (Whiting, 2008).

The future objectives of sustainability marketing should be focused on segmentation, targeting and positioning customer on the basis of sustainability criteria beside with designing sustainability marketing mix for improved products and services, better prices, distribution and promotion. Sustainability in marketing strategy not only helps in competitive advantage, but also encourages ideas for cost savings and innovations (Whiting, 2008)

Taking into account all the previously mentioned, it can be concluded that sustainable marketing obtains a several benefits for companies like (Reutlinger, 2012):

- Cost savings which are achieved through energy, material and waste efficiencies and are often one of the main motivators for companies. Sustainable marketing provides many actions that lead to long-term savings and it is recommended to follow a step by step

approach starting with easily implement and low-cost actions before introducing more comprehensive and cost intensive solutions.

- Reputation: Being sustainable can provide a good reputation to a company and trust of their consumers.
- New markets: When company is renowned for being sustainable, new markets and customers can be open up. It can also be a point of differentiation from that can also arise some new products that will attract new customers who otherwise might not buy the company's products.
- Reduced risk: Switching to alternative energy sources, or becoming more resource efficient decreases the need of using possible scarce resources whose price will rise in a future and supply might become uncertain.
- Attracting and retaining employees: Working for sustainable company can enhance current employees' innovativeness, motivation and productivity.
- Leadership: Leadership can be gained or maintained through sustainable marketing, and the company can enhance their image and achieve a competitive advantage.

4. Case study of Jadran Galenski Laboratorij d.d.

JGL is a flexible, medium-sized, pharmaceutical company, producing primarily generics, developed from a central laboratory for manufacturing and controlling magistral and galenic preparations for the "JADRAN" Rijeka pharmacy. It was founded in 1991 as the first entirely private pharmaceutical joint stock company in Croatia. The company headquarter is in Rijeka. The transformation from a local laboratory into a powerful and fast-growing pharmaceutical company occurred exclusively through organic growth - development of new products and conquering new markets. The beginning of JGL market operation was characterized by an entrepreneurial spirit of its founders, who used the niche strategy with several pharmacologically essential drugs, produced on a small scale, recognizing the market potential for these products.

Systematic investments into employee knowledge and new product development, in addition to a close relationship with our customers and investments into modern technology for manufacturing and controlling drugs have resulted in JGL becoming the second pharmaceutical company in Croatia, developed from the initial small enterprise over a relatively short period of time. Today the JGL portfolio encompasses more than 540 products and in addition to its domestic market, it operates on the various markets in SEE, CIS (The Commonwealth of Independent States) and the rest of the world. JGL is an international pharmaceutical company aimed to developing and manufacturing drugs in target therapeutic areas, with a focus on the senses. The company is striving to be the global leader in using the benefits of sea water for health purposes.

The mission of the company is to improve the quality of life by taking care of their clients' health. It is being achieved by virtue of a clearly defined set of values, team work at all levels of the organization, closeness in communication, excellence in a clear and highly positioned set of goals and standards of quality and performance. During the time when the economic crisis undermines social relations and destroys trust between groups, awareness of the importance and responsibility that organizations have on modern society is more important than ever before. At the same time, being socially and environmentally responsible means not only fulfill legal obligations, but goes further and invest more in human capital, environment and relations with stakeholders. The company is constantly evolving in the cultural, organizational, competence, technological and process area in order to create the necessary conditions to solve a broader range of customer needs through personalized, proactive service as a value-added delivery to the purchaser. JGL strives to be a reliable partner to the customer and his first solution to business challenges.

JGL continuously implements the principles of social and environmental responsibility in its business and, in interaction with other stakeholders, it aims to set an example and contribute to the harmonization of its own long-term growth with the sustainable development. Two DOP Index¹ Awards, received in the category of large companies, are just an example of numerous recognitions given to the company that raises its standards of development and environmental protection year after year.

While enhancing the quality of life through health care globally, JGL continually strives to be a reliable and responsible member of the community in which he lives and works. Furthermore, JGL put intense emphasis on the development of environmental awareness and responsibility towards the local community. Protecting the environment and conserving natural resources are high priority to JGL. By taking care of responsible management and commitment of employees, JGL strives to conduct its operations in an environmentally responsible manner. Health and environmental protection goals are outlined starting from the initial stage of developing the product and further below. Accordingly, the company continues to adopt new environmental standards, to act proactively in the direction of environmental protection, healthy personal development and affirmative social action.

In the following text it will be displayed a specific company activities that aim of contributing to the economic, social and environmental dimensions of sustainability.

There are number of initiatives that stand out in the contribution of the environmental dimension of sustainability. By optimizing its processes JGL strives to achieve measurable results in the areas of environment protection and fuel usage through: reduction of harmful effects - control and separating waste water, increasing the amount of disposed waste, reducing the amount of municipal waste, reduction of water consumption, reduction of electricity consumption, reductions in fuel consumption and emissions in their own transport. In order to ensure the fulfillment of these objectives, JGL keep records on these indicators and prepares relevant reports, which are available to all interested parties. One of the most significant to post is the traverse from conventional to renewably produced sources of electricity. By this action, JGL sends a very strong message to the public about sustainability and provides a concrete contribution to the development of alternative energy technologies. This is a praiseworthy initiative that shows the strategic thinking of enterprise and understanding of future development trends.

Many environmental solutions, departing from the conventional ones and surpassing the legally stipulated solutions, were planned and implemented in the project of the Pharma Valley complex through the company's choice of advanced technological and environmental solutions, as well as reaching the level of maximum possible energy savings in future exploitation. These include the installation of a ventilation system in clean rooms with the free cooling system, which controls the use of fresh outdoor air depending on the temperature, and a power plant with a highly efficient cooling tower. Heating was solved through a burner system powered by extra light heating oil or gas in the second stage. Most of the lighting throughout the building and its surroundings was realized in the LED regulation technology that enables significant annual energy savings and consequently lower CO₂ emission.

As for the waste management, depending on the type and properties of waste, the following methods were applied: recycling, thermal treatment, disposal, authorized collectors financed

¹ DOP Index is a methodology that provides a comprehensive insight into the socially responsible practices of Croatian companies. They consider activities in six areas, namely: enterprise focus on economic sustainability, inclusion of corporate social responsibility and sustainable development in business strategy, responsible policies and practices in the work environment, responsible policies and practices of environmental management, corporate social responsibility in market relations and corporate social responsibility in community relations.

by the Fund, the pre-treatment and treatment. Waste management is applying very strict principles with the aim of minimal environmental impact. It is also significant that the part of the waste is sold as raw material thereby also protecting the environment, and also earns additional income.

Also, it is worth mentioning that an additional pool of 100 m³ was added to the water reservoir. Its purpose is to collect clean technological waste water, which is then used for watering plants. Other technological waste water passes through a biological purifier before being discharged into the sewer system. A special attention is given to the sea, its inhabitants and the coastal area, and a series of actions are organized for the purpose of its preservation. Some of the activities are: Traditional cleaning of beaches, Mediterranean monk seal tracking, raising public awareness about the connection between quality of life and preserving the environment and the importance of healthcare.

It is important to emphasize the implementation of the national project "Education of children of preschool and school-aged children in Croatia about the need to preserve and protect the Adriatic Sea" with the expert assistance of associations PAKS. The project aims to educate children, young people and parents and to encourage care for the preservation of the Adriatic Sea. The same is based on workshops that are held in kindergartens and primary schools and dividing manuals and educational DVDs. Additional promotional activities that are implemented with the aim of stimulating interest in the project among school is and the maintenance of national competition called "The sea is alive", and the contestants had a chance to win prize trips. The company also participates in the organization of conferences on the topic of environmental protection, human health and moral values. Particular emphasis is to promote the Adriatic Sea as a source of health, and its beneficial effects on human health and disease prevention. Also, the new physical insights of the water molecule and the importance of water in the human body are being emphasized.

JGL continuously seeks to have a more open attitude to employees, provide a stimulating work environment, cultivate healthy interpersonal relationships and maintain good communication with internal and external stakeholders, all with the aim of creating a climate that supports the creativity, free expression of opinions, discussion of the problems. Further, the company is continuously encouraging all stakeholders on permanent learning and development, as well as taking responsibility and initiative towards achieving added value to company themselves and their partners.

One of the key parts of the story about the social dimension of responsibility is certainly cooperation, active involvement and supporting the community in which the company live and works. The above is reflected through many examples. One of them is the cooperation with the academic community by means of providing support to new generations of young professionals. It is realized at many levels: through the implementation of teaching, mutual work on projects, and a perfunctory of professional practice. Furthermore, efforts have been intensified to encourage awareness of the importance of health care by participating in public health actions, and special care, love and resources are directed towards the children, the helpless, the sick and the needy. Through a series of sponsor-donor initiative to clubs, associations, events that primarily take care of sick children and the sea, the company is trying to return a part to the community that it takes from. Help and support is targeted to many athletes as well, like - karate, marathoners, triathletes, footballers, judoka, and as always, JGL was especially facing the sea, swimmers, divers and sailors...

It is also noteworthy to mention a JGL's commitment to development based on innovation and product development as shown by a significant investment in research, cooperation with scientific institutions and the education of its own experts in order to increase competence.

These are all indicators of the company desires to grow on its own knowledge and to conquer markets advanced solutions and new products that enhance quality of life.

5. Conclusion

Companies are more intensively recognizing advantages of sustainable initiatives and undertaking steps to incorporate them in their businesses. Making business more sustainable will present both opportunities and threats, but companies need to synchronise their activities to the development of the sustainability agenda if they want to be competitive in the future. When it comes to the marketing part, it is important for marketers to break their traditional frame of reference and reconsider their marketing strategies. Marketing intensively puts importance on sustainability. The aim is satisfying the wants and needs of the customers while putting equal emphasis on environmental and social issues, thus generating profit in a responsible way. It is essential that firms examine the ways in which their marketing mix can become more sustainable, which will, among others, be one of the influencing factors of success in the future. It is crucial to take a pro-active stance on environmental and social responsibly, that is, proactively introduce positive changes before it is made necessary. In order to achieve that, companies will need to invest a considerable amount of effort to change their supply networks and their in-house or contract manufacturing systems. Recycling of materials like paper, metals, plastic etc should be much more widespread and included in the activities of the company. Also, saving energy using the energy efficient lighting and appliances, using efficient and environmentally friendly modes of transportation are also one of possible contributions. Furthermore, it is necessary to avoid any kind of discrimination, child or forced labor, corruption, bribe or similar. The most successful companies in doing this sincerely embrace sustainability principles at its core; set clear and measurable goals; and clearly, transparently and truthfully communicate with their stakeholders about the ecological and social impacts of their products and services. These companies use the four Ps to enhance and fulfill their sustainable positioning. (Gittel et al., 2012).

JGL certainly shows awareness about the strategic importance of sustainable development and reporting on the economic, social and environmental indicators, establishes communication with employees, customers, clients, suppliers and the general public. Its business is based on the principles of sustainable development which implies economic growth with ecological balance and social progress. While stressing the orientation toward to being a reliable and responsible member of the community in which they live and work, they believe that doing good business means and doing commonweal. The company is continuously trying to improve and enhance the working and environmental conditions without consciously reducing environmental impact. Furthermore, particular importance is put on raising awareness of diversity and inclusion, responsible business management and supporting the highest standards of ethics at every step of creating a quality product - from research and development to sales and marketing. By investing in advanced, currently unconventional solutions in the area of energy efficiency, JGL has achieved a significant reduction in operating costs compared to the past, an increase in productivity, and ultimately an increase in the quality of delivery of its services and products to its customers and consumers. This bears testimony to great responsibility toward the local community and the area in which the company operates and builds.

In order to increase the level of sustainability actions, it would be useful to consider the introduction of the assessment and selection of suppliers based on their effects on the environment and society in order to spread sustainability chain to other stakeholders. When looking at a sustainable-marketed product, consideration should be made for sourcing of materials, ingredients used, and the manufacturing of the product. This includes using more natural and organic materials, sourcing local and through fair trade suppliers, utilizing

environmentally friendly materials, using lean manufacturing and distribution methods that minimize the company's carbon footprint. Each company, in striving to achieve more sustainable marketing strategy can rethink how sustainability can be integrated into activities such as product design and development, branding, packaging, pricing, distribution, personal selling, advertising and sales promotion (UNEP, 2005).

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Strategic Priorities for Consumer Co-operatives' Development in the Republic of Moldova

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Abstract. The consumer co-operatives from the Republic Moldova represent a significant sector of socio-economic system of the country. The recent evolution of the co-operative system confirms that it has not yet become stable and durable state, and it is easily influenced by internal and external factors. Nowadays challenges and the internal need for change require rethinking the co-operatives' organization and management, their domains of economic activity, their relationship with members, ownership relations and the motivational system. By signing the Republic of Moldova–European Union Association Agreement, Moldova has expressed its adherence to the European values and focuses toward its integration into the European Economic Area. This requires the adoption of new visions in the co-operatives development and in the implementation of European co-operatives' good practices. This paper is focused on the analysis of the consumer co-operatives from the Republic of Moldova, identifying the strategic directions for sustainable development and strengthening the position on the domestic and foreign market. The main objectives of co-operatives' development are: consolidation of members' community, improving management and organizational structure, diversification and modernization of co-operative activities, assuring financial stability, resource efficiency, human capital development, increasing the competitiveness on internal and foreign market, and strengthening the relationships with foreign partners. The research results were used in the elaboration of the Strategy of Consumer Co-operatives' Development for 2016-2019. The Strategy was approved by the co-operatives' Congress (February 12, 2016). The implementation of innovative and strategic solutions would boost the development of the consumer co-operatives in Moldova.

Key words: *consumer co-operatives, modernization, optimization, economic efficiency*

1. Introduction

Consumer cooperatives, according to their mission and objectives, play an important economic and social role in Moldovan society. Existing for over 147 years, this system has continuously expanded its activity areas getting fully involved in the implementation of national programs for social and economic development.

In order to ensure further development of national consumer cooperatives, strategic planning for the medium and long term development of this sector has an important role focusing on implementation of development policies, advanced modernization of the system, supporting increase of competitiveness as well as of consistent, efficient and sustainable development of

consumer cooperatives while fully meeting the needs of their members, employees and population served.

Given the importance of this issue and based on the Law regarding consumer cooperatives no. 1252/2000 [3], at the request of the Central Union of Consumer Co-operatives from the Republic of Moldova the research team of the Trade Co-operative University of Moldova elaborated the Development Strategy of Consumer Co-operatives for 2016-2019 (hereinafter the Strategy), which was approved by the XVIth Congress on February 12, 2016 and is being implemented currently.

2. Strategy development stages and methodology

Given the importance of the Strategy several steps have been undertaken for its development, such as:

- a) studying of relevant evaluation documents (reports) regarding the implementation of National Development Programs and recorded progress,
- b) analysis of the implementation of Consumer cooperatives development Program for 2012-2015 [9],
- c) SWOT analysis of consumer cooperatives activity as well as of encountered challenges,
- d) social and economic analysis of rural environment where consumer cooperatives entities operate,
- e) analysis of European regulatory and strategic development framework for consumer cooperatives,
- f) analysis of national strategic development documents of the Republic of Moldova until 2020,
- g) analysis of statistical data, reviews, social and economic reports,
- h) identification of internal needs that are challenging the consumption cooperation system, identification of stakeholders (members, employees, other beneficiaries of cooperative services, authorities, etc.) needs and expectations [7, 8],
- i) analysis of strategies and programs for local (district and community) development of consumer cooperatives in 2016-2019,
- j) consultation with sector's key stakeholders (cooperatives and cooperative enterprises, cooperative members, academics, researchers, farmers, processors and traders from rural areas, local government).

The Strategy was developed based on Art. 74 (c) of the Law on consumer cooperatives no. 1252 – XIV of September 28, 2000 [3], on the priorities of social and economic development of the Republic of Moldova established in the National Development Strategy "Moldova 2020", approved through Law no.166 of 11/07/2012 [4], on European economic integration priorities contained in the Republic Moldova - European Union Association Agreement [1], ratified by the Moldovan Parliament on July 2, 2014 (Law no. 112 of July 2, 2014) and by the European Parliament on November 13, 2014, on the Strategy "Europe 2020" providing for smart, sustainable and inclusive growth [2], on national sectorial strategies for economic development, on other policy documents according to international cooperative principles, Regulation (EC) no. 1435/2003 of the Council from July 22, 2003 on the Statute for a European Cooperative Society (SCE) [6], the Promotion of Cooperatives Recommendation R193 of International Labour Organisation, adopted by the ILC session no. 90 on June 20, 2002 [5], the international priorities for the development of cooperatives promoted by International Cooperative Alliance (ICA) [10], Cooperatives Europe (CoopsEurope – The European region of ICA) [11], sectoral international organisations of cooperative activity fields, and to other relevant documents.

The Strategy is based on the following principles: participation and transparency; complementarity and correlation with other strategic documents; additionality of resources;

efficiency. The Strategy is developed on the basis of systemic, complex, problematic approaches and is aimed towards boosting the development of Moldovan consumer cooperatives under increased competition, economic globalization, development of information society.

3. The scale and development of consumer cooperatives in 2012-2015

During the last four years consumer cooperatives continuously offered a wide range of services and promoted various activities (retail and wholesale trade, purchase of agricultural products and of agricultural products of animal origin, their processing, various services, including educational, market, catering services), this activity depending on the interests of their members and of the population from the activity area, thus providing service to about 57% of the population.

As a membership-based system, consumer cooperatives continuously choose community strengthening and development of infrastructure, which currently includes:

- cooperative members – over 144 thousand,
- economic entities – 161, including consumer cooperatives – 98,
- trade units – 1930 with commercial area of 185 thousand m²,
- catering facilities – 230,
- locations where consumer cooperatives exist – 770,
- markets – 32 with 10850 places for sale,
- the production sector comprises 21 factories and bakeries, 14 confectionery-pastry departments, 16 slaughterhouse, 29 agricultural products processing facilities, including 15 for sunflower seeds, 10 for grain, 2 sausage departments, 5 production enterprises,
- educational institutions – 3,
- employees – 4265.

Aiming for increased quality of services offered by cooperative enterprises, in the previous period these focused on infrastructure modernization, on trade, manufacturing and service update. Thus, in 2012-2015:

- 31 trade units were re-opened and put into service of the rural community, 190 stores were re-designed and upgraded in terms of commercial technology,
- 54 catering facilities were refurbished,
- 2 companies and 15 specialized purchasing units and their branches were created in different areas of the country,
- 12 bakeries within the system were refurbished and 5 cafeteria departments were re-equipped,
- 12 commercial markets were refurbished.

Mobilization of domestic resources, employment of existing potential, development of cooperative infrastructure favored growth of all areas of activity as well as of economic activity results during 2012-2015:

- in the mentioned period retail sales have grown up by 8.4%, wholesale sales - by 52.1%, together registering 3,124.7 million lei and 383.5 million lei respectively;
- during the mentioned period, purchase of agricultural production, of animal type and other production has grown by 13.2% recording 315.4 million lei;
- manufacturing of industrial production increased by 7.2%, totaling 238.5 million lei for the reference period;

- from 2012 to 2015 payment-based services for the population have grown by 31.1%, including market services by 27.1%, and accounted for 589.5 million lei;
- export volume amounted to 64.7 million lei, growing 3.8 times;
- domestic investment amounted 88.6 million lei;
- turnover (net sales) increased by 8.4% and amounted 3716.7 million lei;
- net profit increased to 14,057 thousand lei in 2015 (compared with 45 thousand lei in 2012);
- increased contributions to the republican budget by 26.4%, accounting for about 431.8 million lei.

However, lack of financial resources is one of the main impediment factors for intensive and extensive development of consumer cooperatives. Lack of required investment and unattractiveness of the system for foreign investors remain an important barrier to sustainable long-term development of consumer cooperatives.

4. SWOT analysis

In order to design an overall view on the development of consumer cooperatives a SWOT analysis of this system was conducted.

Strengths:

- social background of consumer cooperatives system consisting of cooperative members, associated on the basis of free consent and contribution to their charter capital,
- the legal basis for the operation (national and international) of consumer cooperatives,
- organizational unity of consumption cooperative system,
- multidimensional (diversified) character of economic activities (trade, purchase-processing, services, etc.),
- unified management system based on democratic principles and participatory management,
- image created by a socially oriented system,
- contribution to the implementation of several national development programs,
- experienced personnel for cooperative sector activity,
- established sales market,
- decades-lasting working experience,
- established domestic relations,
- own infrastructure (technical and material),
- investment in infrastructure upgrade,
- own educational system existing at various stages of professional education,
- available research potential,
- contribution to rural development,
- ubiquity of cooperatives worldwide and support of the cooperative activity worldwide,
- national consumer cooperatives system is part of the international cooperative system,
- transfer of experience and international best practices toward the national consumer cooperatives.

Weaknesses:

- imperfection of the legislative and regulatory framework regarding consumer cooperatives,
- decreasing interest of cooperative members in support and development of cooperatives,

- imperfect mechanisms of members' co-participation in economic and administrative activity of cooperatives and of cooperative members responsibility for the work of cooperatives,
- certain imperfect and inefficient elements of the organizational structure,
- diminished responsibility of several managers and employees of cooperative entities for financial and economic results,
- partially obsolete, unused or inefficiently used infrastructure,
- insufficient financial resources for the implementation of extensive programs of infrastructure modernization, refurbishment and work expansion,
- unattractiveness of consumption cooperation system for foreign investment due to the nature and legal status of economic entities from this sector,
- trend towards disintegration among several cooperative organizations,
- positional decrease of cooperative enterprises and organizations within activity markets,
- low profitability of economic activity in certain areas mainly caused by the social character of cooperative benefits in rural regions,
- imperfect motivational system,
- insufficient public information on the benefits of consumer cooperatives.

Opportunities:

- improvement of legislation, harmonization of domestic needs with the *acquis communautaire*,
- state structures' support of consumer cooperatives activity, synergistic cooperation with all-level public authorities,
- increase of the credibility in front of foreign partners and of attractiveness for foreign investment,
- strengthening of cooperative members community and recruiting of new members,
- enhancement of integration and associative processes,
- optimization of cooperatives' structure and management,
- modernization of cooperative infrastructure,
- diversification of the areas of cooperative activities according to the needs of society and to international best practices,
- entering new markets and domestic market niches (urban, regional, food products, etc.) as well as entering external market,
- cooperation with other cooperative areas and cooperatives types,
- implementation of an informational system integrated into consumer cooperatives system,
- rapid adaptation to constantly changing internal and external environment,
- expansion and diversification of the supply of goods and enhancing the quality of goods available to consumers,
- enlargement of opportunities for attraction and employment of consumer purchasing funds,
- increasing confidence, implementing customer loyalty programs.

Threats:

- maintaining contradictions between the legislation on consumer cooperation and other laws, including civil legislation,
- substantial reduction of positions in segments of economic activity,
- reduced interest for consumer cooperatives association,
- uneven competitive environment for all economic players operating in the domestic market, maintaining of unfair competition,

- underestimation by public authorities of the consumption cooperatives system and of the role of businesses and organizations from this system for the achievement of state social policies, lack of support for social-based cooperative activities in remote or low populated regions,
- amplification of the impact of economic and financial crisis,
- destructive demographic trends from the country, labor migration, population and demand decrease,
- reduction of income and purchasing power of the population from service area,
- variation of the structure of population consumption expenditure,
- discrepancies between qualification levels of personnel and skills required for innovative, effective consumer cooperatives activity,
- low attractiveness of consumer cooperatives for youth enrollment in their work,
- limited financial possibilities,
- amplification of disintegration process.

5. Vision, strategic lines and objectives

Vision. Development of consumer cooperatives as a sustainable and competitive system, resistant to internal and external challenges, ensuring welfare for its members and for the population served as well as benefits for its employees.

Strategic lines:

- development of consumer cooperatives as a unified system, economically strong,
- strengthening the positions of consumer cooperatives system within the internal market (rural) and entering other markets (urban), enhancing the competitiveness of consumer cooperatives system, its economic growth,
- amplification of integration and association processes in the consumer cooperatives, expansion of these processes within internal and external dimensions,
- synergistic cooperation with public authorities, potential investors, other stakeholders,
- modernization and innovative development of cooperatives' system,
- integration into the international economic turnover.

Strategic objectives:

- i. strengthening cooperative members' community,
- ii. optimization of organizational structure and making the management of cooperatives' system more effective,
- iii. optimization of traditional activities promoted by consumer cooperatives and diversification of cooperative benefits,
- iv. ensuring financial stability, efficient and effective use of resources, ensuring the efficiency of cooperative entities work,
- v. development of internal potential and increase of system's competitiveness on domestic and foreign markets,
- vi. strengthening relations with external partners.

The strategy includes priority directions for the development of cooperative activity as well as actions necessary for its successful implementation. The main directions are given below.

Strengthening cooperative members' community. The increase of the number of members requires implementation of an effective incentives mechanism, motivation to support and develop local cooperatives, stimulation of investment in the development of cooperatives, increase of subscribed shares. Development of a motivational system for members has become urgent.

An effective tool in this regard would be the allocation of a part of the benefit obtained by cooperative organizations to their members according to the subscribed capital.

In the following period it is necessary to implement an information system in order to keep record of cooperative members and to timely renew the database.

Optimization of organizational structure and making the management of cooperatives' system more effective. Optimization of internal organization of consumer cooperatives system should focus on integration (vertically and horizontally) and association processes, regardless of the territorial area of operation and of the profile of economic activity (retail, wholesale, purchase-processing-storage-distribution of agricultural products, etc.)

Organizational restructuring must be based on:

- diagnosis of the activity of cooperative economic entities across the country and re-organization/disbanding of inefficient and legally non-conforming entities;
- support of economically strong cooperative organizations and integration of their infrastructure into a single economic system,
- re-structuring of cooperative enterprises and their integration into structures specialized in cooperative areas (trade, purchase, services, etc.) at republican and regional levels.

Managerial re-structuring must be based on the optimization of both vertical and horizontal managerial hierarchy of consumer cooperatives through:

- reduction of hierarchical structure and transition to a two-level structure (consumer cooperatives - Central Union),
- optimization of cooperative organizations' management bodies,
- organizational re-structuring of internal management (cooperatives, enterprises).

Optimization of traditional activities promoted by consumer cooperatives and diversification of cooperative benefits.

Trade is the traditional economic activity area having a dominant share in consumer cooperatives turnover. Within this area mapping and assessment of trade facilities in terms of economic and social efficiency, of territorial location, of specialization profile, of the role for community development is planned as well as the elaboration of a *concept regarding the development of cooperative trading system*.

Has become urgent the need for a *unified (integrated) trade system* based on enterprises and on available trade infrastructure of consumer cooperatives' system (retail and wholesale trade), which could compete with national and international networks operating on the domestic market.

In order to strengthen the image and to increase the visibility of consumer cooperatives it is necessary to develop and promote *own trademark(s) for products manufactured and/or sold* through consumer cooperatives networks and trade facilities.

Transport- and logistics-related constraints to trade directly and indirectly affect the competitiveness of the sector. Establishment of a *unified system for product distribution* within consumer cooperatives employing a modern logistics system will allow to reduce distribution costs, lower prices for consumer goods, optimize expenses, and streamline the decision-making process.

An important role in promoting cooperative trade services further lies with expanding the implementation of "CoopPrim" and "CoopPlus" stores formats, development and implementation of new formats of trade facilities.

Special attention must be given to implementation of digital forms and instruments for sales promotion, to initiation and development of electronic trade within consumer cooperatives.

Development of the sector for purchasing agricultural-, animal origin- and other products has strategic importance for the development of cooperatives system. This activity area, similar to trade, comes to support the state with the promotion of its social policy in rural regions, therefore it requires support from authorities.

The development of this sector is hampered by shortage of funds, lack of a unified system for sale of purchased production and for processing, unfair competition on the market of agricultural food products, etc. In order to revitalize this sector evaluation of purchasing potential of the consumer cooperatives' system is imperative based on: agricultural specialization of republic's regions and districts, capacities of cooperative enterprises and organizations, investment needs and *elaboration of a long-term development program for the sector*, attractive for both domestic and foreign investment and involving stakeholders.

Lack of horizontal and vertical coordination of purchase chains within the consumption cooperatives' system, scattering of financial, logistical, human resources as well as information deficiencies cause low competitiveness of this sector and justify the need and opportunity for *establishing a republican cooperative enterprise specializing in purchase-processing-trade-export*.

Industrial sector development is an important source for creating cooperatives' own resources and product supply. Cooperative industry is mainly oriented towards the manufacture of essential products, including bread and bakery products, confectionery and pastry, pasta, sausages, beverages, etc.

Further development of the industrial sector and its economic efficiency can be achieved through integration of production structures (enterprises, departments) into a *single complex* with the centralization of certain functions (design and development of new products, joint information infrastructure, joint distribution system, etc).

Development and launching of *own co-operative production brand* as well as its promotion will increase the visibility of these products internally and externally and will increase consumer confidence.

Services development and diversification will focus on the diversification of services, upgrade of relevant infrastructure, expansion of services traditionally rendered by cooperative entities (catering, marketing, educational and research, etc.) and increase of their quality as well as beginning to render certain social services, services provided to farmers, advertising and other services.

Ensuring financial stability, efficient and effective use of resources, ensuring the efficiency of cooperative entities work is an important factor for sustainable operation of cooperative organizations and enterprises, implementation of projects regarding modernization and expansion of cooperative benefits, increase of service quality, rewarding of cooperative members and of employees from the system.

Insufficient financial resources remain a significant barrier to the development of consumer cooperatives, especially in areas where cooperative activity is unprofitable but needed by the population, primarily for ensuring products of first necessity. Since social mission is the responsibility of public authorities, in order to maintain cooperative benefits in such regions and improve the economic condition of cooperative entities urgent authorities' support of such cooperative activities, that can be achieved in various forms (grants, exemption or reduction of location fees, etc.), is required.

As main external factors that can contribute to the improvement of economic activity of the consumer cooperatives' system, the following can be listed:

- development of economic activities, entering new markets, diversification and expansion of cooperative services,

- modernization and upgrade of cooperatives' infrastructure,
- establishment of internal audit units within the cooperatives' structure,
- implementation of an integrated information system for recording economic and financial results,
- improvement and streamlining of financial and economic activity management, employment of financial management- and risk management tools for economic and financial management of the system,
- cooperation with credit and investment organizations for financing consumer cooperatives development programs,
- establishment of own consumer cooperatives' financial institutions.

Further sustainable development of consumer cooperatives requires strengthening investment potential through:

- attraction of external financial resources (loans, credits, deposits, etc.) from various third parties without losing cooperative identity,
- attraction of monetary resources from members, cooperative employees and from the population,
- application to microfinance and technical assistance projects,
- development and implementation of an effective investment reward system,
- accessing European funds for the development of cooperatives infrastructure.

Development of internal potential and increase of system's competitiveness on domestic and foreign markets. Given continuous economically and socially changing environment, increasing competition on domestic and foreign markets, development of digital economy, in order to meet these challenges the consumer cooperation must follow a process of continuous modernization, implementation of innovations, development of its internal resources, expansion of partnerships with stakeholders (internal, national and international) and with other beneficiaries.

Infrastructure development must focus primarily on three dimensions: expansion of cooperative infrastructure, strengthening of material and technical basis of the cooperative system and refurbishment of activities.

A major priority for increasing the competitiveness of consumer cooperatives' system internally and externally is the implementation of digital marketing tools (e-marketing) in cooperative activity for better visibility and promotion of services.

Human resources are the key resource for ensuring sustainable development of each enterprise and consumer cooperatives. Personnel employed in consumer cooperatives' system, although distinguished by loyalty and having great working experience, are characterized by an "aging" process. This trend and the acute shortage of labor in rural regions urgently need a *program regarding ensuring competitive human resources for consumer cooperatives* in the medium and long term.

Domestic and external economic environment, internal needs of cooperatives' system require imperative development and implementation of a *corporate integrated information system* within consumer cooperatives for integration of all data and information flows, of all cooperative system components and of its management, thus facilitating a more efficient and transparent decision-making, resource optimization, efficiency of economic activities.

An important role for the future development of consumer cooperatives lies with employment of opportunities offered by modern ICT for economic activity and beneficiaries' information. In this regard has become urgent: expansion of cooperative activities in cyberspace;

implementation of electronic forms for the trade and sale of goods, of B2C, B2B and B2A e-commerce models; implementation of electronic payment methods, etc.

Internal change needs as well as European integration aspirations of the Republic of Moldova determine the need to harmonize national legislation on consumer cooperatives with the *acquis communautaire* to the extent ensuring maximal approximation with EU legislation.

Strengthening relations with external partners. To provide the population with goods, particularly of primary need, consumer cooperation requires support from authorities at all levels (from the central to local one). Partial compensation of expenses related to the implementation of social projects in remote localities with small populations, and support of these activities can be realized by:

- allocation of subsidies for economic activities conducted by consumer cooperation and directed towards providing goods of vital importance (production and delivery of bread, etc.) or partial coverage of the costs for transportation of such products;
- exemption of location taxes, local taxes, other tax of cooperative units entities in localities where economic activity is unprofitable due to low number of population served, difficulties related to goods supply.

Development of partnerships should be also extended on the dimension of cooperation with other types and forms of cooperatives (manufacturing, agricultural, entrepreneurship etc.) in order to promote projects of common interest, to modernize legislation, to amplify the potential of promoting common interests and protection.

Cooperation on the external dimension will focus in the future on: implementing international best practices regarding normative-legislative regulation of cooperative activity, organization of cooperatives, attraction of members; extending cooperation with overseas cooperative organizations in carrying out joint economic activities, commodity exchange; promoting export of products purchased and processed by the consumer cooperatives in the country, benefiting from advantages offered by the signed Deep and Comprehensive Free Trade Agreement etc.

6. Conclusions

Implementation of the Strategy will have an impact both *economically*, materialized in enhancing the economic potential of cooperative system, creating favourable conditions of work, improving the legal framework in the field, increasing investment in development, and *socially*, expressed in improving the level of service to its members and to other categories of beneficiaries, affordability of cooperative services, consumers' protection, contribution to the development of localities and community.

Strategy implementation will contribute to achieving the following progress indicators:

- turnover increase by 3-5% annually,
- increase the income of cooperatives on average by 4-6% annually,
- attraction, at least, of 250 new cooperative members annually, implementation of incentive mechanisms for them in developing consumer cooperatives at local, regional and republican levels,
- increase of wages for employees working in consumer cooperatives, provision by 2019 of a share of 75% of the average monthly salary in the country,
- organization of 500 new jobs during the Strategy period of action.

Development of consumer cooperatives will help increase the indicators characterizing the economic and financial activity: retail sales will grow annually during the Strategy period of action by 3-5%, wholesale sales will increase by 5-7%, purchasing of goods - by 4-7%,

production of goods - by 3-6%, provision of paid services - by 3-5%, sales revenue will increase by 3-5% and net profit will increase by 3-6%.

Implementation of the Strategy will contribute to sustainable and intelligent recovery of the consumer cooperatives potential in all its dimensions (institutional, infrastructural, human, financial, informational, managerial, etc.), and will support progress in economic and social development of this system.

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Knowledge transfer offices in the context of knowledge spillover theory of entrepreneurship

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Abstract. Paper will present aspects of the knowledge transfer offices (KTO) from the EU Knowledge Transfer Study report, through the prism of the knowledge spillover theory of entrepreneurship (KSTE). It will also add the argument, based on the existing literature, that knowledge cannot be managed but only the information resources can. This paper contributes to the on-going research of Secondary Experience, whose main aim is to explore avenues for designing information system that will support better usage of the existing scientific papers between universities and their environment, including public, private and civil sector. There is a limited number of the EU wide research studies of the EU universities Knowledge transfer offices. Existing one are sending non-promising results. In the last EU report addressing KTO not even one hypothesis addressing KTO related policies is accepted and one of the hardest parts in conducting research was to find the contacts of the KTO's. It is aligned with results from the master thesis of one of the authors, where sources of information were analysed in terms of the transparency of the projects and their funding related information among 466 universities in the Danube region. That alerted us and opened up completely a new set of questions. In this paper, we use secondary data as content for our research.

Key words: *knowledge transfer entrepreneurship information resources*

1. Introduction

The main research question addressed by our ongoing research, to which paper contributes, is related to the design information system that supports a production and communication process of the scientific documents and interaction of the all agents involved in the process, including academia, public, private and civil sector [1, 2]. Primary focus is on the Danube region universities ecosystem. To design the information system, we have to understand the information behaviour, including information searching and seeking patterns [3]. We also have to gain insights to the what type of information resource, what type of communications channel and what type of the media formats (e.g. scientific journal, conference proceedings, web pages etc.) are used in the process of interaction between agents. Those variables (type of information resources, type of communication channels, information seeking patterns and media formats) except explaining interaction process itself also create solid analytical framework to analyse impact of the already published scientific papers by their environment. Another research inquiry is in the area of interaction, or precisely speaking, what are the motivation drivers and factors that influence the interaction and cooperative and collaborative

processes between scientists and their environment. If we understand the motivation drivers and factors that influence interaction, cooperative and collaborative processes, then we can implement them into a design of an information system. Information systems can be understood as the “extension of meaning engagement practice through mediating and organising social interactions” [4]. Also, patterns of the information system usage can configure cognition and behaviour of a user in the process of accomplishing work-related tasks [5]. Any information system consists of social, technological and informational components, which are not separate but interrelated [6], and there is an inherent inseparability between the technical and the social [7]. So available technical and information components in the information system supporting will influence behaviour of social agents and by doing so we believe that we could increase effectiveness and efficiency of creation and usage of scientific documents. Aim of this paper is to present results from the EU Knowledge Transfer Study 2010-2012 and put them in the context of the Knowledge Spillover Theory of Entrepreneurships (KSTE). Paper is organised as follows: next chapter will present results study and provide recent definitions of the KTOs found in the literature, following by brief explanation of KSTE in the context of KTO. As those two are presented, paper will discuss how issues could be approached from the information system design perspective. This paper is of the exploratory nature and there will be any bold conclusions.

2. Knowledge Transfer Study 2010-2012 results

The objective of Knowledge Transfer Study 2010-2012 was to monitor the status of implementation of the European Commission’s *“Recommendation on the management of intellectual property in knowledge transfer activities and Code of Practice for universities and other public research organisations”* from 2008 [8]. Those Code of Practice recommendations are presented in the Table 1 [9]. Findings are based on the questionnaire send to the Public Research Organisations (PRO) in 28 EU Member States and survey has to be fulfilled by the recommendation requirement that Member States should *“inform the Commission by 15 July 2010 and every two years thereafter of measures taken on the basis of this Recommendation, as well as their impact”*.

Table 1 KTO Code of Practice principles

CoP 1: Existence and publication of IP policy	CoP 7: Existence and publication of publication/ dissemination policy	CoP 13: Sharing of KTT returns between organisation, department and researcher
CoP 2: IP policy provides clear rules for staff and students	CoP 8: Used set of exploitation mechanisms and partners	CoP 14: Monitoring and publication of IP, KTT and research activities
CoP 3: Promoting identification, protection and exploitation of IP	CoP 9: Revenues not prime objective of IP/KT policies	CoP 15: Compatible rules and practices for collaborative and contract R&D
CoP 4: Providing incentives to staff to implement the IP policy	CoP 10: Professionalization of knowledge transfer ser- vices	CoP 16: Early clarification of IP issues
CoP 5: Creation of coherent IP portfolios and patent/IP pools	CoP 11: Existence and publication of licensing policy	CoP 17: Ownership of IP in collaborative and contract R&D
CoP 6: Raising IP and KTT awareness and skills through training actions	CoP 12: Existence and publication of spin-off policy	CoP 18: Access rights to IP

In this study, no correlation was found between total KT performance and KT policies. Results from the study regression analyses that used six performance indicators for which data was collected in the WP2 survey are presented in the table 2.

Table 2 Indicators for accessing the knowledge transfer activities of the PROs they serve

Indicators	Correlations findings
Invention disclosures	No correlation was found between KT policies and invention disclosures – the regression line is almost even (correlation coefficient 0.05)
Patent applications	No correlation was found between KT policies and patent applications – the correlation coefficient is slightly negative (-0.09).
Patent grants	No correlation was found between KT policies and number of patent grants (correlation coefficient 0.09).
Number of spin-offs,	No correlation was found between KT policies and the number of start-ups from PROs. The correlation coefficient is slightly positive (0.13).
License agreements,	No correlation was found for KT policies and license agreements (correlation efficient 0.22).
Licensing income	No correlation was found between KT policies and licensing income. The absolute value of the correlation coefficient was the largest of all indicators, but still not noteworthy high (- 0.2).
Research agreements.	No correlation was found between KT policy intensity and number of research agreements. The regression line is almost even (correlation coefficient: -0.002).

The focus of our interest was the statement from the Knowledge Transfer 2010-2012 study which was that *“most time-consuming step is to obtain contact information for the KTO that serves each PRO. This was done through using both data from professional associations and from telephoning the central administration offices of PROs and asking for this information [10].”* This is very interesting statement considering the same report states, *“many European PROs have established Knowledge Transfer Offices (KTOs) that can provide professional advice to assess the patentability of inventions, interact with firms, and provide licensing expertise [11].”* Formal technology transfer mechanisms include patents, copyrights, trademarks, licensing agreements between the university and private firms, and university-based start-ups and property based institutions such as incubators and accelerators and research, science, and technology parks [12]. According to Siegel and Wright [13], *“Knowledge Transfer Offices (aka Technology Transfer Offices) are an “intermediary” between suppliers of innovations (university scientists) and those who can potentially (help to) commercialize these innovations (i.e., firms, entrepreneurs, and venture capitalists). They facilitate commercial knowledge transfers of intellectual property resulting from university research through licensing to existing firms or start-up companies of inventions or other forms.* According to same authors’ positive side is that they could create additional revenue for the universities (through licensing agreements and spin-offs), they could open employment opportunities for graduate students (including post doctorate researchers) and could impact local economic and technological spillovers through the stimulations of additional R&D investment and job creation. On the negative side their cost could outweigh benefits of the revenues generated and could take university from their role of educators and fundamental research.

Below are the results from the Knowledge Transfer Study 2010-2012 based on the questionnaire send to all EU members’ states. Surveys was designed to obtain information for the six key indicators (number of invention disclosures, number of priority patent applications, number of technically unique patent grants, the number of start-ups, the number of licenses or option agreements with companies, the amount of license income earned) along with three supplementary indicators (the number of R&D agreements between the affiliated institutions and companies, number of USPTO patent grants, the number of successful start

ups). Results will be presented and briefly commented in the context of our ongoing Secondary Experience research.

Table 3 Distribution of Expenditure

	Universities		Other research organizations		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
up to 5 m	60	16.2%	6	8.8%	66	15.1%
5 m - 14 m	74	20.0%	8	11.8%	82	18.7%
15 m-39 m	67	18.1%	15	22.1%	82	18.7%
40 m-79 m	70	18.9%	14	20.6%	84	19.2%
80 m -159 m	49	13.2%	16	23.5%	65	14.8%
160 m or more	50	13.5%	9	13.2%	59	13.5%
Total	370	100.0%	68	100.0%	438	100.0%

Source: MERIT, European Knowledge Transfer Indicator Survey 2011 and 2012.

Note: Based on answers for EKTIS 2011, question 12.3 and EKTIS 2012, question 13.3. Results include ASTP, DASTI (DK), HEFCE (UK), RedOTRI (ES) and UTEN (PT) respondents.

Table 3 shows distribution of research budgets. Average size EU university has 23,750 students [14] that shows us through calculation that per one student per university in the first half of the distribution (up to 39M EUR, in total 54.3%) has maximum 1642.15 EUR for research, and second half of the distribution with (based on 160M/number of students) with budgets of 6736.84 Euro. We witness up to 4 times higher budgets per students in the two distribution of expenditure from those data, which is quite a big difference. Such difference is important, since larger universities do not perform better as a result. Data confirming this statement will follow later in this text.

Table 4 Distribution of Licence income

	Universities		Other research organizations		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
Zero	107	30.9%	16	22.5%	123	29.5%
€1 - € 19,999	54	15.6%	7	9.9%	61	14.6%
€20,000 - €99,999	68	19.7%	13	18.3%	81	19.4%
€100,000 - €249,999	34	9.8%	11	15.5%	45	10.8%
€250,000 - €499,999	25	7.2%	7	9.9%	32	7.7%
€500,000- €1,999,999	40	11.6%	9	12.7%	49	11.8%
€2,000,000 or more	18	5.2%	8	11.3%	26	6.2%
Total	346	100.0%	71	100.0%	417	100.0%

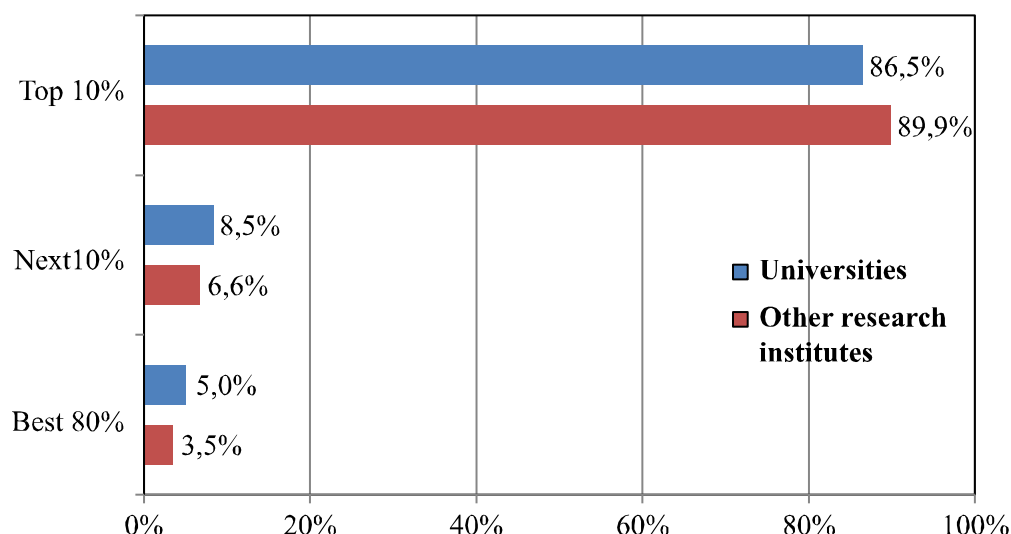
Source: MERIT, European Knowledge Transfer Indicator Survey 2011 and 2012.

Note: Based on answers for EKTIS 2011, question 9.3 and EKTIS 2012, question 10.3. Results include ASTP, DASTI (DK), HEFCE (UK), RedOTRI (ES) and UTEN (PT) respondents.

Table 4 shows income size distribution and that 66.2% of the universities have income less than 100,000 Euro. Another interesting finding from this table is that 50.7% of “other

research organisations” have income lower than 100,000 EUR since they are organisations that should create new knowledge only (no education).

Table 5 Outcomes of the top performing universities



Source: MERIT, European Knowledge Transfer Indicator Survey 2011 and 2012.

Note: Based on answers for EKTIS 2011 question 9.3 and EKTIS 2012, question 10.3. Results include ASTP, DASTI (DK), HEFCE (UK), RedOTRI (ES) and UTEN (PT) respondents. Total reported license income earned at universities was €251 million and €160 million by other research organisations.

Table 5 shows us that top 10% create 86,5% licence income (universities) and 89,9% (“other research organisations). Remaining 80% create 5% (University) and 3,5% (other research organisations). This number shows central power of the large research organisation and their importance in the new knowledge creation and innovation eco system.

Table 6 Distribution of licenses toward different firms by size

	Start-up companies		Other firms with <250 employees		Firms with >250 employees		Total	
	licenses	%	licenses	%	licenses	%	licenses	%
Universities	331	22.2	611	41.0	547	36.7	1489	100.0
Other research organisations	63	12.5	245	48.6	196	38.9	504	100.0
Total	394	19.8	856	43.0	743	37.3	1993	100.0

Source: MERIT, European Knowledge Transfer Indicator Survey 2011 and 2012.

Note: Results are limited to KTOs that reported licenses and have answered in which category the license belongs.

Based on answers for EKTIS 2011, question 9.2 and EKTIS 2012, question 10.2. Results include ASTP and UTEN (PT) respondents.

Table 6 shows who are the “customers” of those universities and research organisations. We find it interesting that the larger part of the total revenue is coming from the companies up to 250 employees and approximately 20% from start-up companies. In total almost 62% comes from small and medium businesses. This could be explained by saying that larger companies have their in-house R&D departments. It also shows that most of the interaction is happening in between research organisations and small and medium business.

Table 7 Share of license revenue by subject area

	Universities	Other research organisations	Total
Biomedical	34.9%	40.8%	36.1%
Computers, communication equipment and software (ICT)	16.8%	12.7%	16.0%
Nanotechnology and new materials	7.7%	6.4%	7.4%
Low/zero carbon energy technologies	3.6%	1.9%	3.2%
Other subject areas not listed above	37.0%	38.3%	37.3%
Total	100.0%	100.0%	100.0%

Source: MERIT, European Knowledge Transfer Indicator Survey 2011 and 2012.

Note: Based on answers for EKTIS 2011, question 10 and EKTIS 2012, question 11. Results include ASTP and UTEN (PT) respondents.

Table 8 License revenue by subject area

	Universities	Other research organisations	Total
Biomedical	81.6%	93.7%	87.0%
Computers, communication equipment and software (ICT)	5.9%	1.4%	3.9%
Nanotechnology and new materials	1.4%	0.2%	0.9%
Low/zero carbon energy technologies	4.0%	0.1%	2.3%
Other subject areas not listed above	7.1%	4.6%	6.0%
Total	100.0%	100.0%	100.0%

Source: MERIT, European Knowledge Transfer Indicator Survey 2011 and 2012.

Note: Based on answers for EKTIS 2011, question 9.3, and 10 and EKTIS 2012, question 10.3, and 11. Results include ASTP and UTEN (PT) respondents.

Tables 7 and 8 show the share of license revenue and licence revenue by subject area. We can see that biomedical makes almost 90% of the total revenue. We can ask a question, why public owned organisations make the most money by selling licenses that could have the strongest social impact such as health to the companies. Taxpayers' money goes to the research organisations, new knowledge is generated and social benefits could be achieved, but then licenses end up as ownership of private companies that generate profit. Interesting finding from our ongoing research that is relevant to this distribution is that at the time when EU Human Brain Project research started and was valued at 1,190 B EUR [15], the top seller category of depression medications was losing its patent rights in 2013. [16] Note that academic literature defines depression a high potential market for pharmaceuticals [17].

Table 9 Performance of KTO'S

	Performance per 1,000			Mil Eur to prod 1 output			Top PRO's		
		Top PRO's	All-Top		Top PRO's	All-Top	US	Mil Eur to prod 1 output	
Table	3,21	3,24	-0,03	3,22	3,25	-0,03	3.25 US	3.23 EU	3.23 US
Invention disclosures	16,4	15,2	1,2	3,3	3,9	-0,6	2.1	3.3	2.1
Patent applications	8,5	8,3	0,2	6,6	7,5	-0,9	2.3	6.6	2.3
USPTO patent grants	5,3	5,4	-0,1	10,4	12	-1,6	NA	NA	NA
Patent grants	1,3	1,3	0	47,1	49,8	-2,7	9.7	10.4	9.7
Start-ups established	1,6	1,3	0,3	30,4	39,9	-9,5	68.0	30.4	68.0
Successful start-ups	2,7	2,5	0,2	16,4	18,6	-2,2	NA	NA	NA
License agreements	6,6	6	0,6	7,5	8,9	-1,4	7.5	7.5	7.5
License income (in M Euro)	0,6	0,6	0	81,1	89,4	-8,3	24.4	81.1	24.4
Research agreements	81,3	75,4	5,9	0,6	0,7	-0,1	NA	NA	NA
Total	1,021,731	785,679		41,072	39,533		45,631	41,587	45,631

Table 9 shows us EU KTO performance in 2011 and 2012 combined. First column presents performance per 1000 research personnel. Second column presents same variable just for the top performing institutions defined in original report (PROs have more than per 1,500 of research staff). Third column presents difference between all KTO and top ones (that have more than 1500 research stuff). It is calculated using formula All-Top=X. Fourth column presents performance by research expenditures (million Euros to produce 1 output) and fifth column presents top PRO's (with with €30 million or more research expenditures). Sixth column presents difference between all and top (All-Top=X). Columns number seven, eight and nine compare top institutions (based on research expenditure) between US and EU PRO's. First raw "Table" indicates table number in the original document.

This table shows limitations of the KTO in terms of generating revenues and cost of their operations. For example, every thousand researchers produce 1.6 start-up companies and it costs almost 40 M EUR. Alternatively, to generate 1 M EUR in revenue from license income it costs universities more than 80 M EUR, while making single invention disclosure cost more than 3 M EUR. From another point, thousands of researches are needed to generate 80 research agreements and it costs around 0.6 M EUR. What also got our attention is negative impact of the size of PRO's in terms of research expenditure. Large organizations have lower return on investment ratio in all indicators. In addition, Table 5 shows that most of the revenue is generated by large organisations. So actually we have double negative impact, as money is not spent efficiently and most of the income comes from the real economy

(companies that operate on the market) so this inefficiency is transferred further. In addition, if we look at the Table 6 where we could see that most of the deals are done by start-ups and small and medium companies which are main generator of the economy. This forms a question related to KTO and their role in process of the social welfare and prosperity rise.

So how to explain these trends and why PRO's are not efficient in creating the benefits for the society through the placement of their output on the market?

As one of the potential frameworks we would like to discuss the difference between new and economic knowledge, how new knowledge becomes economic knowledge, what is happening in this process and who are the main agents of such a transformation. Knowledge Theory of Entrepreneurship covers all these points.

3. Knowledge Spillover Theory of Entrepreneurship

Knowledge Spillover theory of Entrepreneurship (KSTE) [18] clearly separates three main systems by interacting in the process of creation of the new knowledge. These are systems that create “new knowledge” (NKS), systems that creates “economic knowledge” (EKS) and systems that filter knowledge spillover (KFS) from NKS to EKS. Authors of this theory point at organizations that, by using their own capacities and resources to produce new knowledge and for various reasons opted to not commercially exploit it call “**Knowledge Incubators**”. This could be a *private firm, non-profit organization, government, university, or research institution*. Economic agents that are *able to absorb knowledge spillovers and convert them into economic knowledge* are called “**High-impact Entrepreneur**”. They differentiate from other entrepreneurs by *utilizing the spillover from the knowledge incubator, commercializing this knowledge by founding a new firm, entering the marketplace, and converting the new knowledge into economic knowledge*. In addition, it is important to mention that they are not liable for the full cost of new knowledge creation but rather invest their resources to the process of filtering spillovers thus generating income and profits as a reward for risks involved. There are three main characteristics involved in the process of decision making related to economic knowledge (as an opposite to normal economic goods) that influence the cost of decisions making [19]. Those are **high degree of uncertainty**, information is the **asymmetric nature**, and **valuation of knowledge and ideas is non-trivial**.

As this is a process of high risk and high cost, the spillover does not happen automatically. According to authors of KSTE, filter “must be penetrated by knowledge to be appropriated, packaged, modified, and enhanced for it to ultimately contribute to economic growth” [20]. This filter could be modelled under assumptions presented in Table 10 [21].

Table 10 Knowledge Filter Assumptions (cited from Acs et al., 2004)

Economic production functions (goods, knowledge/invention, entrepreneurial/innovation)	<i>Individuals can either be employed in the goods producing sector, the knowledge (invention) producing sector or in the entrepreneurial (innovation) sector</i>
Distribution of entrepreneurial ability	<i>Entrepreneurial ability is distributed unevenly (and exogenously) across individuals</i>
Efficiency of knowledge transformation	<i>There is a filter in the economy influencing how efficiently knowledge is transformed into economic knowledge, implying that only part of the stock of knowledge is converted into economically useful firm-specific knowledge</i>
Type of the channels of transformation	<i>There are two channels to transform knowledge (A) into economically useful knowledge. The first involves incumbent firms and the second involves the entrepreneurial startup of new (Schumpeterian) firms.</i>

Capacity and property of the channels	<i>Incumbent firms transform available knowledge into economically useful knowledge by employing knowledge workers which results in new inventions, new varieties of products and new knowledge. The “thickness” of the filter determines how efficiently firms can transform knowledge into goods and services (commercialization). The thicker the filter, the less efficient exploitation of knowledge.</i>
Emergent property	<i>A start-up (innovation) represents any kind of new combination of existing or new knowledge, where individuals draw on their (given) entrepreneurial ability and the aggregate stock of knowledge.</i>
Competitive conditions	<i>Knowledge produced by firms is non-rivalrous and partly non-excludable</i>

4. Discussion

We would like to contribute to the existing body of knowledge related to KSTE by proposing schematic view of the three systems involved. It is shown in Figure 1 and we believe it could be used as an analytical matrix that could help better understand three systems involved in commercialization of the new knowledge process.

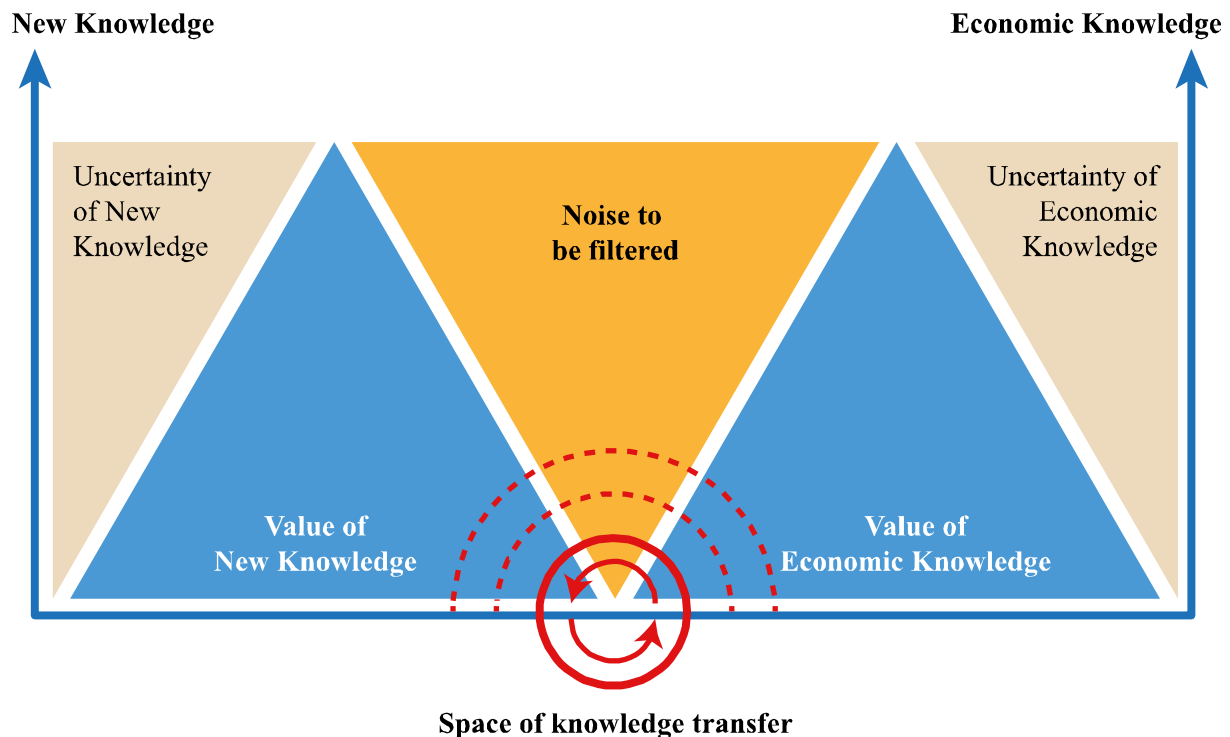


Figure 1 Systemic overview of the KSTE process

The picture above shows three systems; “new knowledge” (NKS), system that creates “economic knowledge” (EKS) and system that filters knowledge spillover (KFS) from NKS to EKS. In the early phase of the research, interests were characterized by high uncertainty. By researching and learning about phenomena of interest, uncertainty is reduced until the NKS system achieved its peak in terms of value. As soon the peak is achieved, it got potential to become economic knowledge, but to do so it should be transformed into EKS system through the KFS. A volume of the noise in the channel is high (and it should be filtered to achieve commercialization). After the peak of the NKS, potential value starts to decline for various reasons so the main corrector is time. For example, invention has higher value at the moment of the discovery than after the results are published and after patents are obtained. Value is reduced in the administrative process of writing and publishing papers, reports and

filling patent forms. By having employed thousands of researchers is high expense and time needed to publish results and fill the patents documentation could take years. Therefore, time directly influences cost of the KTO activities. Once the patents are registered and scientific papers are published, there is no noise involved, but also potential market value is reduced. According to the performance we see indicators as presented above in the text, that in this space most of the activities of KTO are over. By observing the KTO performance through the lens of proposed analytical framework, we could explain high costs associated with time dimensions and low level of noise in the channel. The higher the noise is, the higher benefits and commercial impact can be achieved, but also the risk is higher. Moreover, if KTO offices belong to government owned organizations, incentive schemes involved for the employees that are “pitching” the new knowledge to industry usually is not very flexible. This is the area where **High-impact Entrepreneurs** become important factor. They work in the companies they own, or have shares of and are highly motivated by potential rewards for their risk taking. In addition, as these are smaller companies, negotiation with organizations that are interested in outputs of NKS could be streamlined, and conducted more efficiently. Therefore, we could say that we have competition in the NFS between government owned organization KTOs and **High-impact Entrepreneurs**. Competition is welcome, but the problem is that PRO KTO's are very expensive to run with very limited results in terms of performance and economic impact. At the right side of the picture, we could again see the increase of the uncertainty, but this time it is related to the market and economic knowledge. For example if new patent is acquired and company is the first on the market and if it has a period when nobody could compete, because of legal restrictions, we get the peak of the EKS potential. Nevertheless, as time goes on, more and more competitive products enter the same field, uncertainty increases and EKS has to turn back for the new portion of the signals from the NKS.

As the evidence of the noise presented in our systemic overview, we would like to present in short some findings from the master thesis of the one of the authors in which 270 universities web pages were analysed, where some kind of research is offered to the public. Initial aim of the research was to analyse type of the projects where universities are involved with (private/government/NGO), and what are the budgets of those projects and what is the quality of the information related to the projects. In the process of data collection we have to switch from the initial research questions and change the methods from quantitative to qualitative, as there is no possibility to conduct planned analysis. The data presented on those web pages was incomplete, even in some cases it did not exist and it was not possible to find common pattern that could be used to structure collected data. We even moved step back and went to look for simple numbers such as number of teachers and employees and results of our findings were not very encouraging. We have done analysis of the universities web sites and Wikipedia pages and there was relatively small percentage of universities that even have data about actual number of people teaching at those universities (Czech Republic 13,8%, Austria 38,5%, Croatia 37,2%). Those findings are aligned with the EU study we presented earlier, where *“most time-consuming step is to obtain contact information for the KTO that serves each PRO”*.

5. Conclusion

Instead of the conclusion we would like to cite Professor Wilson who, almost 15 years ago, reminded us that *“data and information may be managed, and information resources may be managed, but knowledge (i.e., what we know) can never be managed, except by the individual knower and, even then, only imperfectly”*. To create the social and economic benefit from the new knowledge made by the academic institutions we should focus on the managing the noise

that stands on the way in this process. In addition, we could do it by systemic view on the sender, receiver, message and information it conveys from the humanistic perspective that challenge technocratic paradigm to which knowledge management belongs. With this approach, entrepreneurship, which as a discipline has a major task challenging existing paradigms, should play an important role.

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Which Freedoms are most Important to Entrepreneurship?

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Abstract. The purpose of this paper is to identify those dimensions of economic freedom which have a stronger influence on business creation at different levels of development and institutional quality. It investigates the relationship between the level of new firms' creation and the dimensions of economic freedom in groups of countries. To measure entrepreneurial activity data were collected from World Bank Doing business on new business density, as the dependent variable while the ten components of the Index of economic freedom released by the Heritage Foundation and Wall Street Journal are used as independent variables. The research uses data for 76 countries, grouped in two clusters according to their level of development and several economic freedom characteristics. The findings reveal certain differences between the two groups of countries in terms of the types of freedom influencing business creation. Econometric modelling shows that in those countries with lower level of development and weaker institutions, the level of start-up entrepreneurship is mostly influenced by trade freedom and business freedom while in more developed countries with higher quality of institutional framework, the level of new business formation is positively influenced by financial freedom and low government spending.

Key words: *entrepreneurship, new business density, economic freedom, statistical methods*

1. Introduction

Entrepreneurship has been widely acknowledged as a driver for economic performance, greater entrepreneurial activity being associated with greater economic prosperity (Holcombe, 1998; Baumol, 2002; Van Praag&Versloot, 2007).

At the same time, the existing literature emphasizes on the importance of institutions in supporting entrepreneurial activity (Sautet, 2005; Aidis et al., 2008; Valdez&Richardson, 2013). That is, institutional quality can explain and model the relationship between entrepreneurship and economic development (Díaz Casero et al., 2013) and influences the nature of entrepreneurial activities (Baumol, 1990; Hall&Sobel, 2008; Powel, 2008).

Economic freedom is one dimension of institutional quality which has been largely explored in literature as related to entrepreneurial phenomenon. Kreft&Sobel (2005, 614) conclude their study on the relationship between public policy, entrepreneurship and economic growth by stating that "economic freedoms generate growth primarily because they promote underlying productive private-sector entrepreneurial activity". Campbell&Rogers (2007) showed that there is a positive and powerful relationship between economic freedom and new business formation.

At the same time the effects of economic freedom are proven to vary according to the stage of development (Kuckertz et al., 2016) and for a more accurate analysis its dimensions should be considered separately (Aidis et al., 2012).

Starting from these aspects, the aim of this paper is to identify those dimensions of economic freedom which have a stronger influence on business start up at different levels of development and institutional quality. It investigates the relationship between the level of new firms' creation and the dimensions of economic freedom in groups of countries. Countries' grouping is obtained with cluster analysis. The paper aims as well at estimating econometric models at cluster level to explain the variation of entrepreneurial activity in relation with the components of economic freedom.

This paper continues as follows: the next section provides a brief review of the recent literature on the subject. Section 3 focuses on data and methodology used in this study. The research results are presented and analysed in Section 4. The last section summarizes the conclusions of this study.

2. Literature review

The construct of economic freedom encompasses multiple dimensions such as, secure property rights, lack of corruption, small size of government, low business regulations, freedom to trade, to invest etc. Each of these dimensions is to a greater or a smaller extent related to entrepreneurial activity.

Property rights protection is proven as significantly positively related to the level of start-up (Chowdhury et al., 2015). Freedom from corruption is also significantly related to new entries (Aidis et al., 2012). Desai et al (2003) find that better protection of property rights and greater fairness (the opposite of corruption) are associated with higher rates of entry and lower exit in Central and Eastern Europe. The authors conclude that "greater fairness and stronger protection of property rights are critically important in encouraging both the emergence and the growth of new enterprises, particularly in emerging markets" (Desai, Gompers & Lerner, 2003, 31).

Besides secure property rights and better legal structure, a smaller government sector tends to increase entrepreneurship (Nyström, 2008). High government spending can create barriers to entrepreneurship and a large public sector may reduce the market options of the potential entrepreneurs (Díaz Casero et al., 2015).

When it comes to fiscal freedom, several existing studies show that the greater the level of taxes, the lower the level of new firm startup (Chowdhury et al., 2015) and the tax administrative burden significantly diminishes the entry rate (Braunerhjelm & Eklund, 2014). On the other hand the relationship between fiscal freedom and entrepreneurship is considered a complex one and "can vary depending on existing factors such as capital gains tax, income tax and corporate tax" (Herrera-Echeverri et al., 2014).

Investment freedom is also positively related to starting a business. Removing barriers and making financial resources available encourage startup entrepreneurial activity (Chowdhury et al., 2015).

The link between business creation and freedom to trade was also explored in literature (Sobel et al., 2007). Some researchers argue that there is a "symbiotic relationship" between them (Herrera-Echeverri et al., 2014, 1922).

Low business freedom in terms of numerous start-up procedures is negatively correlated with the level of new firm start-up (Klaper et al., 2006; Chowdhury et al., 2015).

These are only some of the dimensions of the broad concept of economic freedom we also use in this study. The above literature review has the purpose to set a brief state of art on the subject and to provide the rationale for our research.

The next part of the paper focuses on the used data and the applied methodology.

3. Data and methodology

3.1 Data

Data used in this study were collected from three different sources. Entrepreneurial activity is measured in terms of *New business density* from World Bank Doing business. It is used as the dependent variable and it reflects the number of new registered companies per 1000 working-age people (age ranging from 15 to 64 years).

Economic freedom data are the independent variables. The study uses the components of the Index of Economic Freedom released by the Heritage Foundation and Wall Street Journal. The Index covers ten freedoms grouped into four pillars: Rule of Law (Property rights, Freedom from corruption), Limited Government (Fiscal freedom, Government spending), Regulatory Efficiency (Business freedom, Labour freedom, Monetary freedom) and Open Markets (Trade freedom, Investment freedom, Financial freedom). Each component is graded on a scale from 0 to 100, the higher the value, the higher the degree of freedom. Also, each is being given an equal weight in aggregating the overall index of a country's economic freedom.

GDP per capita is also used as an independent variable. Data are in current U.S. dollars and they were drawn from World Bank.

Our study database includes 76 countries. Data were collected from 2014 surveys.

3.2 Methodology

Correlation analysis is used in order to study the intensity of the relationships existing between the variables and identify those factors which have a strong association with the level of entrepreneurial activity. For the considered sample, of 76 countries, the bivariate correlation between *New business density* and each independent variable using the Pearson correlation coefficient was studied.

The economic freedoms from each pillar having the highest correlation coefficients were subsequently selected to perform a cluster analysis: from Rule of Law we selected *Property rights*; from Limited Government, no dimension was chosen since none of the two is significantly correlated with New business density; from Regulatory Efficiency, *Business freedom* was selected and *Financial freedom* from Open Markets. GDP per capita was also included.

At the level of the two resulting clusters, new correlation analyses were performed and several econometric models were estimated to explain the variation of *New business density* in relation with the economic freedoms, at cluster level. The most significant factors were selected using stepwise regression method.

4. Results and analysis

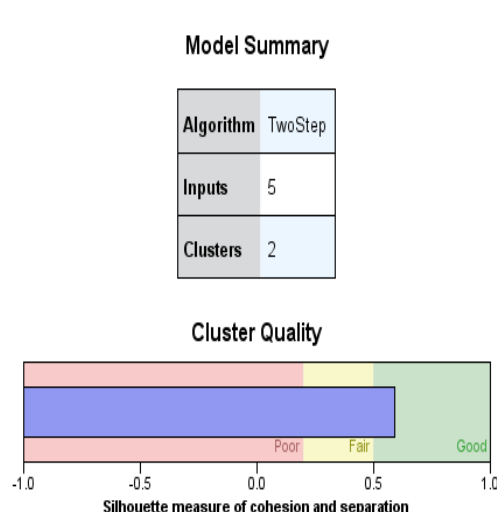
The correlation analysis results show that *GDP per capita* and eight of the ten economic freedoms namely, *Property rights*, *Freedom from corruption*, *Government spending*, *Business freedom*, *Labour freedom*, *Monetary freedom*, *Trade freedom* and *Financial freedom* are positive associated with the level of New business density.

Table 1 Correlations

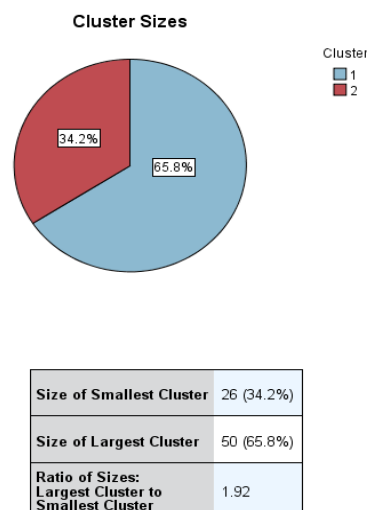
	New business density		
	Pearson correlation	Sig.	N
New business density	1		76
Property rights	0.520	0.000	76
Freedom from corruption	0.493	0.000	76
Fiscal freedom	0.042	0.718	76
Government spending	-0.039	0.738	76
Business freedom	0.524	0.000	76
Labour freedom	0.382	0.001	76
Monetary freedom	0.330	0.004	76
Trade freedom	0.409	0.000	76
Investment freedom	0.419	0.000	76
Financial freedom	0.538	0.000	76
GDP capita	0.348	0.002	76

Source: authors' presentation based on the output obtained in SPSS.

Two-step cluster analysis results show that the analysed countries can be optimally grouped into two clusters, as shown in *Figure 2* and *Figure 3*.



Source: Output obtained in SPSS.

Figure 2 Clusters' Quality

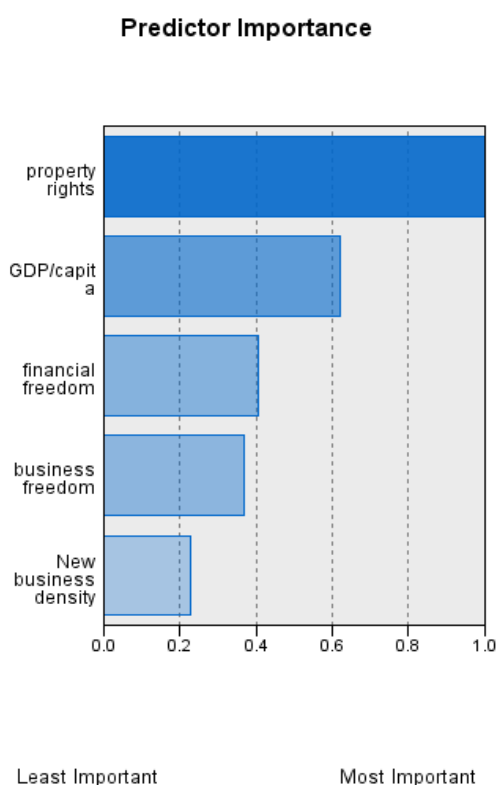
Source: Output obtained in SPSS.

Figure 3 Clusters' Sizes

The results presented in *Figure 2* and *Figure 3* show that the optimal number of clusters considering the similarities and differences between countries is 2. The cluster quality chart indicates that the overall quality of the model is „Good”, the coefficient of cohesion and separation being above 0.5.

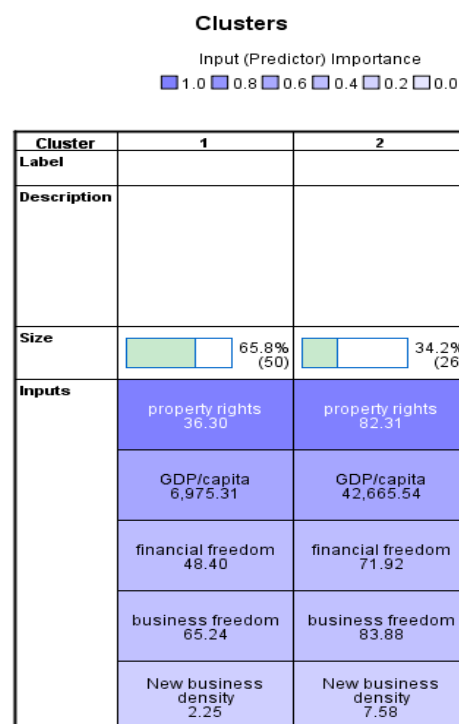
The descriptives for each cluster is presented in *Figure 4*. The variables are sorted according to their overall importance in separating the countries into the two clusters. Thus, the variable that contributes the most is *Property rights*, as opposed to *New business density*, which contributes the least in creating the two clusters. The group averages for all the considered

variables are higher for the countries belonging to the second cluster. The differences between the clusters in terms of the analysed variables are as well observed in *Figure 5*.



Source: Output obtained in SPSS.

Figure 4 **Clusters' Description**



Source: Output obtained in SPSS.

Figure 5 **Comparison between the Two Clusters**

The countries' membership to clusters is illustrated in *Table 2* below.

Table 2 Countries' Membership to Clusters

Country	Cluster membership	Country	Cluster membership	Country	Cluster membership	Country	Cluster membership
Australia	2	Norway	2	Croatia	1	Morocco	1
Austria	2	Portugal	2	Dominican Republic	1	Nepal	1
Botswana	2	Qatar	2	El Salvador	1	Nigeria	1
Canada	2	Singapore	2	Georgia	1	Pakistan	1
Chile	2	Spain	2	Guinea	1	Peru	1
Cyprus	2	Sweden	2	Hungary	1	Romania	1
Czech Republic	2	Netherlands	2	India	1	Russian Federation	1
Denmark	2	Algeria	1	Italy	1	Rwanda	1
Estonia	2	Argentina	1	Jamaica	1	São Tomé and Príncipe	1
Finland	2	Armenia	1	Jordan	1	Senegal	1
France	2	Azerbaijan	1	Kenya	1	Serbia	1
Hong Kong	2	Belarus	1	Kyrgyzstan	1	Slovakia	1
Iceland	2	Belize	1	Latvia	1	Slovenia	1
Ireland	2	Bhutan	1	Macedonia	1	Suriname	1
Israel	2	Bolivia	1	Madagascar	1	Thailand	1
Japan	2	Bosnia and	1	Malaysia	1	Timor-Leste	1

		Herzegovina					
Lithuania	2	Brazil	1	Mexico	1	Togo	1
Mauritius	2	Bulgaria	1	Mongolia	1	Turkey	1
New Zealand	2	Costa Rica	1	Montenegro	1	Zambia	1

Source: authors' presentation based on the output obtained in SPSS.

Further on, we built econometric models for each cluster, using stepwise regression, in order to identify the most significant factors that can help us explain the variation of *New business density*.

The model summaries for each model, for the two clusters, are presented in Table 3.

Table 3 Regression models summary

Model Summary										
Cluster Number	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
						R Square Change	F Change	df1	df2	Sig. F Change
1	1	.489 ^a	.239	.223	2.00844	.239	15.063	1	48	.000
	2	.551 ^b	.303	.274	1.94181	.064	4.351	1	47	.042
2	1	.524 ^c	.274	.244	5.92898	.274	9.078	1	24	.006
	2	.656 ^d	.430	.380	5.36793	.156	6.279	1	23	.020

a. Predictors: (Constant), trade freedom

b. Predictors: (Constant), trade freedom, business freedom

c. Predictors: (Constant), financial freedom

d. Predictors: (Constant), financial freedom, government spending

Source: output obtained in SPSS.

The correlation coefficients (R) for the final models are above 0.5, which means that there is a moderate to a strong dependence between *New Business Density* and the independent variables.

For the first cluster, we notice that adding the *Business freedom* significantly improves the original model, between *New business density* and *Trade freedom* (Sig.=0.042<0.05).

Similarly, for the second cluster, *Government spending* was added to the model between *New business density* and *Financial freedom*, and the result is an improved model compared to the initial model (Sig.=0.02<0.05).

The regression estimates are presented in Table 4.

Table 4 Regression estimates

Coefficients ^a							
Cluster Number	Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
			B	Std. Error	Beta		
1	1	(Constant)	-6.857	2.364		-2.900	.006
		trade freedom	.118	.030	.489	3.881	.000
	2	(Constant)	-7.884	2.338		-3.372	.002
		trade freedom business freedom	.084 .056	.034 .027	.348 .291	2.495 2.086	.016 .042
2	1	(Constant)	-15.122	7.623		-1.984	.059
		financial freedom	.316	.105	.524	3.013	.006
	2	(Constant)	-18.780	7.054		-2.662	.014
		financial freedom government spending	.301 .104	.095 .041	.499 .395	3.164 2.506	.004 .020

a. Dependent Variable: New business density

Source: output obtained in SPSS.

For the first cluster, the estimated regression equation is:

$$\text{New business density} = -7.884 + 0.04 * \text{Trade freedom} + 0.056 * \text{Business freedom}$$

Both regression coefficients are positive, which implies that an increase in *Trade freedom* and *Business freedom* scores results in an increase in *New business density*'s score. On average, an improvement of 0.084 in *Trade freedom*'s score determines a one point increase in *New business density*'s score. Also, an increase of 0.056 in *Business freedom* determines an average increase of one point of *New business density*. Examining the values of standardized coefficients, we observe that the most important factor of influence on *New business density* is *Trade freedom* (0.348).

According to the methodology of the Heritage Foundation and Wall Street Journal, Business freedom stands for “the ability to start, operate, and close a business that represents the overall burden of regulation as well as the efficiency of government in the regulatory process” (<http://www.heritage.org/index/regulatory-efficiency>) while trade freedom is “a composite measure of the absence of tariff and non-tariff barriers that affect imports and exports of goods and services” (<http://www.heritage.org/index/open-markets>).

The countries in this cluster are the ones with lower GDP per capita and less secure property rights, lower business freedom and less financial freedom. Worth mentioning, all former communist countries included in our sample, except for Czech Republic, Estonia and Lithuania, are included in this cluster. The fundamental market institutions in these countries are still to be developed. The burden of numerous procedures and costs for starting a business generate high transaction costs and discourage start-up entrepreneurial intentions.

For the second cluster, the estimated equation of regression is:

$$\text{New business density} = -18.78 + 0.301 * \text{Financial freedom} + 0.104 * \text{Government spending}$$

An increase in *Financial freedom* and in *Government spending* scores determines an increase in *New business density*'s score. The values of the estimated regression coefficients shows that an average increase of one point in the *New business density*'s score is determined by an increase of *Financial freedom*'s score with 0.301 and by the increase of *Government spending*'s score by 0.104 points. The most important factor of influence on *New business density* for the second cluster of countries is *Financial freedom* (0.499).

Financial freedom, a component of Open Markets pillar, captures banking efficiency and measures the independence from government control and interference in the financial sector (<http://www.heritage.org/index/open-markets>). Government spending is included in Limited Government pillar and takes into account the level of government expenditures as a percentage of GDP (<http://www.heritage.org/index/limited-government>)

The countries in this cluster are the more developed ones, with high institutional quality, which encourage entrepreneurial activity by increasing the ease of doing business, securing property and providing access to financial resources. At the same time, government spending is often high and supported by a high level of taxes which may discourage entrepreneurs by weakening the incentives. And, as the existing studies point out, a welfare state reduces the incentives for necessity entrepreneurs (Aidis et al., 2012) and in the case of higher taxes, potential entrepreneurs will be discouraged to engage in business start-up (Braunerhjelm & Eklund, 2014; Chowdhury et al., 2015).

5. Conclusions

The purpose of this study was to identify those dimensions of economic freedom which have a stronger influence on business start up at different levels of development and institutional quality in 76 countries.

The results of this paper once again confirm the relation between institutional quality, hereby measured with components of economic freedom and entrepreneurial activity.

The results of the correlation analysis pointed out that stronger property rights, lower levels of corruption, lower government spending, higher business, labour, monetary, trade and financial freedoms are positively significantly associate with the degree of business creation. Also, there is a positive relation between economic development in terms of GDP per capita and the level of business start-up. Our findings are in line with research results from the existing literature.

The estimated econometric models show that there are differences in the components of economic freedom that influence new business creation, according to the level of economic development and institutional quality. For the cluster which includes those countries with a lower level of economic development and lower institutional quality, the variations in the degree of business creation are rather explained by business freedom and trade freedom.

For the other analysed countries, with opposite characteristics for the cluster predictors, low government spending and high financial freedom are the dimensions which better explain new business formation.

These aspects suggest the directions of intervention for increasing the degree of business start-up: increasing the ease of doing business and removing barriers from trade, in countries with lower level of development and weaker institutions and diminishing the size of government, i.e. reducing government spending and increasing access to financial resources in developed countries.

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**CIET
2016**

Track 3

**Information Technology,
Electrical Engineering and
Mechanical Engineering**

Knowledge representation in the ontological engineering using conceptual modeling and graph-based reasoning

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Abstract. The process of software engineering follows a few basic stages of development: the business system analysis, the design of the new software solution, the software development with correctness verification and, finally, the software implementation in a user environment. Ontological engineering is also considered through the basic engineering steps. It can be perceived as a support for the process of developing information systems through two aspects: the conceptual modeling and the formal implementation. The conceptual knowledge is a representation of knowledge of considering the business system domain. Tools and languages for building formal ontology support the knowledge representation described with the conceptual model. The integration of ontological engineering in software engineering can be considered as the improvement in the development, implementation and use of the information system.

In this paper, the knowledge representation and reasoning formalism of ontology are presented with a graph-based formalism. This formalism is logically founded, and it is a key feature for knowledge representation and reasoning.

An ontology lifecycle development starts with competency questions about the domain specification. The specification of concepts and basic relationships by a conceptual graph model are the foundations for the modeling of formal ontology elements such as rules and constraints. Complex queries derived from competency questions are also presented with graph-based formalism. Relations between graphs like specializations and generalization operations, and also mapping like homomorphism, will optimize the ontology structure. The described process of ontology development is applied to a case of education domain modeling.

Keywords: *knowledge base, knowledge reasoning, ontology, competency questions, conceptual graph*

1. Introduction

Development and maintenance processes of software solution can be complemented by the usage and integration of ontologies. The role of ontology using is manifold: the support in modeling, the impact on the architecture of processes and data, and the implementation of ontology as an integral part of the new software versions [1].

Using the ontology we can show the structure of any domain, organized at the level of concepts and their relationships. In practice ontology represents a meta-model for database model of individual software solutions. Defined standards are used to support programs with the aim of the better communication with the environment. In this case we are talking about achieving interoperability (especially on the Web) among software solutions [2]. We say that the ontology allows efficiency of collecting and processing the diverse and multi-purpose knowledge. So the ontology becomes an integral part of knowledge representation. Using the software solution

supported by the ontology [3] and by Semantic Web [2] [4] we have the following important features:

- *Providing communication* between people and systems supported by computer because it reduces the conceptual and terminological ambiguities. The ontology increases the consistency of information, eliminates ambiguity and combines different versions of the same domain.
- *Information retrieval* on the Internet is facilitated by using the ontology. The ontology contains information structured in a vocabulary. Web becomes a huge dictionary that provides faster and more comprehensive access to the source of the requested information.
- *Accessing to information* from the user or the system can be expressed in an unfamiliar language or an unknown format. Ontology helps to identify information and helps to improve associations between sets of concepts and relations between concepts.
- *Interoperability* as an interaction among different users or software tools for data exchange. In this case the ontology plays a role of the reference domain model that will be able to support translation from one programming language to another and from one data structure to another.

A development and implementation of the ontology is not an easy task. This problem requires a detailed and sophisticated development methodology, and even with this strategy ontology development is more an art than conventional technological or engineering task [4].

Authors of ontology development use ontological editors that offer a graphical interface for creating and editing ontology which is necessary to define the ontological concepts, their attributes, properties and relationships. After this activity it is necessary to decide how to record the ontology in a formal language such as OWL and RDF / RDFS [5].

In this paper we proposed a method of ontology development combining the best practices of several established sources. We are using, so called, competency questions [6] in learning about domain (such as user requirements in software engineering). Elements of ontology modeling are creating according to the ontology engineering such as methodology in [5]. For the domain knowledge representation and reasoning we are using techniques of conceptual graphs [7]. This procedure follows the development of a case study of the Human Resource Management (HRM) domain.

The second chapter of this paper describes opportunities provided by ontological engineering for upgrading the software solution development and an information system architecture. The third chapter defines specification purpose and scope for example of ontology cluster for HRM. We create a part of concepts and relations taxonomies for HRM ontologies. In the fourth chapter we have used, so-called, Competency Questions (CQs) for developing an ontology purpose and scope. For those CQs examples we made compatible conceptual graphs. The fifth chapter is composed of (1) an example of the conceptual graph formalized into RDF(S) language, and (2) the conceptual graphs homomorphism that help us to demonstrate that individual programs can be upgraded with ontology. The conclusion highlights the possibility of sharing the software engineering and the ontological engineering.

2. Ontologies in software engineering

The software (or the information system) construction is a complex process, and it is necessary to look at the overall architecture of the business processes. The study of enterprise business includes activities like modeling the business organization, the business information and the business technology. These models are then used in business software engineering, from problem analysis, program's design, program's development, to testing and implementation in user's environment.

2.1 Ontological engineering as an extension of software engineering

Software engineering is composed of several basic stages of development such as analysis of the business system, the design of future software, development of the software solution, testing, validation and verification, and, finally, the implementation in the user environment (Figure 1). At the very beginning, before development activities, it is necessary to make a project plan and also, consider the business problems and the scope of the required solutions. It is necessary to create a schedule of software development activities according to the selected methodology.

The complexity of development of the entire information system required to pay attention to the *information system architecture* [8] [9] [10]. Except the functionality of business it is necessary to examine the relationships of different business subsystems, especially data and information sharing among these subsystems. These requirements have influence to the architecture of databases, software, hardware, communication and so on.

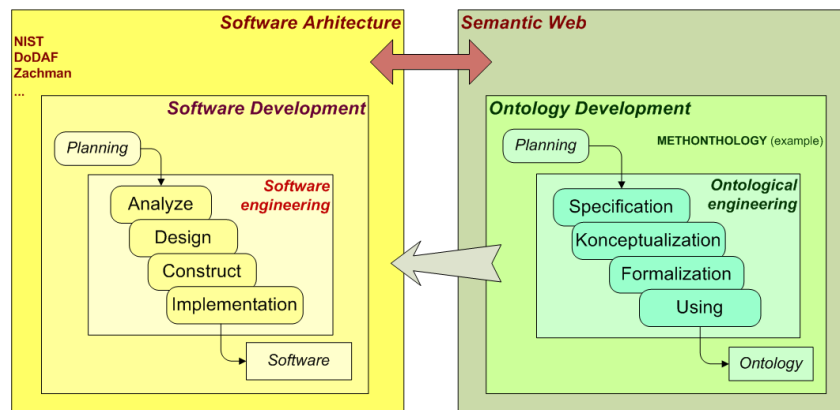


Figure 1 Software development and Ontology development

On the other hand, methodologies for *ontology development* are used in various areas of business and human activities [4] [5] [11]. To improve the process of information system development and quality assurance of software solutions we are considering the influence of ontological engineering as a part of software engineering.

In the ontology development we also recognize the basic engineering steps. Figure 1 shows the *ontological engineering* composed of the specification of domain models, the conceptualization of domain elements and the formalization of these elements in the computer supported ontology. We can conclude that the combination of the ontological engineering and the software engineering together is an improvement of development, implementation and use of the system [12].

2.2 Ontological engineering process

The elaboration of basic stages of the ontology development is described in detail in several methodologies [4] [5] [11] [12]. Some methodologies describe only the ontology development and some others are comprehensive and include planning, management of ontology developing and results monitoring. Examples of such methodologies are METHONTOLOGY [5] and NeOn [13].

According to aforementioned references, we can conclude that, in addition to the basic stages of ontology development, we need a detailed specification of each phase (Figure 2). Like a classical requirements engineering in the software engineering process, the ontology development starts with the domain specification which is composed of (1) the specification of purpose and usage of the ontology, scope of the domain and, finally, degree of the formality, and (2) data collection using different methods. The conceptualization phase is divided into (1)

the conceptualization of domain vocabulary and the result is the preliminary ontology, and (2) consideration of possible integration with other ontologies. The implementation phase is composed of (1) the formalization in an ontology language and (2) the evaluation of the completeness, consistency and redundancy of developed ontology. Most of these steps, we will describe and use in modeling the HRM case study.

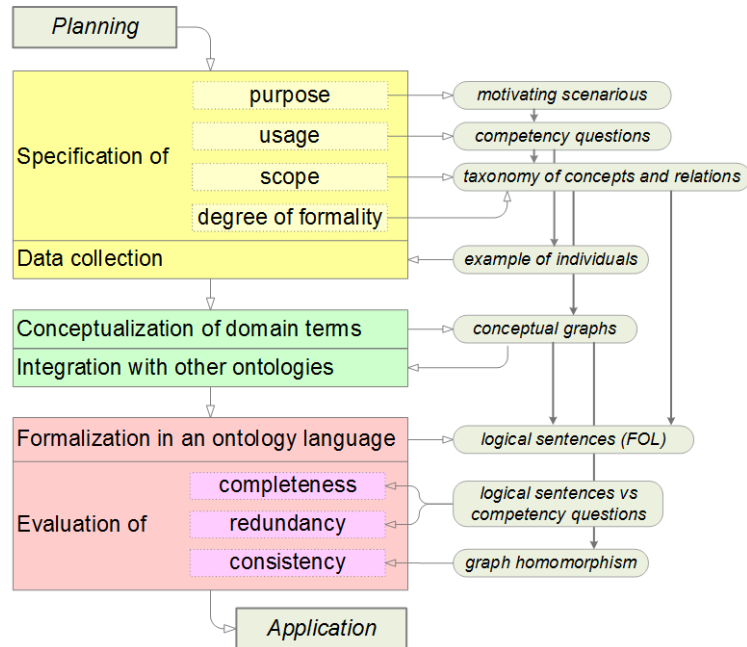


Figure 2 Ontological engineering phases and models

Figure 2 shows the steps of the ontology development and input/output documents or models. Techniques used in this paper for modeling ontology elements during ontological engineering are motivating scenarios and competency questions for the domain description [6], and graph-based knowledge representation and reasoning for the ontology structure [14]. Logical sentences are a form of knowledge representation described by CQs. Logical sentences are written using conceptual graphs. Construction, testing and modification of conceptual graphs are accompanied by reasoning formalisms.

3. Ontology design for the domain of Human Resource Management

A HRM problem will be the basis for a case study where we will present (1) development of ontology model elaborated towards activities in Figure 2, (2) model of domain knowledge using conceptual graphs, and (3) application in a Web environment by testing the possibility of matching a one software example in the default ontological model.

Literature [15] [16] describes mentioned problem and suggests some solutions. The enterprise management emphasizes the HRM as an ongoing process that important fields are shown in Figure 3. The focus of the case study will be on education, competence and knowledge.

3.1 Ontologies cluster for Human Resource Management

The set (the cluster) of HRM ontologies are based on two key elements: *Job Offer Ontology* and *Job Seeker Ontology*. *Job Seeker Ontology* includes information from a CV like education and acquired knowledge, previous jobs, skills and competences. *Job Offer Ontology* contains information about employers, job offers and job vacancies.

Education Ontology includes information about levels and fields of education. Fields of education are based on FOET¹ taxonomy and level of education on standard ISCED 97² [17].

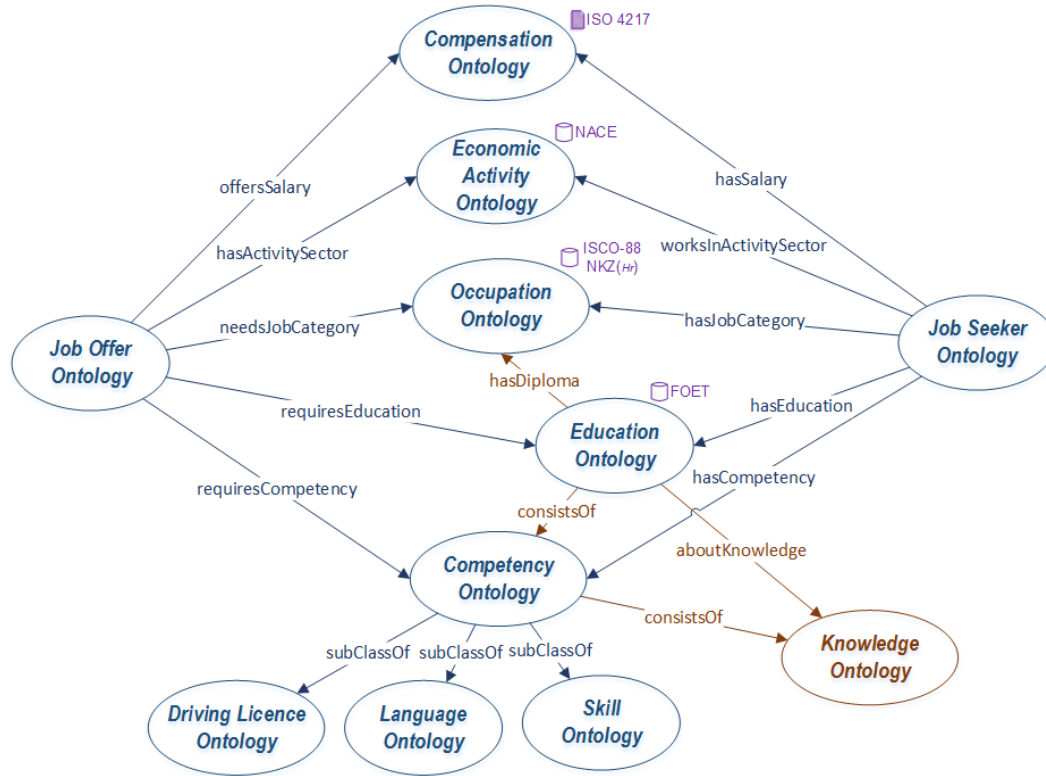


Figure 3 Ontologies cluster for Human Resource Management [18]

Occupation Ontology includes information about occupations and workplaces. An integral part of this ontology is taxonomy of workplaces standard ISCO-88³ [19]. In the following discussion it will be analyzed the set of occupations associated with *Job Seeker Ontology* work experience and workplace, or required work experience from *Job Offer Ontology*.

Compensation Ontology describes the concepts related to salaries and wages for employees. An integral part of this ontology is the currencies concept standard ISO 4217⁴. *Economic Activity Ontology* describes a model of economic activities which includes a taxonomy of standard NACE⁵ [20]. For simplicity and because of the case study specification of purpose, *Compensation Ontology* and *Economic Activity Ontology* will not be include in further considerations.

Competency Ontology combines several sub-ontologies from different fields of competences. Figure 3 shows examples for skills, language and driving license. *Competency Ontology* and *Job Offer Ontology* are connected via the vacant jobs. Both are related to *Job Seeker Ontology* through the application of candidates. *Education Ontology* is connected via competencies required by education. For simplicity of further analysis of our case study, only *Competency Ontology* (not its sub-ontology) will be considering. It is not easy to give a precise definition of competence. Many papers highlight this issue and give a proposal of definition. So the

¹ FOET Fields of Education and Training

² ISCED International Standard Classification of Education was adopted by the UNESCO General Conference in November 2011. The ISCED classification serves as an instrument to compile and present education statistics both nationally and internationally. The framework is occasionally updated in order to better capture new developments in education systems worldwide.

³ ISCO-88 International Standard Classification of Occupations

⁴ ISO 4217 International Standard for currency codes

⁵ NACE European Classification of Economic Activities

definition from the paper *ECTS User's Guide* [21] says that the competencies include dynamic combination of knowledge and understanding, intellectual and practical skills, and so on.

Clusters described above are extended with *Knowledge Ontology*. Concepts of knowledge areas are associated with *Education Ontology* and *Competency Ontology*. For our case study, we have set a small part of the Computer science knowledge area [22].

3.2 The importance of the selected ontologies cluster and fraction of their taxonomy

We have seen that ontologies clusters described above (cluster of *Job Offer Ontology* and cluster of *Job Seeker Ontology*) containing well-defined standards. Concepts and relations of standardized taxonomies are the foundation for automating queries addressed to the potentially interested actors. For example, after RH joined EU, our citizens have the opportunity for employment in the large labor market. However, if we have search (via the Web) these wide area, we probably will not receive clear answers about job offer or job seeker and what are their requests. So far we have looking for the job in RH where we know a lot of information about enterprises, their activities, workplaces and so on. Now, we can access to the large number of data at EU level, but these data are not unified in one location neither are grouped by businesses, professions, education areas or languages. Therefore, it makes sense to modeling the conceptual knowledge level about this complex issue, and for the beginning it is exactly the model in Figure 3. The problem is very complex and detailed design of all clusters and related ontology exceed the scope of this paper (there are examples of case studies that deal with these details, such as [15] [18]).

However, for further analysis of our case study we should develop our ontologies in more detailed elements (concepts and relations). Figure 4 shows only the part of concepts taxonomy and relations taxonomy. We will specify the definition of vocabulary in the following way:

Definition of vocabulary: Let a triple (T_C, T_R, I) is consists of T_C , T_R and I that are finite pairwise disjoint sets. The set of concepts T_C , the set of relations T_R , and the set of individuals I defined vocabulary $\mathcal{V} = (T_C, T_R, I)$, and there are satisfying the following conditions:

- T_C is the set of concepts with a subsumption⁶ relation, denoted \leq , and with maximal element denoted \top ,
- T_R is the set of relation divided into subsets T_R^1, \dots, T_R^k with arity $1, \dots, k$, respectively. Any two relations with different arities are not comparable. Every relation subset has subsumption hierarchy.

By the definition, in Figure 4 is shown the part of the vocabulary of the HRM. There is a set of concepts (A), a set of relations (B) and an example of individuals (C). An example of the ontologies cluster is made in the tool *CoGui* [23].

4. Ontology specification and conceptualization

Specification of the problem begins with the purpose of our case study.

The first step in the specification of ontology is the creation of, so-called, *motivating scenarios*, which describe a business problem. Scenarios are the basis for defining the *competency questions* about a detail level of conceptualization. Furthermore, these questions are the basis for the development of ontology elements, like dictionaries and taxonomies, and also rules among concepts and relations [24].

⁶ A **subsumptive** containment hierarchy is a classification of object classes from the general to the specific. Other names for this type of hierarchy are *taxonomic hierarchy* and *is-a hierarchy*. The taxonomical structure is a subsumptive containment hierarchy.

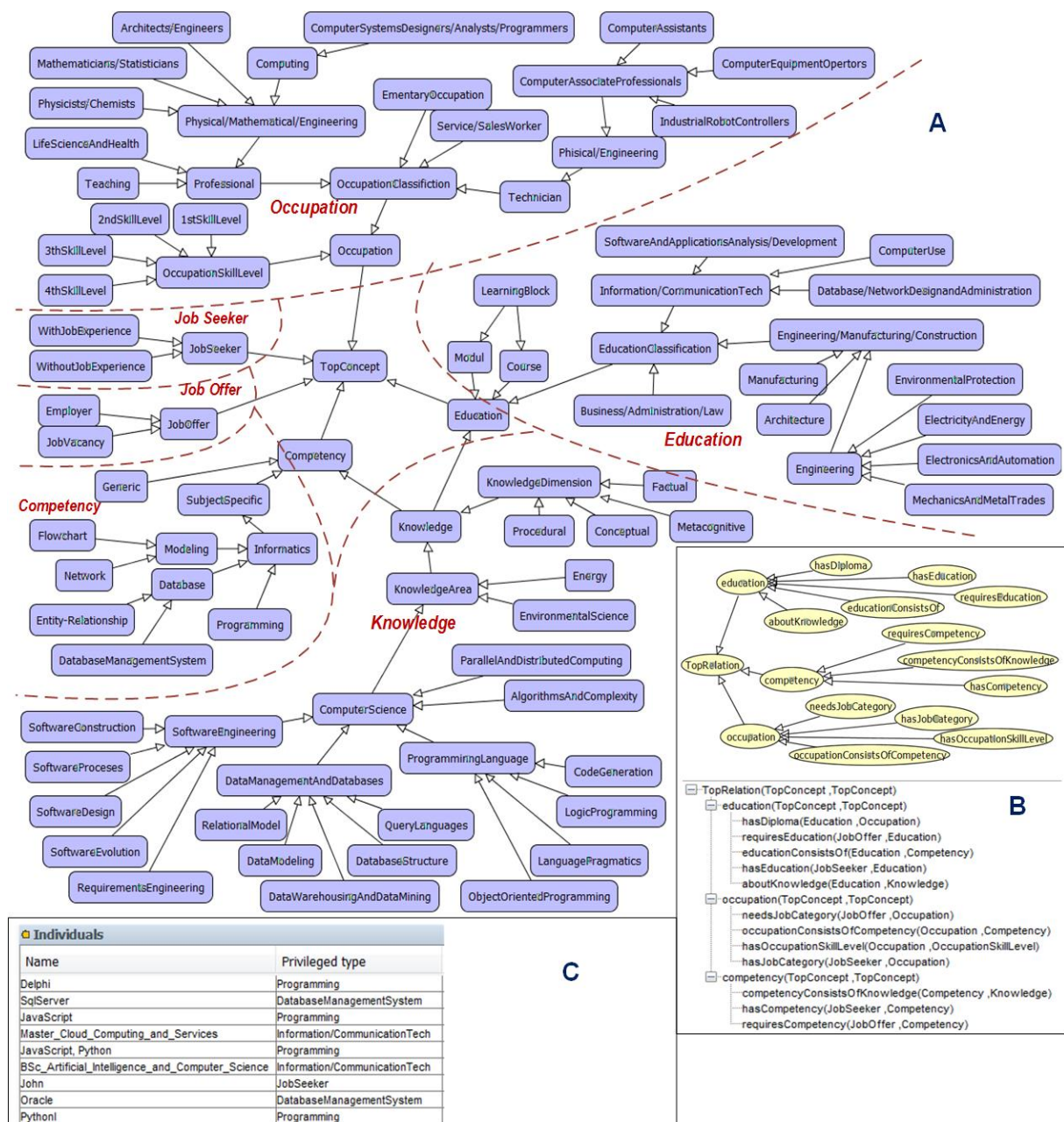


Figure 4 A part of ontology cluster for Human Resource Management

4.1 Motivating scenarios

We chose one motivating scenario that describes an example of request for workplace:

In the job offer of ICT sector someone is seeking candidates for Computer Systems Designers/Analysts/Programmers jobs, for example, for the working place of BI/DWH⁷ developers. Required knowledge must be in the field of Software Engineering (specifically in fields of Software Design and Construction Software), Programming (specifically in fields of Object Oriented Programming and Algorithms and Complexity) and Data Management and Databases (specifically in fields of Database Structure, Query Languages and Data Warehousing and Data Mining). Candidates must have a degree of bachelor or master of profession of ICT studies. The skills that candidates must have are excellent knowledge of software tools such as Word, Excel, PowerPoint, JavaScript, C # and SQL Server or Oracle.

⁷ Business Intelligence / Data Warehouse

This scenario describes a typical example of job advertising. This is a good reason to modeling the scenario functionality through the ontologies cluster, like the example in Figure 3. According to [6] [25] the detail specification of the scope and usage will be written in the form of competency questions.

4.2 Competency questions and conceptual graph

Competency questions (CQs) are written in the informal form and they describe elements of ontology. Responding to these questions ontologist checks taxonomy of concepts and relations, and develops other structure of the ontology. CQs are made on the basis of motivating scenarios. For the scenario from the previous chapter, here are some important CQs:

- CQ1)** *Job Offer provides jobs for a certain profession and completed education with specific skills and competencies.*
- CQ2)** *Job Seeker was completed ICT education, he has a knowledge about databases and programming, and he is looking for developer jobs.*
- CQ3)** *The person was working as a software engineer and acquired 3th⁸ level of skills, and also, he was working as a programmer and acquired 4th⁹ level of skills.*
- CQ4)** *What skills can expect employers for completed education in the field of software and application analysis/development?*

In the practice, the use of CQs is quite subjective and depends on the ontologist experience (after all, this process is similar to the user requirements specification in software engineering). One of the important dilemma when we are creating the vocabulary and taxonomies is an identification of granularity. It is important, but not easy, to determine the level of detail when we build the structure of concepts (also the structure of relations). For example, in Figure 3, we can ask the question whether we will develop *Education Ontology* on the level of overall FOET taxonomy, or we will make only the elementary level. Because of the limited space of this paper an example of taxonomy, Figure 4 shows a small part of whole ontologies cluster.

Four examples of CQs will be written in the form of graph-based sentences. Parts of these sentences are concepts and relations with each other graphically related. We will specify the definition of conceptual graph in the following way:

Definition of Conceptual graph: A basic conceptual graph over a vocabulary $\mathcal{V} = (T_C, T_R, I)$, is a 4-tuple $G = (C, R, E, l)$ satisfying the following conditions:

- A triple (C, R, E) is a finite bipartite multigraph. C is the set of concept nodes, R is the set of relation nodes, and E is the family of edges,
- l is a labeling function that joined nodes and edges,
- Edges incident to a relation node $r \in R$ are totally ordered and they are labeled from 1 to arity of relation r .

According to [26] each recognized CQs will be modeled in appropriate conceptual graph. All relations in the conceptual graphs in Figure 5 have arity of relation 2. Labels of concepts and relations are specified in all graphs, and the edges of relations should not be labeled because each of edges is the first (start arrow) or the second (end arrow).

The conceptual graph in Figure 7a) is the result of procedures like generalization and specialization of graphical structures in Figure 5 (procedures are described in [14]). If we apply these procedures, we can define a procedure that optimized the development of the integrated graph. In this paper we assume the existence of the graph in Figure 6. The procedure itself will be the subject of the further research.

⁸ According to the ISCO-88 specification that may include skills such as communication with customer, understanding the needs of business system, and the coordination and control of the software development process.

⁹ According to the ISCO-88 specification that may include skills such as passed advanced courses of programming languages, analysis of complex algorithms, design of demanding interfaces, and integration of software solutions.

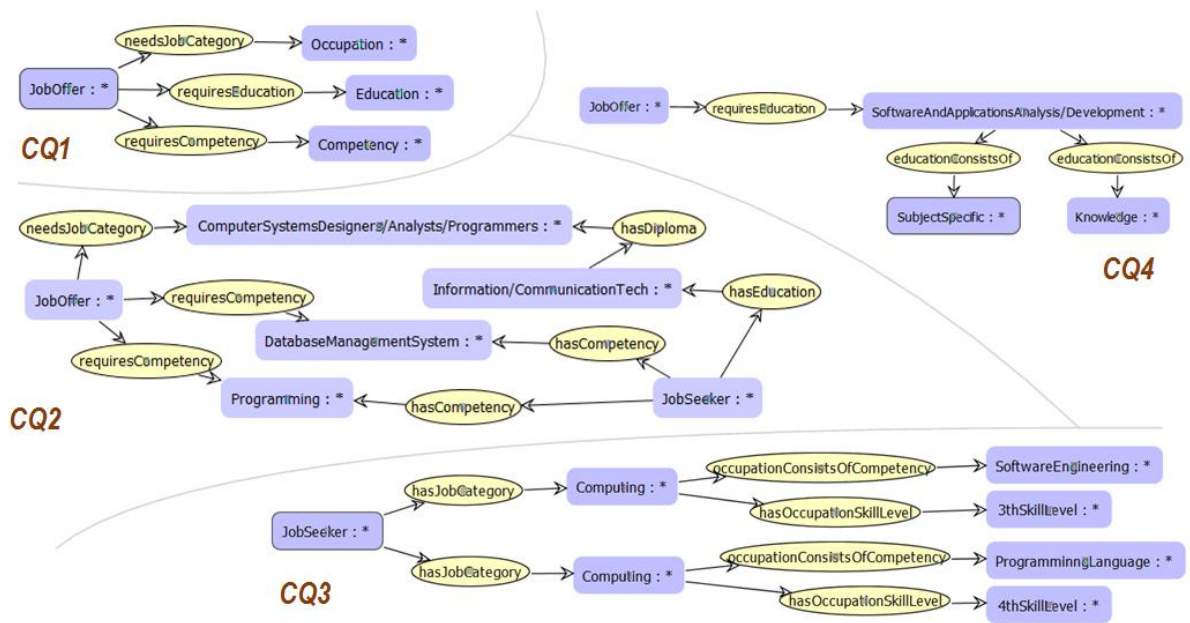


Figure 5 CQs in the form of conceptual graphs

5. Formalization and evaluation

Characteristics of the Web are the basis for the development of ontology languages (*Web-based ontology language* or *ontology markup language*). The syntax of ontology languages is based on HTML and XML languages. RDF (*Resource Description Framework*) and its extension RDFS (*RDF Schema*), together denotes as RDF(S), allowing the construction of semantic annotations given by a set of triples (*subject, predicate, object*) [4]. RDF(S) is a language designed for processing metadata to support the exchange of information by the Web (interoperability among applications).

5.1 An example of general concepts formalization

Ontologies cluster for our case study is a reference model for the structure, format and the understanding of information. Take a look at descriptions of some basic elements of RDF(S) language [5]. The most general class is *rdfs:Resource* for defining any Web resource. The class *rdfs:Class* defines the class of all classes. The class *rdf:Property* defines the class of properties. Some of core properties are: *rdf:type* states that a resource is an instance of a class, *rdfs:subClassOf* and *rdfs:subPropertyOf* are used to define class taxonomies and property taxonomies respectively. The conceptual graph and RDF structure share very similar characteristics. Therefore, the conceptual graph can be written in RDF(S) language [27] following the comparison shown in Figure 6.

Conceptual graph element	RDF(S) triple
C concept type	C rdfs:type rdfs:Class
R binary relation type	R rdfs:type rdf:Property
$C \leq D$	C rdfs:subClassOf D
$R \leq S$	R rdfs:subPropertyOf S

Figure 6 Comparison between conceptual graph and RDF(S) triples (a part of)

Applying the aforementioned rules conceptual graph in Figure 7a) can be written in RDF(S) triples form as it is written in Figure 7b).

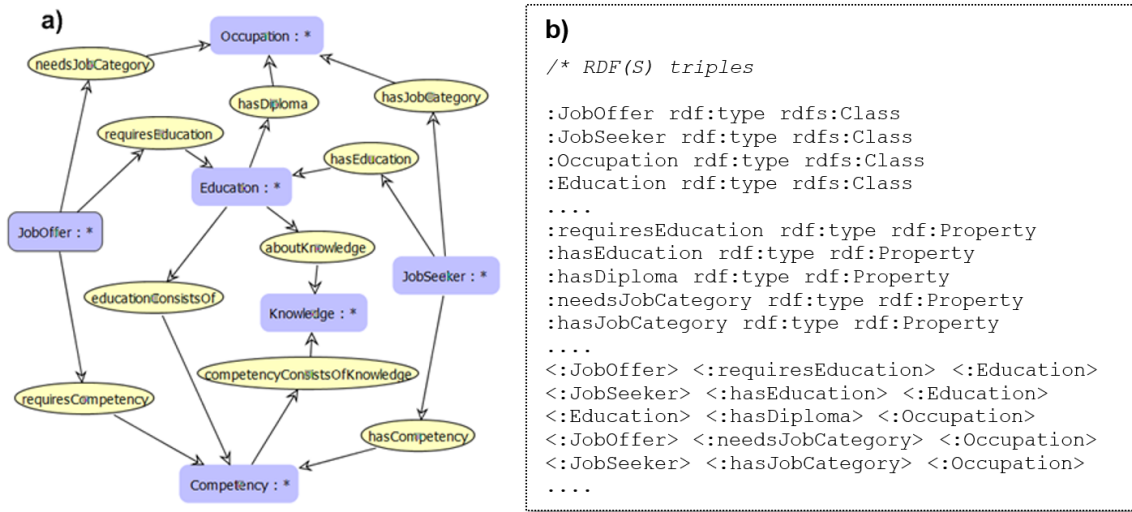


Figure 7 a) General concepts of ontology cluster for HRM and b) their equivalent in RDF(S) triples

5.2 Database and graph homomorphism

This previously described procedure makes sense if the wide community adopts the significance of ontology concept, and also be able to involve actively in the development of ontology conceptual structure and its implementation. Despite extensive analysis and study of possible applications of ontology, today it is still not represented in significant extent.

By now, we was developed (a part of) the formal HRM cluster ontology. In practice, an individual instance of HRM database can be partially mapped with the ontology through the structure and rules. Figure 8 shows the comparison of two graphs. On the left side is an imaginary graph-based data model of enterprise HRM business process, and on the right side is our HRM ontologies cluster. Comparison can be done through the formal verification of graphs homomorphism.

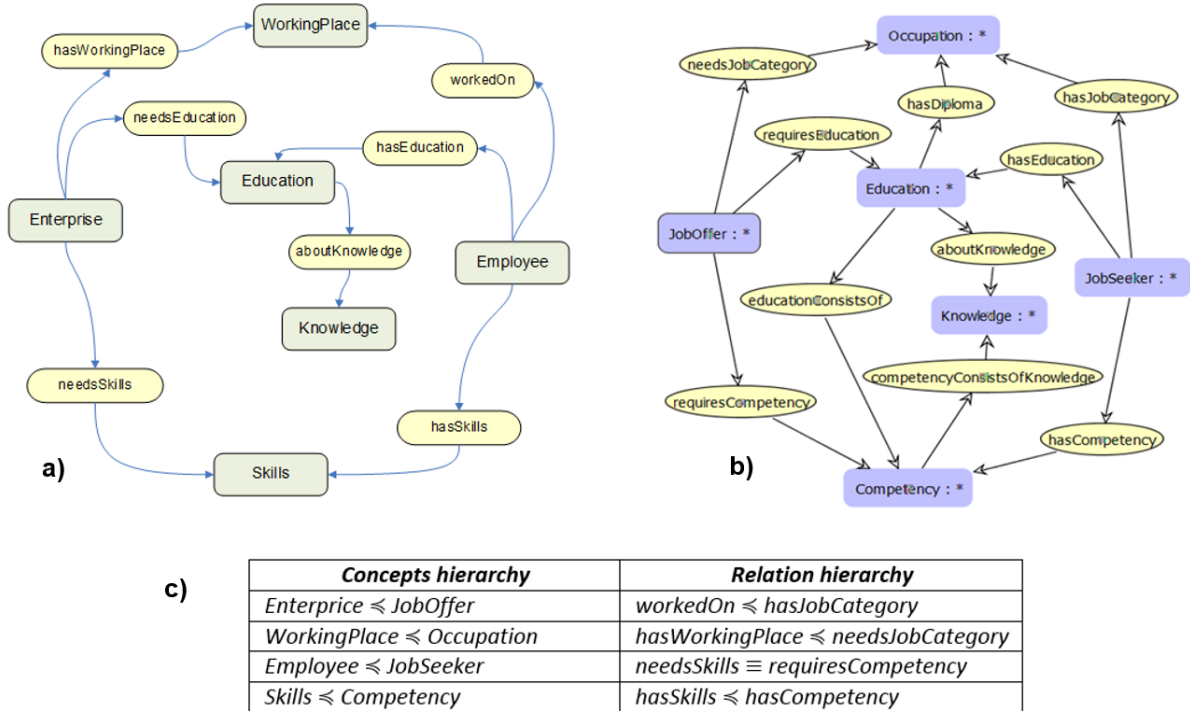


Figure 8 a) Graph-based data model, b) graph-based reference ontological model, and c) properties, facts and rules for generalization/specialization

Definition of Graph homomorphism: Let $G = (C_G, R_G, E, l_G)$ and $H = (C_H, R_H, E, l_H)$ be two conceptual graphs defined over the same vocabulary. A homomorphism π from G to H is a mapping from C_G to C_H and from R_G to R_H which preserves edges and related labels of concepts and relations, and satisfying the following conditions:

- $\forall (r, c) \in G \Rightarrow (\pi(r), \pi(c)) \in H$, where $r \in R_G$ and $c \in C_G$, and
- $\forall e \in C_G \cup R_G \Rightarrow l_H(\pi(e)) \leq l_G(e)$.

According to the definition and using the rules listed in the table in Figure 8c) we can conclude that the left graph, Figure 8a), is homomorphic with the right graph, Figure 8b). This example shows how the software solution can adapt and upgrade to the existing ontology.

6. Conclusion

A practical application of the ontology today is still lagging behind the potential that it offers. Two problems are constantly present. The first is the development of an ontology for some domain because it is a tedious task for the whole community of interest. The second problem is the inclusion of individual software solutions in developed and usable ontology. Adjustment software solutions requires an extra effort that may not be cost effective or may not be known for developers.

However, the Internet (specifically Semantic Web), business expansion and globalization emphasize the importance of the software solution customization with the ontological platform. According to the stages of ontology development, the ontology specification and conceptualization can extend the process of software solution reengineering. Comparing conceptual structures using mapping such as homomorphism helps to identify the place where one can customize and change the existing software solution.

In the further work it is necessary to develop the comparison process for the structure of individual software solution, comparing it with the existing ontology. This process is time consuming because it involves all phases of the ontology development. Therefore, it is important to improve the activities of the ontology development which can enhance the software solution.

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Damping and excitation in the torsional vibrations calculation of ship propulsion systems

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Abstract. Calculation of torsional vibrations is essential in the early phase of the design of any ship propulsion system, after selection of shafting diameters in accordance with the Classification Rules. Later on, during ship trials, the calculation shall be validated by measurements on board. The calculation results depend upon inertial moments of actual masses, stiffness of shafting components, damping in the actual shafting components, as well as the excitation forces and moments exerted by the propulsion engine(s) and the propeller. Inertial moments and stiffness can be determined with no ambiguities. However, this is not the case with either the damping, or the engine excitation. Actually, during validation on board the calculation supposed damping is the main influential factor to be verified. The aim of this paper is to present and compare several models to define and compare damping definitions in the the torsional vibrations calculation (Frahm's model, Archer's model, physical damping, magnification factor, etc.) in a systematic way, to enable designers to correctly apply the selected damping model. Further on the engine excitation may be expressed by means of cylinder pressures or tangential forces to the cranks. The essentials of the two models and the procedure to convert one excitation model into another one are also presented. The application of the presented damping and excitation models is presented on an actual ship propulsion system and conclusions drawn.

Key words: *marine shafting design, steady-state torsional vibration analysis, SimulationX, validation by on-board measurements, acceptance criteria*

1. Introduction

Designer of any ship propulsion system has the main goal from the very beginning: to select the propeller that enables ship to achieve contracted speed for the given ship hull form, as well as to select the proper main propulsion prime mover (e.g. Diesel engine, steam or gas turbine plant and reduction gearbox) able to produce and transmit power to the main propulsion shafting.

The next step is determination of design form, dimensions, material and service loading of the shafting itself. Preliminary dimensions, i.e. external and internal diameters of particular shafts may be easily determined on the basis of MCR power, relevant rotational speed and mechanical properties of the selected material by implementing classification Rules. These classification Rules are generally based upon IACS Unified Requirement UR M68, comprising simple formulae applied to the calculation of these diameters.

However, in this very first design phase it is very important to determine the shafting steady state response to the engine and propeller variable torque excitation around the shafting axis, i.e. torsional vibrations response. It is a difficult task in this phase, because the entire shafting system has not been completely defined yet. Unfortunately, in case of improper design in this phase, there is not much that can be done in later phases, other than providing and installing the torsional vibration damper. For this reason, proper calculation of torsional vibration is necessary in the initial phase of the marine shafting design.

In general, torsional vibrational response of shafting depends also upon its design form, dimensions, material and service loading. The most appropriate model for the analysis of shafting system torsional vibrations is the model with lumped masses (represented by their mass moments of inertia around the shafting axes), massless shafts (representing stiffness and damping of parts of the system) and engine loading.

Considering steady-state response in terms of angular, torque and stress amplitudes for various shafting rotational speeds in the operational speed range the particular necessary data to be provided are the mass moments of inertia for each concentrated mass, the torsional stiffness of shafts, structural damping in the shafts, damping of propellers, flexible couplings and torques due to cylinder pressures and inertial forces of the reciprocating parts of engine systems for a single engine cycle (two-stroke or four stroke).

Evaluation of either mass moments of inertia for each lumped mass in the system, or stiffness of every particular shaft element is not difficult and can be performed in a rather straightforward non-ambiguous manner. Unfortunately this is not the case with the estimation of damping for particular elements of the system. The damping may be defined in various terms. In addition to this, the excitation engine torques may be defined in several different ways: cylinder pressures or crank tangential forces, both in closed form or expressed by the Fourier series coefficients.

For these reasons this paper focusses on presenting several definitions of damping in the torsional vibrations shafting model, the methods to convert among them, as well as the definitions of excitation torques in the model and their origin. In addition to this, classification societies (e.g. in [1] and [2]) require validation of the torsional response of the shafting system by measurements on-board the first in the series of newly built ships. In case the results do not match the 5 per cent margin difference, the calculations shall be run again. So, it is necessary to have the proper reliable methodology for defining of element damping properties and excitation forces readily available in the shafting numerical model.

2. Modelling of torsional vibrational damping

The torsional damping estimation is the most ambiguous for the marine shafting designers. No designer can be completely confident whether the damping data introduced and implemented in the torsional vibration calculations are correct, unless the calculation results are validated by means of measurement on-board [3].

The damping is the effect tending to reduce the vibratory amplitude of any oscillating system. Energy dissipation always accompanies damping itself. For the calculation of marine shafting torsional vibrations the four main types of damping are important [3]:

- viscous damping;
- fluid damping;
- internal damping; and
- structural damping.

The cause of viscous damping is the energy loss occurring in lubricating liquid between the system parts in relative motion. Viscous damping force is directly proportional to the relative

velocity between the moving parts of the vibrating system. Viscous damping may be considered as absolute (between the moving part and the non-moving environment) or relative (between the two parts in relative motion) [3].

The cause of fluid damping is the dynamic interaction of propeller and surrounding water. The cause of internal (material) damping is the mechanical energy dissipation within the material of the shafting, material of flexible couplings, as well as within the torsional vibration dampers. The cause of structural damping is the relative friction between the shafting system elements that are in mutual contact [3].

Owing to the fact that only the linear viscous damping model enables a simplified analytical calculation approach, all the remaining types of damping models are in practice transformed to the equivalent viscous damping, as follows: fluid damping as absolute viscous damping, internal and structural damping as relative viscous damping [3].

For the above stated reasons there exist several possibilities to define and enter damping data in various torsional vibration calculation computer programs. The definitions of damping used in the most important programs will therefore be presented here.

Program SimulationX, developed by ITI GmbH [4], Dresden uses the following approach. Viscous damping torque amounts to:

$$T_D = b\omega [\text{Nm}] \quad (1)$$

and the damping approach factor, B (in the expression: $b = B\sqrt{k}$) uses the following "rule of thumb" to estimate the damping:

$B = 0,005 \dots 0,01$ - damping in metallic materials (e.g., shafts)

$B = 0,10 \dots 0,25$ - damping in highly elastic materials (e.g., rubber coupling elements)

$B = 0,05 \dots 0,15$ - structural and contact damping (e.g., gear teeth contacts / toothings)

Relative damping (ratio of damping energy), ψ (nonlinear, frequency dependent)

$$\psi = 2\pi \frac{\omega}{k} b \rightarrow b = \frac{\psi}{2\pi} \cdot \frac{k}{\omega} \quad (2)$$

Lehr's damping factor, D

$$D = \frac{\psi}{4\pi} = \frac{b\omega}{2k} \rightarrow b = 2D \cdot \frac{k}{\omega} \quad (3)$$

where:

k – element linear stiffness, Nm/rad

b – element linear viscous damping, Nms/rad

ω – phase velocity of vibration, rad/s

In the program ShaftDesigner, developed by prof. Y. Batrak, the following damping definitions are used (the denotations for the k , b and ω as specified above):

Ratio of damping energy, ψ

$$\psi = \frac{2\pi \cdot b\omega}{k} = 2\pi\kappa = \frac{2\pi}{\sqrt{Q^2 - 1}} = 4\pi\varepsilon = \frac{2\pi}{M} \quad (4)$$

where:

κ – non-dimensional damping factor

Q – vibration magnifier

$$Q = \frac{\sqrt{k^2 + b^2 \omega^2}}{b \omega} = \frac{\sqrt{1 + \kappa^2}}{\kappa} = \frac{\sqrt{4\pi^2 + \psi^2}}{\psi} = \frac{\sqrt{1 + 4\varepsilon^2}}{2\varepsilon} = \sqrt{1 + M^2} \quad (5)$$

ε – percent of critical damping, %

$$\varepsilon = \frac{b \omega}{2k} = \frac{\kappa}{2} = \frac{\psi}{4\pi} = \frac{1}{2\sqrt{Q^2 - 1}} = \frac{1}{2M} \quad (6)$$

M – dynamic magnifier

$$M = \frac{k}{b \omega} = \frac{1}{\kappa} = \frac{2\pi}{\psi} = \sqrt{Q^2 - 1} = \frac{1}{2\varepsilon} \quad (7)$$

Program GTORSI, developed by MAN Diesel & Turbo, Copenhagen, uses the following definitions:

- absolute torsional damping (in % of critical damping), ρ_θ [%]
- physical damping (between the actual and previous inertia), b_θ [Nms/rad]
- percentage modal damping wrt. stiffness, ρ_{inner}
- resulting physical damping, $b = \frac{2\rho_{inner}}{\omega} k$ [Nms/rad] (8)

For its importance, the damping of the propeller deserves to be presented separately, regardless of the calculation program. Propeller damping may be presented by means of the equivalent absolute viscous damping. Dimensional equations are generally implemented, so the user is to take care about the units used.

Frahm's propeller damping factor, D_F (in practice: 2,9...3,7), is used to define the propeller absolute damping (Frahm), b_{Ap} as follows:

$$b_{Ap} = D_F \cdot \frac{30}{\pi} \cdot \frac{T_p}{n_p} = D_F \cdot \left(\frac{30}{\pi}\right)^2 \cdot \frac{P_0}{n_{p0}^3} \cdot n_p = D_F \cdot \left(\frac{30}{\pi}\right)^3 \cdot \frac{P_0}{n_{p0}^3} \cdot \omega_p \text{ kNms/rad} \quad (9)$$

Archer's propeller damping factor D_A (in practice: 25...35, based upon the open water characteristics of the Wageningen B-propeller series) implements a similar approach as for the Fram's factor [3]:

$$b_{Ap} = D_A \cdot \frac{T_p}{n_p} = D_A \cdot \left(\frac{30}{\pi}\right) \cdot \frac{P_0}{n_{p0}^3} \cdot n_p = D_A \cdot \left(\frac{30}{\pi}\right)^2 \cdot \frac{P_0}{n_{p0}^3} \cdot \omega_p \text{ kNms/rad} \quad (10)$$

Obviously:

$$D_A = D_F \cdot \frac{30}{\pi} \quad (11)$$

In the above equations the following denotations have been used:

P_0 – engine nominal rating power (MCR), kW

n_0 – engine nominal speed at MCR, rpm

i – gearbox transmission ratio

$$n_{p0} = \frac{n_0}{i} \text{ – propeller nominal speed, rpm} \quad (12)$$

$$\omega_p = \frac{\pi \cdot n_p}{30} \text{ – propeller angular velocity, rad/s} \quad (13)$$

n_p – propeller speed, rpm

$$T_0 = \frac{30}{\pi} \cdot \frac{P_0}{n_0} - \text{engine nominal torque, kNm} \quad (14)$$

$$T_{p0} = i \cdot T_0 - \text{propeller nominal torque, kNm} \quad (15)$$

$$P = P_0 \left(\frac{n_p}{n_{p0}} \right)^3 - \text{propeller power curve, kW} \quad (16)$$

$$T_p = T_0 \left(\frac{n_p}{n_{p0}} \right)^2 - \text{propeller torque curve, kNm} \quad (17)$$

Other propeller damping definitions, such as Ker Wilson's formula, Dien-Schwanecke's formula, as well as MAN Diesel & Turbo's recommendation to set propeller damping as 5% of the critical have been presented in detail in [3].

3. Modelling of engine excitation loading

The Diesel engine cylinder may be provided by the engine manufacturer expressed in various forms:

- actual cylinder pressures vs. crank angle in the range of either $\pm 180^\circ$ for two-stroke engines, or $\pm 360^\circ$ for four-stroke engines;
- crank forces in tangential (circumferential) direction vs. crank angle, originating also from the combustion pressure in engine cylinders
- crank forces in tangential (circumferential) direction in terms of Fourier series coefficients (precisely trigonometric approximation coefficients for the orders of 1; 2; 3; ... in case of two-stroke engines and orders of 0,5; 1,0; 1,5; 2; 2,5; ... for four stroke engines.

In practice it is often necessary to provide simple means to convert among these forms. Harmonic analysis, i.e. expressing of cylinder pressure/crank force vs. crank angle in the terms of trigonometric approximation coefficients, from (a) to (b) or to (c) above, is rather easy, following the procedure for the approximate calculation of Fourier series coefficients by e.g. their numerical integration. However, the reverse procedure, from (c) to (b) or to (a) above, may be a tricky one. For this reason the Excel/VBA program *S06HarmSynt* has been developed and will be shortly presented hereafter.

Program *S06HarmSynt* calculates tangential force, cylinder pressure and crank torque, all vs. crank angle, for the two cases: case of gas normal firing and gas compression only (misfiring) for 2-stroke and 4-stroke internal combustion engines, from the following input data: cylinder bore diameter, ratio of crank radius and connecting rod length, crank radius and harmonic cosine and sine components of Fourier series expansion of gas normal firing and gas compression only tangential pressure values, given for orders 0,5; 1; 1,5; 2; ... for 4-stroke engines or orders 1; 2; 3; ... for 2-stroke engines.

Program input data comprise the gas normal firing and misfiring N harmonic (cosine and sine) components F_{TC} and F_{TS} expressed as: $p = F_T / A_{cyl}$, where

F_T – force in tangential direction, N

$$A_{cyl} = \pi d^2 / 4 - \text{cylinder area, mm}^2 \quad (18)$$

The calculation procedure can briefly be described as follows:

Crank angle range α in 2-stroke engines

$$-360^0 \leq \alpha \leq +360^0 \quad (19)$$

Crank angle range α in 4-stroke engines

$$-180^0 \leq \alpha \leq +180^0 \quad (20)$$

Ratio of crank radius to the connecting rod length

$$\lambda = r/l \quad (21)$$

Connecting rod angle

$$\sin \beta = \lambda \cdot \sin \alpha \quad (22)$$

Gas force (positive downwards)

$$F_{gas} = p \cdot \frac{\pi d^2}{4} \quad (23)$$

Tangential force on the crank journal due to gas forces

$$F_T = F_{gas} \cdot \frac{\sin(\alpha + \beta)}{\cos \beta} \quad (24)$$

Cylinder pressure from tangential force

$$p = \frac{4F_T}{\pi d^2} \cdot \frac{\cos \beta}{\sin(\alpha + \beta)}; \sin(\alpha + \beta) \neq 0 \quad (25)$$

(valid under condition: $\sin(\alpha + \beta) \neq 0$, otherwise: linear interpolation for nearby values)

Trig. approximation for tangential forces

$$F_T = \frac{F_{T0}}{2} + \sum_{k=1}^N F_{TC,k} \cos \frac{k\alpha}{2} + F_{TS,k} \sin \frac{k\alpha}{2} \quad (26)$$

for zero crank angle

$$F_{T0} = -2 \sum_{k=1}^N F_{TC,k} \cos k\pi \quad (27)$$

Mean indicated pressure (numerical integration)

$$p_{m,i} \frac{1}{2} \int_{\alpha_{\min}}^{\alpha_{\max}} p(\alpha) \left(\sin \alpha + \lambda \frac{\sin \alpha \cdot \cos \alpha}{\sqrt{1 - \lambda^2 \sin^2 \alpha}} \right) \cdot d\alpha \quad (28)$$

The calculation example to illustrate the presented methodology for a two-stroke engine cylinder excitation, where inertial forces are to be considered separately begins from the data presented in the following table.

Table 1 Input data for an actual engine excitation loading calculations

Engine licence: **MAN B&W**

Type: **6S50MC-C, 9180 kW / 123 rpm**

engine working cycle (two stroke-2, four stroke-4)

cycle= 2

cylinder bore

D= 500 mm

ratio of crank radius and connecting rod length

$\lambda = r/l =$ 0,4878

crank radius (half of piston stroke)

r= 1000 mm

Order	Inertia	Gas normal firing		Total Ampl	Gas misfiring only		Ampl	[Nmm/mm ³]
	SIN	COS	SIN		COS	SIN		
0	A₀=	1,2624064		A_{0comp}=	0			
1	0	0,762603	1,459809		-0,0003	0,1566		
2	0	0,0092984	1,727643		-0,0016	0,2393		
3	0	-0,234102	1,315507		-0,0009	0,2222		
4	0	-0,277969	0,930338		0,0011	0,1672		
5	0	-0,297135	0,600769		0,0006	0,1235		
6	0	-0,230167	0,362201		0	0,0899		
7	0	-0,1787	0,224368		0,0003	0,0644		
8	0	-0,137667	0,1123		0,0004	0,0454		
9	0	-0,085266	0,048867		0,0001	0,0319		
10	0	-0,0569	0,0176		-0,0002	0,0226		
11	0	-0,0326	-0,00943		0,0003	0,0154		
12	0	-0,010833	-0,0175		0	0,0108		

The calculated results have been presented in Figure 1.

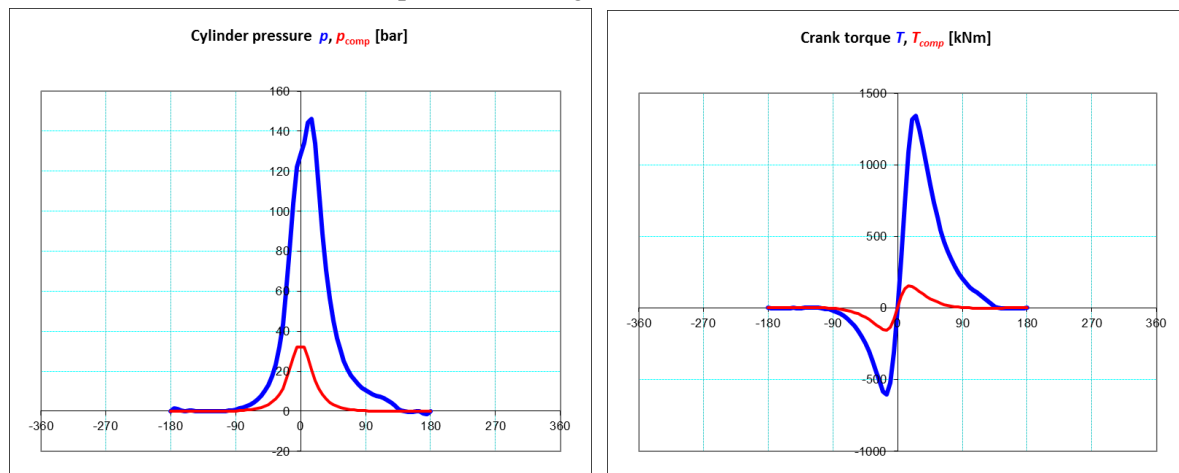


Figure 1 Calculation results, cylinder pressure and crank torque vs. crank angle

4. Validation of calculation on-board

Torsional vibrations calculation shall be verified on-board the first ship in the series. The most practical way is measurements by strain-gauges, connected into the full Wheatstone-bridge, that are glued on the surface of the shafting part which can be easily accessible from the machinery space (e.g. intermediate shaft). The strain-gauges measure strain, for the various levels of shafting rpm. This strain is converted into torsional stress and finally the

torsional stress vs. shafting curve is plotted. Looking into this graph easily reveals critical speeds and maximal stress levels. In accordance with class Rules, measured critical speed shall not differ to the calculated ones by more than 5%. A more detailed presentation of measurement methods and interpretation of the results would be beyond the scope of this paper.

5. Illustrative example of the torsional vibration calculation

For the illustration of the proposed methodology, the two-stroke propulsion engine system has been selected to be briefly presented hereafter. These calculations have been performed with and the results obtained by the SimulationX program [4].

The main propulsion system of the oil-tanker consists of the 5-cylinder two-stroke slow speed main propulsion engine connected to the fixed-pitch four bladed propeller by means of the intermediate shaft and the propeller shaft.

The absolute damping in the engine cylinders, as well as the absolute damping of the marine propeller in the system, is modelled by means of dynamic magnification elements specially developed for this purpose. This possibility to develop and implement self-developed elements is an important advantage of the SimulationX software.

Figure 2 shows the calculation model for the shafting system.

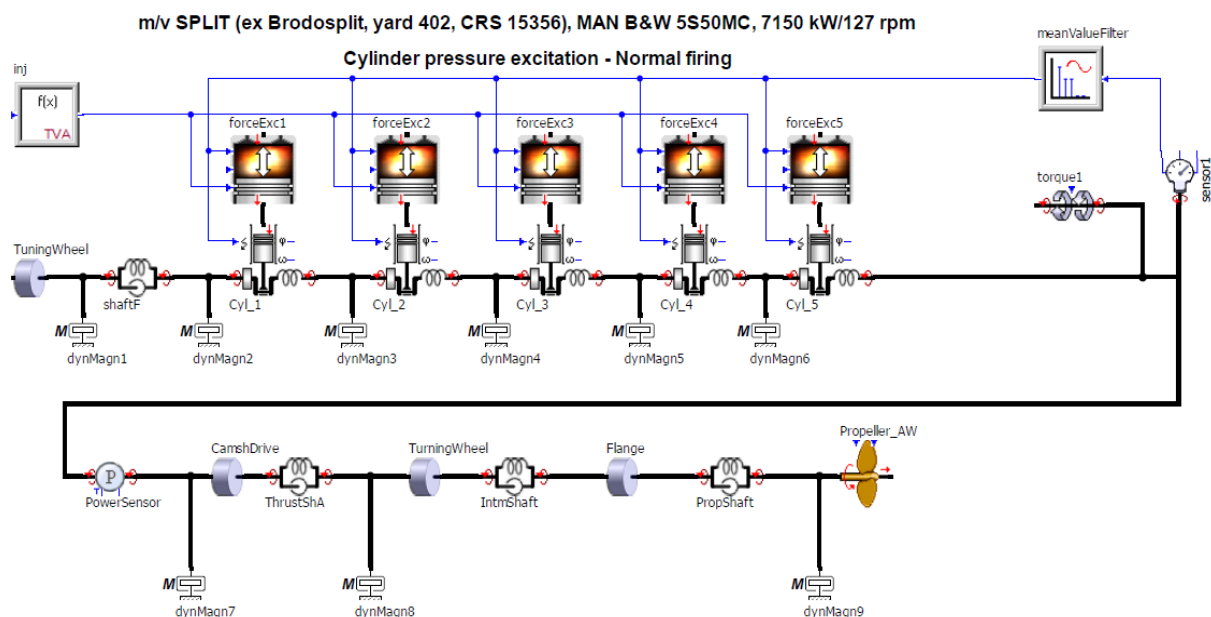


Figure 2 SimulationX shafting model for the calculation of torsional vibrations

Figures 3 and 4 present the steady-state calculation results for the torsional stress (MPa) in the intermediate and propeller shaft vs. the shafting speed (rpm) for each excitation order separately, as well as their sum and mean value. The allowable stress levels are also shown.

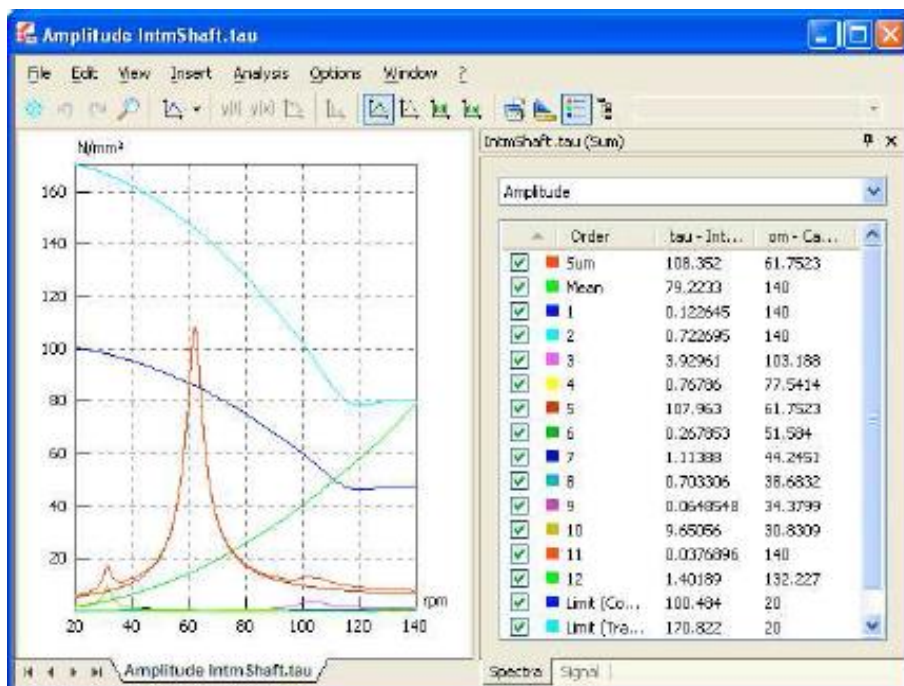


Figure 3 Calculation results: torsional stress in the intermediate shaft

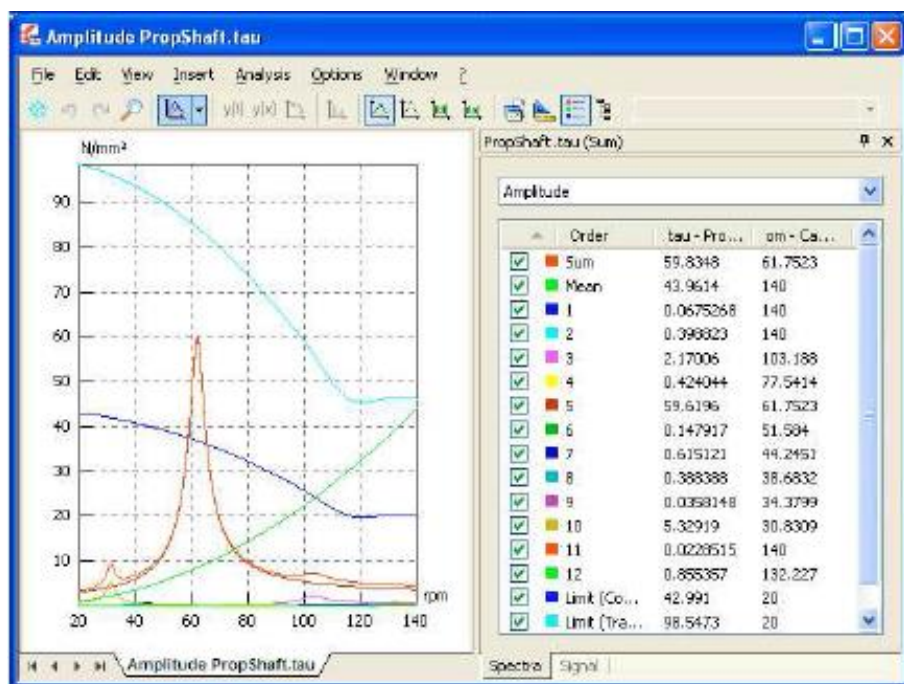


Figure 4 Calculation results: torsional stress in the propeller shaft

An important outcome of these analyses is that, for the particular ship in question, the propulsion system continuous operation within the range of shafting rotational speed of about 60 rpm should be avoided (barred speed range), in order to decrease the possible damage to the system due to resonance caused by excitation.

6. Conclusion

Torsional vibrations calculations are essential calculations which have to be performed in a very early stage of the shafting design process, by means of an appropriate software program.

The most difficult part in preparing data for these calculations, i.e. steady state response of the system modelled by lumped mass and massless stiffness and damping elements is to define damping and engine excitation in a proper way.

For this reason the methodology of definition of the damping implemented by several modern software programs has been presented in such a way that particular values can be easily converted from one to another and the results compared. This was the primary goal: to enable user to select the damping model best fitted for the purpose of modelling the real system.

An additional goal was to present the approach to the calculation of engine excitation in other forms (cylinder pressure vs. crank angle, or crank tangential force vs. crank angle), when these are given in terms of trigonometric approximation (Fourier's coefficients) for various excitation orders. There are some tricky points in this approach, to which the attention has been drawn.

Validation of the calculation results is essential, by measurements on-board, being the only way to check out whether the damping and engine excitation has been correctly taken in the calculations.

An illustrative example, showing the system and the obtained shafting torsional stress results has been presented in the end, just to show the powerful possibilities of one of the calculation programs intended for torsional vibration calculations (such as SimulationX).

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Simulation contributions of frequency convertors applied for AC motor in electric propulsion

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Abstract. The advantage of a simulation is the level of detail that can be obtained from it. A simulation yields results that are not experimentally measurable with our current level of technology. Most of the time, simulation testing is cheaper and faster than performing multiple tests of the real design. Designing and testing is becoming much easier with development of simulation tools. The pretesting while the model is still under construction can eliminate the different oversights that can be made. Three of the most commonly used types of converters used as motor drives for AC motors in electric propulsion are presented in this paper: cyclo-converters, PWM converters and synchro-converters. Modelling the frequency convertors in simulation software, it is possible to define which converter is suitable for a given power system.

Key words: *electric propulsion, Matlab Simulink, motor drives, power quality.*

1. Introduction

Modeling and simulation techniques have an advantage of simulating the behaviour and performance characteristics of real physical systems without conducting actual expensive and potentially dangerous physical experiments. Besides the benefits in evaluating and optimising existing systems and their states, modeling and simulation techniques also bring many advantages to designing new electric propulsion systems or some of their elements. In this way, the expensive and time consuming process of building a prototype, testing it and performing its modification is bypassed. The other advantage is that the behaviour of unmeasurable variables can also be observed and taken into a consideration.

Unlike in a mechanical propulsion system, in an electric propulsion system there is no direct link between the prime mover and the propeller, so the speed of a prime mover (for example gas turbine) can be optimised regardless of the propeller speed, which leads to better efficiency and lower fuel consumption.

The electric propulsion system allows more flexible ship design and can be integrated in a known or previously designed ship construction more easily, while the mechanical propulsion systems have to be taken into consideration at the very beginning of the ship construction designing process. It also requires less of the internal ship's space than the mechanical

propulsion system. The free volume acquired in this way can bring additional economical benefits to the ship, according to its allocation. In this way, for example, war-ships can use the extra volume for additional or bigger weapon storage, commercial ships for more passengers or load. In technical sense, the electric propulsion is used mainly where there's a need for a high level of maneuverability.

As shown on Figure 1, electrical propulsion system consists of a prime mover, a generator, a motor drive, a motor and a propeller. Rotation speed of electric propulsion motor is typically regulated by a static frequency converter, which is the most significant component of the electrical propulsion system, whose efficiency, output power quality and transient response depend upon it significantly.

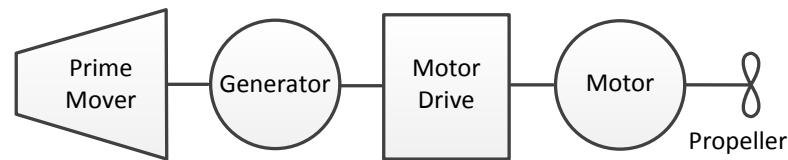


Figure 1. Electrical propulsion scheme

In order to improve the electric propulsion system efficiency, every element of the electrical propulsion scheme should be carefully chosen and modelled. Typical values of electrical efficiency for basic elements of the electric propulsion system are given in Table 1.

Table 1. Typical values of electrical efficiencies in diesel-electric propulsion (DEP) system[1]

	Typical values of electrical efficiency
Generator	0.95 – 0.97
Switchboard	0.999
Transformer	0.99 – 0.995
Frequency Converter	0.98 – 0.99
Electric Motor	0.95 – 0.97
Diesel engine shaft to electric propulsion motor shaft	0.88 – 0.92

2. Electrical drive

Electrical drive is chosen depending on the electrical propulsion motor. Thyristor controlled DC drive that directly converts AC to DC voltage is used for DC electrical propulsion motors, which are being slowly abandoned, mainly due to their size, purchase and maintenance costs. For rotation speed regulation of AC electrical propulsion motors, most commonly induction (asynchronous) machines, classic synchronous and permanent magnet synchronous motors, both voltage and frequency control must be applied.

There are three main types of converters used as motor drives for AC motor electric propulsion: cyclo-converters, pulse width modulation (PWM) converters and synchro-converters. Cyclo-converters perform direct AC to AC conversion and can be used to drive all AC electrical machines. PWM converters also used as drives for all AC electrical machines. Synchro-converters are used exclusively for synchronous machines perform indirect conversion in two steps: AC to DC and DC to AC voltage conversion. While cyclo- and synchro- converters played a significant role in the past, in a last decade they are being replaced by PWM converters. The main reason for more frequent application of PWM converters is the rapid development of power electronics, which made it possible to produce electrical power high enough for electric propulsion demands as seen on Figure 2. For very

high power, the most favoured option is to use a pair of high efficiency, high voltage AC synchronous motors with fixed pitch propellers (FPP) driven at variable speed by frequency control from electronic converters. A few installations have the combination of controllable pitch propellers (CPP) and a variable speed motor. Low/medium power propulsion (1-5 MW) may be delivered by AC induction motors with variable frequency converters or by DC motors with variable voltage converters. The prime-movers are conventionally constant speed diesel engines driving AC generators to give a fixed output frequency.

Figure 2. Single line diagram of electric propulsion system with PWM converters 2x6 MW, 24-pulses
SOURCE: <http://www.sam-electronics.de/dateien/pad/broschueren/1.002.pdf>

There are three most commonly used modulation methods of PWM current control: hysteresis PWM, sine-triangle pulse width modulation SPWM and space vector PWM. They were explained, conducted and compared in [3]. Figure 3. represents Matlab Simulink model of PWM regulated propulsion motor that was used in [3].

Figure 3. Matlab Simulink model of PWM regulated propulsion motor [3]

The model simulation and analysis is based upon electric propulsion motor power quality characteristics and doesn't take the converter's effect on the ship's electrical system into a consideration. For further and more complex analysis, the Matlab Simulink model and its elements could be additionally upgraded. Model presented in [3] focused on the PWM generator block, which was designed differently for each of the three analyzed modulation methods. Its programmed pulses bring transistor to required on and off stages and in this way control the output electric propulsion motor currents and voltages.

The principle of a hysteresis current control PWM method is the maintenance of electric propulsion motor current value within the error limits, set in relation to the referent current value, which is defined by the hysteresis bandwidth. The comparison is based on the current feedback. PWM inverter is controlled in a way that when the regulated current for a specific phase overreaches the referent current, it is being decreased by one of the upper transistors (T1, T3, T5) responding to that phase switching off and one of the lower (T4, T6, T2) switching on. When the regulated current decreases below the referent current value, the transistors switch contrariwise, which causes the wanted current increase. The advantage of a hysteresis current control PWM method is that it provides an output current independent of a DC link current ripple. Its imperfection lies in a necessity to ensure lock-out time between the transistors switching stages.

The principle of a sine-triangle PWM method is the maintenance of electric propulsion motor voltage value within certain limits, defined by a comparison of its referent sinusoidal voltage signal to a triangular carrier voltage signal. Programmed PWM pulses are switching semiconductor valves in geometrical intersections of those two compared signals, enabling the output voltage value to increase or decrease when it goes beyond boundary limits. The same carrier signal can be used in controlling all three output phase voltages. The quality of the output voltage and frequency spectrum can be described with a frequency modulation index m_f , defined as an ratio of the triangular sinusoidal carrier frequency f_c and the output voltage fundamental frequency f_o :

$$m_f = \frac{f_c}{f_o} \quad (1)$$

The principle of a space vector PWM method is the maintenance of electric propulsion motor voltage value close to its referent value, which is modulated by combining eight space vectors. Space vectors are defined by possible transistors switching stages, where each stage is defined by the upper and lower transistor of the same phase being in opposite modes, meaning one has to be off and the other one on. Since there are three phases with two possible switching states (upper transistor on and lower off representing logical 0, logical 1 represented by the opposite stage), this provides eight different combinations. Referent voltage signal vector formed in this way is then transformed from three-phase abc into stationary $\alpha\beta$ time frame and its α and β components and an angle between them γ are used for calculation of switching times.

The output characteristics for those three methods were compared in [3], considering the electrical propulsion motor current and voltage fluctuations and frequency spectra. The comparison was made in a stationary state for different motor loads and speeds and same switching frequency of 1800 Hz, which was approximately met with the hysteresis bandwidth of 0.1 per unit (p.u.) in hysteresis current control method, and accurately reached with constant frequency modulation index of $m_f = 93$ in sine-triangle and space vector control methods. For the purpose of showing the influence of the frequency modulation index m_f on the output metrics quality, the analysis for sine-triangle and space vector control methods was also performed for $m_f = 63$, which represents the switching frequency of 1260 Hz.

Figure 3. represents the results for the three analysed PWM modulation methods, expressed as the voltage and current harmonic distortions depending on the electrical propulsion motor speed. Total harmonic distortion THD is defined as a mean square value of higher harmonics

expressed as a percentage of the value of the first harmonic. The total harmonic voltage distortion THDu and the total harmonic current distortion THDi are defined as [7]:

$$THDu = \frac{\sqrt{\sum_{h=2}^n U_{(h)}^2}}{U_{(1)}} \cdot 100\% \quad (2)$$

$$THDi = \frac{\sqrt{\sum_{h=2}^n I_{(h)}^2}}{I_{(1)}} \cdot 100\% \quad (3)$$

As illustrated, of all three methods, for the same switching frequency of 1800 Hz, hysteresis current control PWM method (Hyst.) shows the highest THDi and significant increase in THDi harmonic distortions at lower motor speeds, which can be lowered by narrowing the hysteresis bandwidth, but it would have a higher switching frequency as a side effect, which would add to a converter complexity and cost. For the same switching frequency of 1800 Hz, the sine-triangle PWM method (STM, $m_f = 93$) gives sufficiently low and the space vector PWM method (SVM, $m_f = 93$) the lowest THDi. But, it can also be noticed that a frequency modulation index influences the THDi so strongly, that the sine-triangle PWM method for $m_f = 93$ gives lower THDi than the space vector PWM method for $m_f = 63$ (SVM, $m_f = 63$).

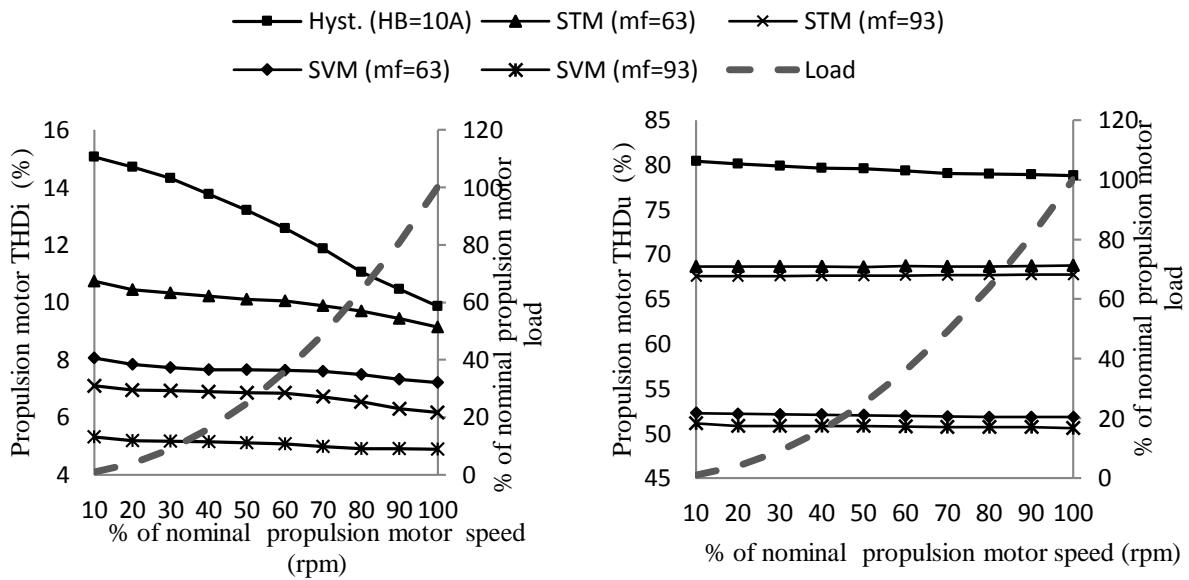


Figure 4. Comparison of total current and voltage harmonic distortion between simulated methods with different frequency modulation indexes as a function propulsion motor speed[3]

THDu shows no significant dependence upon the propulsion motor speed. It is the lowest for the the space vector PWM method and the highest for hysteresis current control PWM method and isn't significantly influenced by frequency modulation index m_f . By increasing the frequency modulation index, and therefor also the switching frequency, THDu shows only slight decrease. Although THDu is very high comparing to THDi, it has less influence on the electric propulsion motor performance.

Besides the lowest THDi $\approx 5\%$ and THDu $\approx 50\%$, space vector PWM method also gives the highest effective DC voltage utilization[3].

Table 2. shows technical data of a driven motor and the harmonic distortions as results of another sine-triangle PWM (SPWM) simulation [4], made in Electro Magnetic Transients

Program (EMTP), a professional software for simulation and analysis of transients in power systems.

Table 2. Technical data of a SPWM converter driven motor study case [4]

Converter characteristics	
SPWM converter:	
input frequency, output frequency: 12 Hz, amplitude factor: 0.9, carrier frequency: 108 Hz	
Driven motor characteristics	
Induction motor:	
3- phase, 12 Hz, 5 kV/ 10 MVA Y, 4 poles	
Harmonic distortion of study case	
Voltage THD	66 %
Current THD	22 %

In the simulation model a prime mover was analysed as a diesel engine and a cogeneration gas turbine, power generation as two to four synchronous generators capable of covering more than 50% of the installed load each, connected to the SPWM converter motor drive through the power transformer. Electrical propulsion motor is presented as an induction machine. Figure 5. represents the scheme of a three-phase PWM converter used as a motor drive in this simulation.

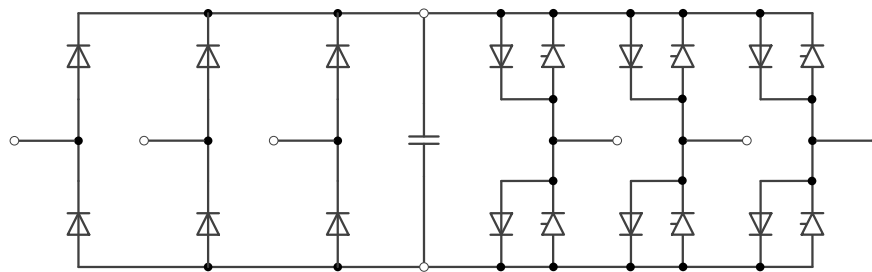


Figure 5. Typical structure of a three-phase pulse width modulation (PWM) converter

The SPWM converter consists of a three-phase six-pulse diode rectifier (a full wave bridge), DC link and a six-pulse two level transistor PWM inverter. Diodes connected in parallel to each switching transistor provide current bypass paths and protect the transistors. When a transistor is switched off, the current through the diode connected to it flows until all the energy in the inductive load (electric propulsion motor) is dissipated. [10]

The total harmonic voltage distortion $THD_u = 66\%$ and the total harmonic current distortion $THD_i = 22\%$ are higher than in the best case of previously considered PWM simulation, the one that used space vector PWM method. The reason for that lies in the approach to this simulation, which mainly focused on modeling of the converter and electrical propulsion motor, while the power quality was of a secondary consideration.

4. Contributions of simulations of cyclo-converter control

Table 3. shows technical data of driven motors and the harmonic distortions as results of cyclo-converter control simulation, made in EMTP [4].

Simulation model is presented with the prime mover as a diesel engine and a cogeneration gas turbine, power generation as two to four synchronous generators, a power transformer, a motor drive as a cyclo- converter. Two simulations were done, where the electrical propulsion motor was presented as an induction machine in the first case and as an synchronous motor in the other one.

Table 3. Technical data of cyclo-converter driven motors study cases [4]

Converter characteristics			
12- pulse IGBT cyclo- converter: 12 IGBTs per phase, input frequency: 50 Hz, output frequencies: 12 Hz, 5 Hz			
Driven motor characteristics			
Induction motor: 3- phase, 12 Hz, 5 kV/ 10 MVA Y, 4 poles		Synchronous motor: 3- phase, 5 Hz, 5 kV/ 10 MVA Y, 4 poles	
Harmonic distortion of study cases			
Voltage THD	24 %	Voltage THD	14 %
Current THD	13 %	Current THD	19 %

Figure 6. represents the scheme of a three-phase cyclo-converter used as a motor drive in this simulation.

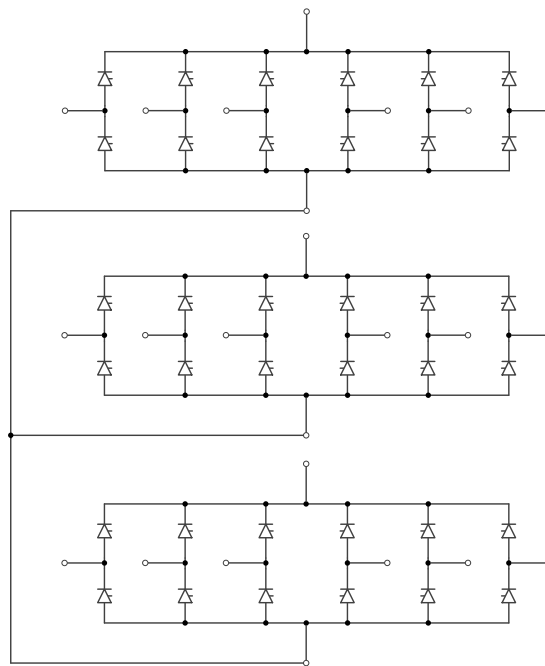


Figure 6. Typical structure of a three-phase cyclo-converter

A converter used in this simulation is a three-phase 12-pulse cyclo-converter, that consists of 36 thyristors. For each phase of the cyclo-converter, an input is connected to the corresponding phase of the power transformer and an output to the corresponding phase of electrical propulsion motor. A converter's phase consists of two 6-pulse inverter bridges connected in parallel, with mutually contrariwise directed six thyristors. One of the bridges is responsible for providing a positive and the other one for a negative cycle of the output current. A specific characteristic of a cyclo-converter is the omission of the intermediate DC link, for it provides a direct conversion of AC supply frequency and voltage to an output frequency and voltage.

The main power quality disadvantages of the cyclo-converter are large content of higher harmonics in voltage quantity and significant distortions in the output voltage waveform. The results of the study summary presented in Table 3. are the total harmonic voltage distortion $THDu = 24\%$ and the total harmonic current distortion $THDi = 13\%$ for the given induction motor and total harmonic voltage distortion $THDu = 14\%$ and the total harmonic current distortion $THDi = 19\%$ for the given synchronous motor.

Although total harmonic distortion factors for the three-phased cyclo-converter appear low in comparison to PWM converters, they grow significantly with the increase of the output

frequency. For that reason, cyclo-converters are limited in terms of the output frequency, that, in practice never goes beyond 30% of the input frequency. Nevertheless, due to the more loose power quality standards in the ship electrical propulsion system than in the land-based electrical power system, cyclo-converters provide satisfactorily low harmonic distortion factors and find their implementation electric propulsion systems.

The results also show that three-phase cyclo-converters give better output power factor characteristics for synchronous than for induction machines, which corresponds to their common application.

5. Contributions of simulation of super-capacitor hybrid converter control

In dynamic working conditions, such as dynamic positioning, the load variations influence the electric system stability. Dynamic working conditions sometimes entail the need for additional running engines, which causes significant increase in fuel consumption and increases the system maintenance costs. The enabling the increase of the average loading with as fewer running engines would provide environmental and economical benefits.

For dynamic working conditions, the performance of electric propulsion system can be additionally improved by choosing a modern hybrid converter control solution, that includes the super-capacitors, as introduced in [2].

Super-capacitors are a low cost new type of energy storage that can be implemented in both AC and DC grid systems and improve system efficiency up to 20%. They found their appliance mainly in transport industry. The geometry and the physical construction of a super-capacitor distinguishes it from a conventional battery, by bringing the advantages like greater capacitance within the same volume, ability to deliver frequent pulses of energy for quick charging, more than hundreds of thousands of cycles in a lifetime and a wide working voltage range. As a result, they also grant lower maintenance costs. Unfortunately, unlike the high power density, energy density is limited comparing to conventional batteries.

In electric propulsion systems with previously considered converters, super-capacitor would be implemented directly to the DC bus of the frequency converters, as shown in Figure 7.[2]

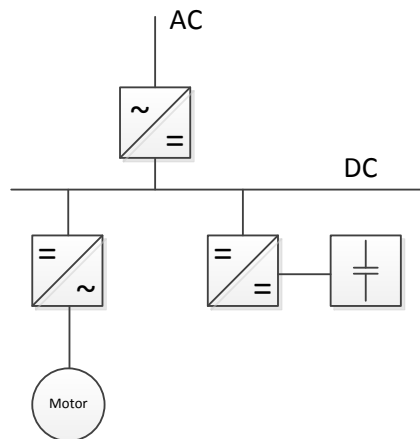


Figure 7. Implementation of a super-capacitor hybrid converter

The typical structure of a super-capacitor hybrid converter is shown in Figure 8. In the buck mode super-capacitor is being charged through the MOSFET T_1 and energy flows from the network to the super-capacitor. When the charging cycle is complete, the current through the super-capacitor is closed in the D_2 -L-SC loop and the current from DC bus is directly transmitted to the output $I_{DC}=I_{out}$. In the boost mode super-capacitor is being discharged through the diode D_1 and energy flows from the super-capacitor to the network. When the

discharging cycle is complete, the current through the super-capacitor is closed in the T_2 -L-SC loop and the current from DC bus is directly transmitted to the output $I_{DC}=I_{out}$.

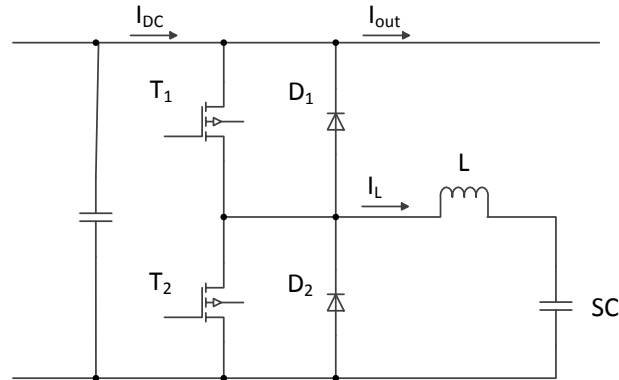


Figure 8. Typical structure of a super-capacitor hybrid converter

ABB designed drive control unit modified for the super-capacitor hybrid converter includes double loop control method that both controls the dynamic power flow and ensures that the super-capacitor voltage range is maintained between certain limits. Regulation of the control signal also takes into consideration the capability of a source regarding to a load power consumption. Figure 9. and 10. represent Matlab Simulink model of described ABB designed regulated propulsion and simulation results, respectively. [2]

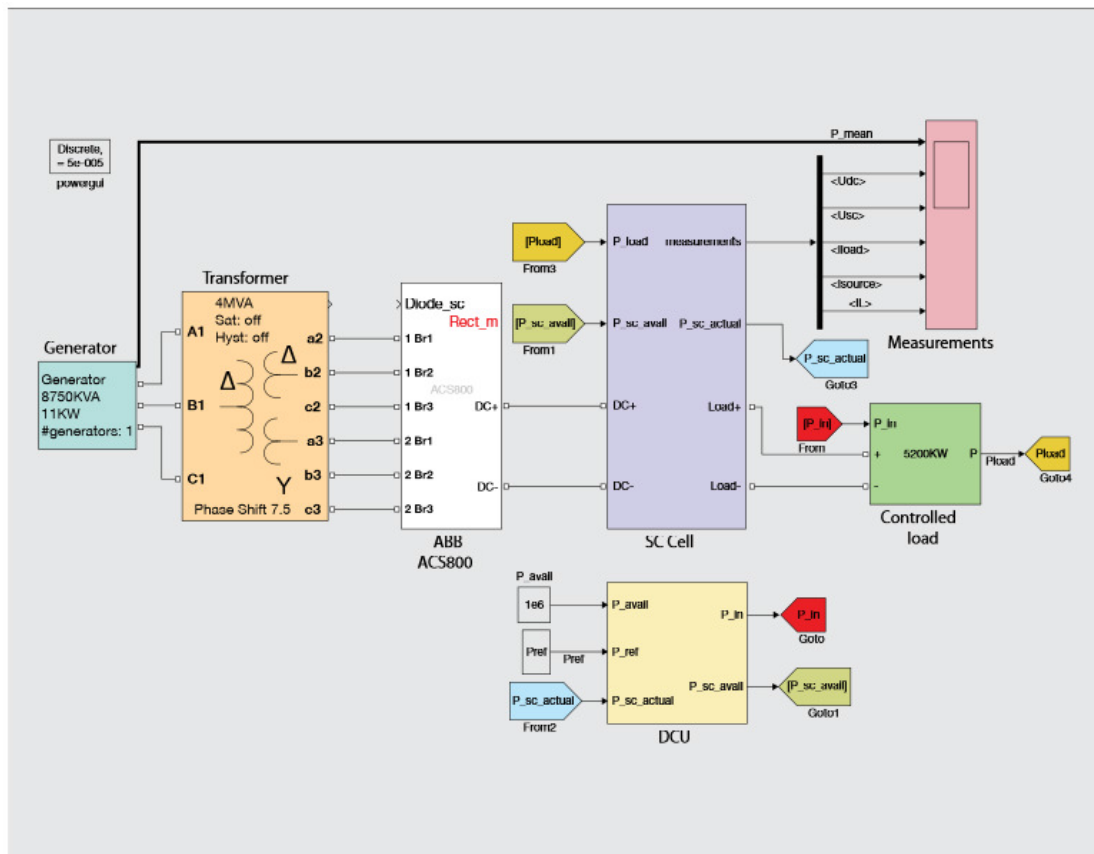


Figure 9. Matlab Simulink model of super-capacitor regulated propulsion motor [2]

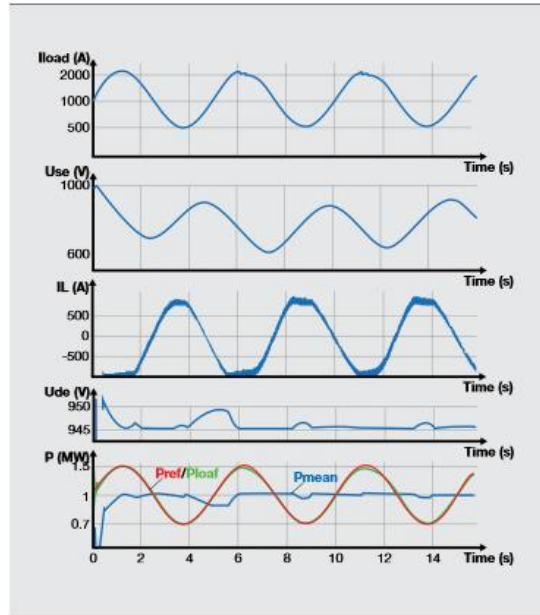


Figure 10. Simulation results [2]

Simulation results represent super-capacitor voltage U_{SC} and current I_L dependence on load current I_{load} and give an insight into the output powerquality. It can be noticed that the the super-capacitor is charged during the period of a low load current and discharged during the period of high load current. Dynamic load variation was set as sinusoidal function with values between 0,5 MW and 1,5 MW and a period of 5 s. The output power P_{load} follows the reference power P_{ref} practically without deviation. In the same time input power is limited to the available power signal of 1 MW maximum and about constant. Adding the fast-acting energy storage super-capacitors doesn't significantly effect the frequency converters output characteristics, therefor it can be easily implemented into existing electric propulsion systems. It can provide a higher level of independency between the power drawn for the network and variations in thruster load. Even with load variations, the network power remains limited and practically constant, which adds to the safety, economical and environmental benefits of the propulsion system designed in this way.

However, specific limitations in some practical uses should be further considered, especially in electric propulsion systems with ongoing rapid load variations, where the super-capacitors would be charging and discharging practically all of the time, like in the example given in simulation results. While the super-capacitor as a short-term energy storage improves power quality by limiting its fluctuations and maximum value and lowers the energy production costs, its usage as a long-term energy storage is still not researched enough. Focus should be on the super-capacitor costs in terms of energy, for they have disadvantages regarding low specific energy, disability of using the full energy spectrum and low cell voltage, which could impose the need for serial connections. Super-capacitor posses relatively high cost per watt-hour. [9]

6. Simulation of power generation and electric propulsion system (PGAEPS)

Constant increase in electric propulsion power demands and therefor a larger amount of that power that can't be used in other ship's electric power systems imply the future ships design as the all-electric ships with an integrated power system. An integrated power system would include and combine all electric systems: power generation system, distribution system, energy consumption, energy storage and power control systems. The simulation of electric

propulsion machines can be expanded to include both power generation and the electric propulsion system, which can, ultimately, help designers achieve higher efficiency and greater stability of the whole integrated power system, as it was exposed in [8]. Figure 11. shows Matlab Simulink model of PGAEPS introduced in [8].

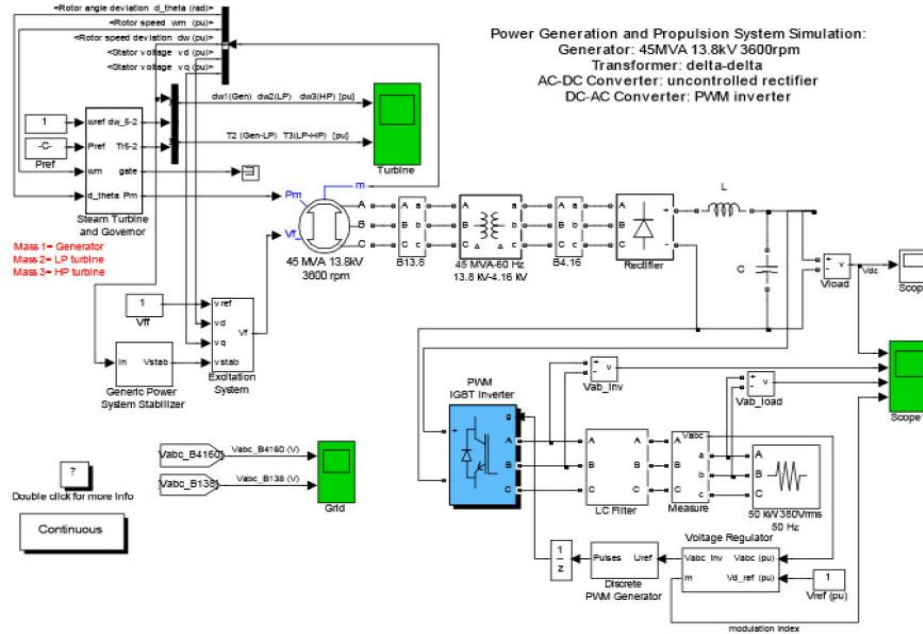


Figure 11. Matlab Simulink model of PGAEPS[8]

In power generation subsystem part of the model prime mover and governor are presented as turbine and governor block, generator as a synchronous machine block, exciter as an excitation system block, stabilizer as an generic power stabilizer block, transformer as a three-phase transformer block. The regulation part of power generation subsystem consists of voltage regulation, which is implemented in the Matlab Simulink model as a swing bus generator set up, and turbine speed regulation, which is implemented in the model as a regulation loop. In electric propulsion subsystem part rectifier is presented as an universal bridge block with diodes, PWM inverter as an universal bridge block with IGBTs and diodes, motor as a motor block, while the propeller, ship-speed dynamics and external forces are modeled as a three-phase parallel RLC load. The regulation part of electric propulsion subsystem consists of motor controller, which is implemented in the model as a voltage regulation loop.

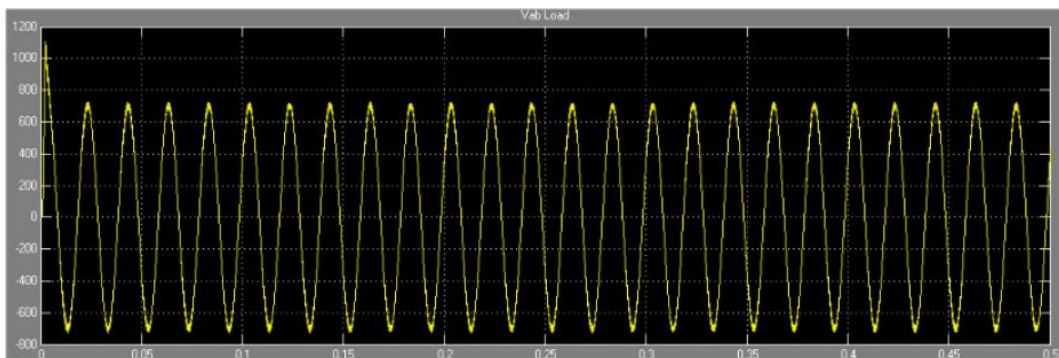


Figure 12. Output voltage of the PWM inverter [8]

Matlab Simulink, like other simulation programs, makes it possible to display any metrics of interest, which can enable easier implementation of changes in the initial design. Among all

electrical elements behaviors considered in this simulation, quality of PWM converter output characteristics is presented through the output voltage of the PWM inverter, shown in Figure 12., which is of sinusoidal shape with a little distortion and satisfying to the electric propulsion load demands. The PWM converter output voltage and, at the same time, output power quality can always be additionally improved by more sophisticated control design.

7. Conclusion

Three most commonly used types of converters used as motor drives for AC motor electric propulsion were presented in this paper: cyclo-converters, PWM converters and synchro-converters. What is the best solution? Each of the three types has its advantages and disadvantages. While the synchro-converter was proven as the simplest and the cheapest, being consisted only of uncontrolled diode rectifier, DC link and diode inverter, with a possibility for easy monitoring, and low THD, it has its specific limitations. The main limitation of a synchro-converter is the disability to be implemented in the electric propulsion systems with any other type of machine rather than the synchronous motor and is additionally limited only to slow speed motors.

The cyclo-converter was proven to be the most complicated, being consisted of three 12-switch thyristor bridges, and therefor also the most expensive, because of the need for 36 thyristors and often also for a transformer or motor-generator pair for supply. Its advantages are the omission of reduction gear and the fact that it can be used as a drive for middle and high power rated propulsion motors, although only for slow speed.

The PWM converters can be used for all electrical machine types and have no problem with driving high speed motors, although only low rated power ones, which makes them the most interesting of all of the three types of converters considered. They have the ability of easy filtering of harmonics. The cost and the complexity of the PWM converter, being consisted of uncontrolled diode rectifier, capacitor and the PWM driven IGBT transistor inverter, is much less challenging than of the cyclo-converter and more challenging synchro-converter.

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Track 4

Interdisciplinary
Teaching and Learning

Motivation and Attitudes in Foreign Language Learning: A Comparative Study of Croatian and Erasmus+ Exchange Students

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Abstract. Motivation, as one of the internal key features of successful foreign language achievement, is considered in this study as a variable correlated with complexity of emerging internal, external sociocultural and dynamic factors. Taking into account motivation components and attitudes toward learning the language a comparative study among junior and senior Croatian learners and Erasmus + exchange students, who are spending a semester at the University of Split in the academic year 2015/16 and are attending a Business English course, is conducted as a basis for understanding the implications and correlations between attitudes and motivations to study English. The study will look into integrative and instrumental reasons for learning the language, attitudes toward the target language and dynamic social processes to find underlying links between these factors and language proficiency. Our institution's involvement in Erasmus + exchange programs, as the main cause of higher occurrence of foreign students, offers an exceptional opportunity for a focus at a broader reference group encompassing not only domestic students but also international Erasmus + students arriving from geographically different areas and countries of the EU. The authors have adopted a three-part questionnaire validated by Mihaljević Djigunović and Bagarić in 2007, hoping that the results will give an interesting insight into interlinking motivation, attitudes and language proficiency.

Key words: *motivation, attitudes, EFL, language achievement, success*

1. Introduction

L2 motivation, which is considered to be an indispensable internal cause of successful foreign language learning, has been a very prolific research topic spanning for more than five decades and encompassing the social-psychological phase (1959-1990), the cognitive-situated phase (during the 1990s), the process-oriented phase (turn of the 21st century) and the current socio-dynamic phase, as identified by Ushioda and Dörnyei (2012) in their overview of the field. The first period is characterized by seminal works of two Canadian social psychologists, Robert Gardner and Wallace Lambert, who claimed that L2 motivation did not only encompass an individual's cognitive and psycholinguistic propensity for language development, but it included the learner's interest in the culture and the people of the target language (integrative aspect) and reflected the pragmatic side of acquiring the new language (instrumental aspect). The second stage of L2 motivation aligned with motivational psychology and situated its analysis in particular educational settings (classrooms) and field. The cognitive-situated phase focused more on irregular nature of motivation during the situation-specific learning process. The third stage looked at dynamic structure of L2 motivation, which is divided into pre-actional (initial or choice motivation), actional (executive) and post-actional (evaluation) phases. This cyclical structure unveiled

shortcomings to the previously dominant linear approach and confirmed the volatile nature of motivation. It also indicated that once motivation was generated in its initial stage it needed to be retained and protected during the executive phase in classroom environment where a lot of internal and situation-specific distractors (such as off-task thoughts, sense of anxiety, peers, peer pressure, physical conditions etc.) constantly threatened to side-track the initial motivation for learning. In the post-actional phase, often termed “motivational retrospection”, learners reflected and evaluated the outcomes of learning. This segment is really important because “the way students process their past experiences in this retrospective phase will determine the kind of activities they will be motivated to pursue in the future” (Cohen, 2010: 170).

Motivational psychologists have looked into what internal motives make learners learn a second language, whereas social psychologists focused on attitudes perceived as “the functions of the social context and the interpersonal/intergroup relational patterns” (Dörnyei, 1994). They have found positive disposition towards the language and its socio-cultural aspects, values, beliefs and attitudinal factors to be among the most important components of choice motivation as well as instrumental and integrative motivation. The central argument about these two types of motivation was first introduced by Gardner and Lambert in 1959 and was later developed in the social-psychological phase. Gardner’s concept of integrative motivation, which consists of “integrativeness”, attitudes towards the learning situation and motivation has had a central role in theoretical inquiry of L2 motivation for five decades, because there is always “some level of willingness to interact with other communities” even when motivation is instrumental (Gardner, 1985 in Dörnyei, 2012: 399).

“Integrativeness reflects a genuine interest in learning the second language in order to come closer to the other language community. At one level, this implies an openness to, and respect for other cultural groups and ways of life. In the extreme, this might involve complete identification with the community (and possibly even withdrawal from one’s original group), but more commonly it might well involve integration within both communities” (Gardner, 2001: 5, in Dörnyei 2009: 23).

While instrumental motivation refers to practical reasons for learning the language, such as getting a job, integrative motivation includes positive attitude toward the target group and willingness to integrate oneself into the target language community.

These two concepts helped explain the rationale behind the initial motivation for learning the language, but the main downside in this conceptualisation was the fact that it could not offer answers as to what happens in specific educational contexts such as in case of English as an international or global language, which lacks specific L2 community (e.g. English as a lingua franca in the EU), nor outline the behaviour direction of an individual in the process of learning.

Further research into motivational components included intrinsic and extrinsic dimensions, intellectual curiosity, need for achievement, linguistic self-confidence, classroom goal structures and other learning environment factors (Dörnyei, 1994, 275-277). These conceptual systems of cognitive theories of motivation have shown that, generally speaking, the higher subjective perceptions of assurance and trust in oneself, the higher the degree of positive motivation. However, despite positive attitudes towards learning, numerous studies have shown that unless there are other positive conditions and concrete action plans such as learner’s active engagement and motivational components specific to learning setting (e.g. quality teaching and teaching methodology), there will be failure in L2 learning (Nikolov’s study in 2001, and Donitsa-Schmidt and Shohamy in 2001, in Djigunović&Bagarić, 2007: 261; Cohen, 2010: 161).

In relation to theoretical background and motivation research explained in this chapter, our attention is directed towards such concepts as the learner's linguistic self-confidence, the learner's interest toward the L2 target culture, instrumentality and milieu as well as learning experience. Zoltán Dörnyei's theory of the L2 Motivational Self-System will help explain the central components of this study.

2. L2 Motivational Self-System

Understanding that L2 motivation does not occur in isolation nor has a clear delineation of where one learning process starts and ends, but is a complex, comprehensive and dynamic process that occurs in relation to diverse individual's internal, social and contextual factors, is what characterizes the current socio-dynamic phase (Ushioda and Dörnyei, 2012, 397-399). By utilizing previous theorization on L2 motivation and linking it to aspects of the psychological research on the self, eminent Hungarian psycholinguist and author of numerous crucial publications on L2 motivation, Zoltán Dörnyei, generated the new theory entitled "L2 Motivational Self System" (Dörnyei, 2005).

There are two major powerful motivational tools in the L2 Motivational Self-System that centre on people's perception of themselves in the future: possible selves and future self-guides. These two concepts originate in an idea developed by Markus & Ruvolo, about a self-system that provides incentive for future action and goal-directed behaviour. The authors claim that by envisioning actions and desired goals through possible selves we are "phenomenologically very close to the actual thoughts and feelings that individuals experience as they are in the process of motivated behaviour and instrumental action" (Markus & Ruvolo, 1989: 217 in Dörnyei, 2009:13). Imagining future goals through the integration of the self brings an interesting tie between motivational psychology and personality psychology, and an important realization that a traditional view of a person's self-concept does not need to relate to the present view of oneself, but to the "possible self", or to the set of attributes one would like to possess to become *the ideal self* (the best case scenario), what one might or ought to possess to become *the ought-to self* (default scenario), or what one is afraid of becoming (the worst case scenario) in the future (Dörnyei, 2009: 11-13). The best (the ideal) and the worst case (the ought selves) scenarios act as central components of the system of future self-guides and are potent motivational factors in L2 learning, since the acquisition of L2 proficiency is the desired state on one's *ideal self*. Furthermore, in the educational setting, the ideal self, which is defined as *Ideal L2 Self*, is closely connected with L2 mastery because of the learner's motivation to become a competent and proficient user of the language, thus constantly trying to reduce the discrepancy between the actual and the ideal selves. Dörnyei explains that this concept equates with Gardner's notion of integrativeness as it encompasses its central components: instrumentality and attitudes towards members of the L2 community. *Ought-to L2 Self* is connected with extrinsic and instrumental motives (duties and obligations imposed by others) where the learner wishes to possess certain attributes in order to avoid possible negative outcomes (e.g. negative grade) and *L2 Learning Experience*, which includes the immediate learning setting: the curriculum, the teacher, the peer group, the teaching materials, the experience of success, among others.

3. Internationalization of English and Erasmus + exchange mobility

Thanks to an increasing level of academic internationalization and the 20% goal of student exchanges by 2020¹, the European student mobility program Erasmus+ has become one the most imminent international and intercultural training programs in the EU. Among many

¹ As agreed by the EU member governments (*Council conclusions on the modernisation of higher education*, 2011, p.10)

other benefits of this program, promoting and developing foreign or second² language skills is certainly one of its specific priorities, because linguistic and cultural knowledge are perceived to be some of the key tools in strengthening personal competitiveness and knowledge capital. English is not a native language in most of the countries where the Erasmus program is conducted, but it is nevertheless a vital means of achieving communication goals in the academia and elsewhere. Precisely because of the global spread of English as an international lingua franca theorization about the languages' integrative and instrumental motivation has become problematic mainly because it has become impossible to clearly identify the target community and culture that language learners want to integrate with. Tomoko Yashima thus introduced the concept of "international posture", which subsumes an individual's desire to connect with the international community, show an interest in international affairs, and possess readiness to interact with people belonging to other nations (Yashima, 2009: 146). Yashima further argues that international posture might lead to generation of possible selves because envisioning the learner's ideal selves, for example, working in an international company or pursuing an international career might help incite the learner's motivation to become self-confident and a proficient user of English. Our study corroborates Yashima's theory that international and intercultural communication of exchange students makes it easier for them to situate themselves in their possible selves, as opposed to those of Croatian learners who have not yet entered the world of international L2 communities and the only time they do is when it becomes visible through the limited educational context of the English language lessons.

4. Aim of the study

There has been no research, known to the authors of this paper, on differences between Croatian and Erasmus learners in relation to attitudes and motivation towards foreign language learning, so the aim of the study is to understand how both groups of students feel about English as a FL/ L2, how they perceive their language learning, what they think of their immediate learning environment and what motivates them to learn the language. The study was conducted in order to compare attitudes and motivation between non-English-major university students who originate from different socio-educational contexts and represent different linguistic and cultural backgrounds, but find themselves in the same educational setting. Besides looking at these aspects from different cultural perspectives and horizons the paper also engages in investigating attitudinal-motivational components between younger and older Croatian students in comparison to Erasmus students.

Between given heterogeneous groups of participants we specifically wanted to embrace individual motivational factors with the social learning environment and compare 1) individual motivational components such as attitude, desire and interest to learn the language, positive disposition towards learning FL, effort in relation to possible selves; 2) international posture, instrumental motivation and social dimension, such as interest toward targeted community and culture; and 3) L2 Learning Experience within immediate learning situation.

4.1 Sample

A total of 129 students divided into three subsamples participated in the study. The 17 Erasmus + students arriving from different EU countries comprise the first group of respondents. The 102 domestic students belong to the second group of first year Croatian students of Information Technology (66) and Mechanical Engineering (35), and the 11 senior

² Foreign language is the additional language besides mother tongue which is normally not spoken in the area where it is taught (e.g. English in Croatia) while second language is used as lingua franca, e.g. English as the means of international commerce, administration and, in places, education in the EU. Typically, L2 Learning takes place in a naturalistic setting and/or through immersion, while FL occurs in formal classroom environment.

year (3rd year) students comprise the third group at the Department of Professional Studies of the University of Split. All participants took some form of English class: 1st year students were enrolled in Business English I, 3rd year students had Technical English and Erasmus students took Business English II. Participants were not evenly spread across groups as there were only 17 Erasmus + students who spent their one semester mobility period as guest students at the time the questionnaire was conducted. Croatian students are regular and part-time students at the Department.

4.2 Instruments

The questionnaire included the demographic data, 20 statements about motivational-attitudinal, integrative and instrumental factors regarding English language acquisition, 8 statements concerning socio-cultural aspects of the language and 8 other statements about the immediate learning experience such as classroom activity, teacher and teaching materials. The second part of questionnaire (attitudes and motivation) contained a five-point Likert scale of likelihood (1=does not apply; 5=completely applies) and a five-point Likert scale was used to describe the level of agreement (1=strongly disagree; 5=strongly agree) in the third (socio-cultural aspect), and the fourth (learning experience) section of the questionnaire. The adopted questionnaire in use was validated by Mihaljević Djigunović and Bagarić in 2007 on a comparative study of attitudes and motivation of Croatian learners of English and German language.

Mann-Whitney U test was used to compare arithmetic means of sequential size of two basic sets. The hypotheses are:

H0: there is no statistically significant difference in the average values of observed variables between the two populations.

H1: there is a statistically significant difference in the average values of observed variables between the two populations.

The usual level of significance is $\alpha = 0.05$. The hypothesis H0 is accepted if the empirical level of significance is greater than the specified limit values for α . Otherwise it is dismissed.

4.3 Procedure

The questionnaire was administered to the three groups of participants during appropriate regular English classes. It was administered in Croatian language for Croatian students and in English for the Erasmus+ students. Qualitative analysis was performed on the collected data using Mann Whitney U test in SPSS.

5. Results

Besides the usual demographic questions in the first part of the questionnaire we looked at an overall number of years of studying English (in and out-of-school), general students' assessment of their English proficiency as well as their expected semester grade.

Table 1: Statistically significant items in the demographic data of the questionnaire

Question:	Erasmus		Croatian learners (1)			Croatian learners (2)		
	Average	Standard deviation	Average	Standard deviation	P - value	Average	Standard deviation	P - value
ITEM 11: Expected semester grade in English:	4,00	0,84	3,47	0,81	0,018*	2,91	0,67	0,003**

* statistically significant at 0,05

**statistically significant at 0,01

As it can be seen from the table the only statistical difference that we have found was in the expected semester grade (ITEM 11). Even though there was no statistically significant difference, it is important to note that 94% of Erasmus students use English outside the classroom, as opposed to 80% of 1st year Croatian students and 72% of senior year students.

Table 2: Statistically significant results of descriptive statistics for the second part of the questionnaire

Question:	Erasmus		Croatian learners (1)			Croatian learners (2)		
	Average	Standard deviation	Average	Standard deviation	P - value	Average	Standard deviation	P – value
ITEM 1. I like English very much.	4,71	0,57	3,96	1,18	0,010*	3,55	0,89	0,001**
ITEM 3. My parents think it is important that I know English.	5,00	0,00	4,37	0,91	0,002**	4,45	0,89	0,009**
ITEM 8. I often fail while learning English.	1,53	0,92	2,45	1,22	0,002**	2,82	1,40	0,014*
ITEM 9. I am afraid of speaking English in class.	1,53	0,78	2,51	1,27	0,003**	2,36	1,49	0,157
ITEM 10. I want to communicate with someone who speaks English.	4,76	0,55	3,87	1,18	0,001**	3,82	1,03	0,009**
ITEM 12. What I learn in this class will be useful in my life.	4,88	0,32	4,11	1,07	0,002**	4,64	0,48	0,128
ITEM 13. I will go far in life.	4,35	0,68	3,83	0,94	0,035*	4,36	0,64	1,000
ITEM 14. Outside of classroom I almost never think about what we have learned in class.	2,18	0,86	3,01	1,19	0,008**	2,55	0,89	0,253
ITEM 15. Realistically speaking, I do not strive to learn English.	1,76	1,00	2,59	1,22	0,010*	2,55	1,16	0,088
ITEM 18. Knowledge of English is of no great value to me.	1,06	0,24	1,46	0,85	0,040*	2,00	1,28	0,011*
ITEM 19. I want to get a good grade in this class.	4,76	0,42	4,36	0,98	0,124	3,91	1,00	0,014*

* statistically significant at 0,05

**statistically significant at 0,01

The results presented above show that there are 11/20 statistically significant differences in the part of the questionnaire that reflects motivational-attitudinal components. These are:

ITEM 1 (I like English very much); ITEM 3 (My parents think it is important that I know English); ITEM 8 (I often fail while learning English); ITEM 9 (I am afraid of speaking English in class); ITEM 10 (I want to communicate with someone who speaks English); ITEM 12 (What I learn in class will be useful in my life); ITEM 13 (I will go far in life); ITEM 14 (Outside of classroom I almost never think about what we have learned in class); ITEM 15 (Realistically speaking, I do not strive to learn English); ITEM 18 (Knowledge of English is of no great value to me); and finally ITEM 19 (I want to get a good grade in this class). We have also tested the learner's effort, commitment to learning, general feeling towards the language and utilitarian purpose of learning the language, without statistical significance among the three groups.

Table 3: Statistically significant results regarding students' attitudes toward socio-cultural aspects of language

	Erasmus		Croatian learners (1)			Croatian learners (2)		
Question:	Average	Standard deviation	Average	Standard deviation	P - value	Average	Standard deviation	P – value
ITEM 1. I enjoy learning about other cultures.	4,81	0,39	3,95	1,04	0,001**	4,18	0,83	0,033*
ITEM 2. I am interested in people who speak English.	4,69	0,58	3,84	0,97	0,001**	4,18	0,72	0,052
ITEM 3. I'd like to be able to use English in different situations.	4,88	0,33	4,33	0,93	0,015*	4,18	1,03	0,040*
ITEM 4. I use English in my spare time.	4,19	1,01	3,87	1,09	0,260	3,00	1,28	0,020*
ITEM 6. I talk to native speakers of the language.	3,75	1,09	3,26	1,31	0,180	2,73	0,86	0,037*
ITEM 7. I read books in English.	3,50	1,22	2,45	1,35	0,006**	2,55	1,44	0,095
ITEM 8. I read daily and /or online news in English.	4,19	0,73	3,64	1,42	0,311	3,09	1,31	0,027*

* statistically significant at 0,05

**statistically significant at 0,01

The results of table 3 illustrate statistically significant differences in all items but item 5, which tested interest in watching movies and TV programs in English. Significant differences were found in: ITEM 1. (I enjoy learning about other cultures); ITEM 2. (I am interested in people who speak English); ITEM 3. (I'd like to be able to use English in different situations); ITEM 4. (I use English in my spare time); ITEM 6. (I talk to native speakers of the language); ITEM 7. (I read books in English) and ITEM 8. (I read daily and/or online news in English).

Table 4: Statistically significant results about learning experience

	Erasmus		Croatian learners (1)			Croatian learners (2)		
Question:	Average	Standard deviation	Average	Standard deviation	P - value	Average	Standard deviation	P – value
ITEM 1. I enjoy coming to English classes.	4,50	0,61	3,13	1,08	0,001**	3,36	0,88	0,001**

ITEM 2. I find classroom activities interesting.	4,38	0,70	3,47	0,99	0,001**	4,55	0,50	0,618
ITEM 3. I feel the teacher wants me to do well in this class.	4,81	0,39	4,26	0,77	0,005**	4,55	0,50	0,143
ITEM 4. Our textbooks are bad.	1,69	0,85	2,15	1,01	0,080	2,91	0,90	0,003**
ITEM 6. My English classes are boring.	1,69	0,68	2,38	1,06	0,012*	1,82	0,83	0,749
ITEM 8. My English language teacher is motivating.	4,69	0,46	4,17	0,84	0,019*	4,45	0,66	0,381

* statistically significant at 0,05

**statistically significant at 0,01

The results of the table above confirm significant statistical difference in 6 out of 8 items as regards the learning experience. These are: ITEM 1 (I enjoy coming to English classes); ITEM 2. (I find classroom activities interesting); ITEM 3, (I feel the teacher wants me to do well in this class); ITEM 4 (Our textbooks are bad); ITEM 6. (My English classes are boring); ITEM 8 (My English language teacher is motivating). Learning capabilities and willingness to learn were not significantly different among the three groups.

6. Analysis

As the overall results demonstrate the advantage of Erasmus student exchange is clear in the majority of the tested items. Erasmus students expect better grades in English, like English more, consider the language important, fail less while learning, are not as afraid of speaking the language and are more eager to communicate in English. They also believe that what they learn in an English class will be useful in their life, as do their parents, as opposed to younger Croatian students who are less optimistic about their future prospects. Junior Croatian students do not strive to learn English too much, nor find great value in knowing English. They are also afraid of speaking the language. Senior Croatian students think it is important to get a good grade in English and this might be because they are approaching the end of their studies and are more pragmatic and career oriented. Regarding cultural aspects, Erasmus students surpass Croatian students in factors of integrative motivation. They are generally more interested in people who speak the language and they make use of the English language in different forms in their free time (e.g. talking to strangers, tutoring, talking to other exchange students, traveling, working abroad). Similarly, results concerning learning experience go in favour of Erasmus students who enjoy coming to English classes, find classroom activities interesting, feel the teacher wants them to do well and is motivating. On the other hand, younger Croatian students feel that their English classes are boring and senior Croatian students find their textbooks bad.

When taking into consideration the factors we wanted to analyse, we conclude that regarding 1) attitudinal-motivational aspects, generally speaking, Erasmus students show a more positive attitude towards the L2 language. *A propos* section 2), which concerns social-cultural spheres, we infer that Erasmus students show a higher international posture than that of Croatian students. Furthermore, exchange students report larger gains in the classroom experience, as demonstrated in section 3.

7. Discussion

Our analysis has showed that Erasmus students differ in their attitudes and motivation towards the English language from their Croatian peers, especially from younger ones. Of particular importance is the fact that foreign exchange students demonstrate significant statistical differences on majority of tested elements in the three tested areas: attitudes and motivation, instrumental motivation and social dimension and educational setting.

These results raise the question of why the Erasmus students have such significantly different levels of motivation and positive attitude towards learning the L2. We would like to suggest that there are several crucial reasons for that:

1) Erasmus exchange students possess higher propensity for international posture which is stimulating and contributes to students' self-efficacy, linguistic self-confidence and motivation. They also (consciously or unconsciously) understand the instrumental and integrative importance of L2 motivation as they are key tools in achieving the Ideal L2 selves of increased language proficiency. Unlike their Croatian peers, exchange students value the importance of communication in English as it is often the only means of communication between them and the foreign community they are placed in. A critical moment in relation to L2 is the instant when English becomes a means to achieve a communicative goal (as it has become for Erasmus students) rather than a tested and graded school subject (majority of Croatian students).

2) Higher recurrence of English use outside of the classroom context grants a solid platform for exchange students to envision their English using selves communicating in an international arena. Regular and usual participation in an international L2 community makes it easier for learners to imagine themselves as Ideal L2 selves. On the other hand, those students who are not frequently involved in communication in English will find it harder to connect to their Ideal L2 self-image. Furthermore, the Ideal L2 self-image functions not only as a strong incentive for further study and more proficient communication in L2 in various contexts, but helps students conceptualise model image of themselves in interaction with the world.

3) Erasmus students have freely chosen to participate in the learning process and have chosen to take an English course themselves while Croatian students are forced to take English courses as these are an obligatory subject in their field of studies. This could explain the higher level of instrumental motivation of Croatian students in obtaining good grades in the course, junior students' negative attitudes towards the English classes and seniors' towards textbooks. On the other hand, exchange students might value support and motivation obtained by the teachers during the obvious process of their language development.

Even though the present study reveals substantial differences between the three subgroups of partakers, a more thorough research corroborating our thesis that the Erasmus student exchange program endows its participants a higher level of international posture that helps motivate students to enhance English language proficiency and have a more positive attitude towards learning the L2 is still needed. However, one thing is certain: strengthening English language skills and meta-skills within this concept of exchange mobility is the key component of a knowledge society, particularly on an EU scale. By definition, the majority of Erasmus students embrace the globalized world of cultural diversity and transnational shared practices, values, norms, behaviours, cultures and patterns; values which will provide the right framework and be useful throughout their entire life-course including their entry into the labour market. The present study has shown that the positive image of their Ideal L2 selves shapes their engagement in learning and empowers them to mediate their own self-concepts with the world around them.

Having the findings of this paper in mind we should reinforce exchange mobility and provide a greater involvement of Croatian students in Erasmus programs. While the Croatian youth

needs to take a more positive attitude and become active agents of their learning, educators should provide incentives in helping them sustain visions of their linguistic possible selves as well as create such classroom momentum to maintain their motivation for L2 learning. We believe that bringing a positive shift in students' self-perception of themselves as capable language learners, promoting contact with the international community and developing learners' instrumental motivation, all the while preserving national identity and cultural diversity within the European mosaic of cultures, should become a common classroom practice. This study confirms that student exchange is a powerful motivator for L2 learning. It might also prove to be the crucial transformational experience for Croatian students influencing their attitudes and motivation toward the English language.

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Do gender and age impact student success?

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Abstract. The paper presents results from the study investigating impact of gender and age on students' academic success. Students from Department of Professional Studies, University of Split, Zagreb teaching centre, who attended 2008/2009, 2009/2010, and 2010/2011 classes participated in our study. Fischer test and t-test were used to analyse the data in Microsoft Excel. Although results show that female students have higher grade point average in 30 out of 34 subjects, statistically significant differences were found in 8 subjects. The sample was split in younger (under 30 years of age) and older (over 30 years of age) groups and results show that older students have higher grade point average in 28 out of 34 subjects. Statistically significant differences were found in 9 of these subjects.

Key words: *age and academic achievement, gender, age, academic performance, economics students*

1. Introduction

Scientists around the world are trying to determine the parameters that affect the academic performance and thereby improve the education system. Numerous studies indicate the existence of differences in achievement based on gender and age. Results indicate that female students achieve higher academic achievement from young age (kindergarten) to university level studies in all subjects, including mathematics and natural sciences (Mickelson, 1989; Perkins, Kleiner, Roey and Brown, 2004). At the same time, several test of knowledge administrated internationally indicate that boys perform better on standardized math tests while girls achieve better educational results in reading and language tests (Baker and Jones, 1993; Beller and Gafni, 1996; Gallagher and Kaufman, 2005).

Lifelong learning extends through all stages of life and motivation for learning is being triggered by changing mental functions and life priorities. These changes subsequently enhance or inhibit ability to memorize and learn. Researchers have also established certain differences in information processing and memorization between younger and older individuals. In addition, research has identified different levels of motivation for learning that differentiates younger and older individuals (Pastuović, 1999).

After the introduction there is a discussion of differences between male and female students. Next, a discussion of differences between younger and older students follows. This is followed by methods section and then by results. The conclusion offers some implications of research study.

2. The differences between female and male students

According to the results of PISA conducted in 2012 in Croatia, boys achieve significantly better results than girls in mathematics while girls are more successful in reading (OECD, 2012). Studies also suggest that gender differences are the weakest at the beginning of schooling and while boys advance faster in mathematics during their schooling, girls advance faster in literacy and reading ability (Maccoby and Jacklin, 1974; Hyde, Fennema and Lamon, 1990; Willingham and Cole, 1997).

Table 1 below illustrates the distribution of Croatian university alumni by gender. The source of this information is the Central Bureau of Statistics of the Republic of Croatia and their publication *Women and Men in Croatia in 2015*.

Table 1 University graduates

Year	University graduates by gender %	
	Female	Male
1960.	31,8	68,2
1970.	46,1	53,9
1980.	44,6	55,4
1990.	53,7	46,3
2000.	55,6	44,4
2007.	58,1	41,9
2008.	58,7	41,3
2009.	58,6	41,4
2010.	60,8	39,2
2011.	58,5	41,5
2012.	59,5	40,5
2013.	58,9	41,1

Source: Central Bureau of Statistics of the Republic of Croatia

Data shows that in the last 50 years women almost doubled its share of the population who graduated from institutions of higher learning. In 1960 women made up 32% and in 2010 they were 61% of all university graduates. During the last decade women make up about 52% of the total Croatian population (Croatian Bureau of Statistics, 2015) and Table 1 shows that the proportion of female college graduates is greater than female share in the overall population. With this it can be concluded that women are more successful in terms of successful completion of university studies.

There are large gender representation discrepancy based on subject of study at the university level. Table 2 shows the distribution of graduates by gender with an area of study with predominant female participation (social services), an area of study with predominant male participation (computer science), and an area of study encompassing students from this

research study (social science). It is evident that certain areas of studies attract one gender more than other so it could be expected gender-driven tendencies toward individual courses.

Table 2: *University graduates according their area of study – 2013.*

	University graduates by gender %	
	Female	Male
Total	58,9	41,1
Social services	96,0	4,0
Social science	70,0	30,0
Computer science	16,4	83,6

Source: Central Bureau of Statistics of the Republic of Croatia

3. The differences between younger and older students

Studies show that older adults are less successful in storing information than younger adults. In addition, older adults do not organize information as efficiently as younger adults (Craik, 1979; Craik & Rabinowitz, 1984). In terms of time management, some studies have shown that older students have better time management skills (Trueman and Hartley, 1996). Another fact that goes "in favor of" older adults is the amount of prior knowledge. The amount of prior knowledge grows throughout life and improves cognitive abilities so that older adults use their knowledge and skills in solving everyday problems better than younger adults (Tversky and Kahneman, 1981; Neimark, 1982).

Department of Education shows that only 0.6% of people over the age of 35 take part in some form of professional development in Croatia while the EU average for the same age group is about 10 times more. Such numbers lead to the conclusion that Croatian citizens are not inclined to change professions.

The results regarding labor survey "Croatia 2014 - Europe 2014" show the percentage of adults age 25-64 participating in professional development and training. Table 3 shows the results of three countries: Croatia, Denmark – due to the largest percentage of the population participating in professional development and training and Romania – due to the lowest percentage of population participating in professional development and training.

Table 3: *Life-long learning(adult age 25-64 participation in education and training)*

Country	Total %		
	2012	2013	2014
Romania	1,3	1,8	1,5
Croatia	2,8	2,9	2,5
Denmark	31,6	31,4	31,7

Source: Bureau of Statistics of the Republic of Croatia

Individuals in this report participated in professional development and training within four weeks of the survey.

4. Data and research method

The subject of this research study is the influence of gender and age on the success of male and female students in mastering the material from 34 subjects. Success was measured by examining test scores students received in these 34 subjects. The study was conducted in 2013 and the data collected was from students enrolled in Department of Professional Studies, University of Split, teaching center Zagreb in the academic year 2008/2009, 2009/2010, and 2010/2011. Students were majoring in Accounting and Finance, three year study.

The main objectives of research are to:

- establish whether different genders (male vs. female) perform differently in any of the 34 subjects examined and if these differences are statistically significant.
- establish whether different age groups (younger vs. older) perform differently in any of the 34 subjects examined and if these differences are statistically significant.
- establish whether gender of students contributes to difference in success in different academic years

In this study there are used null hypothesis:

H1: There is no statistically significant difference in the academic success of students of different genders.

H2: There is no statistically significant difference in the academic success between older (over 30) and younger (under 30) student groups.

The differences between groups were tested with t-test which aims to establish any significant difference between the measured variables. F-test (Fisher's exact test) is used first to test the hypothesis of equality of two population variances.

5. Results

5.1. The influence of gender on student success

87 female and 38 male students were randomly selected to participate in this study. All of them were students at the Department of Professional Studies, teaching center Zagreb, enrolled in classes in 2008/2009, 2009/2010, and 2010/2011. They all majored in Accounting and finance. Gender breakdown is shown in the Figure 1 below.

Only students who received passing grades for their classes were included in the study. Students who failed the exam or failed to take the exam were excluded from the study. Three elective courses (Business Communication, Entrepreneurial Strategy, and Stock Market Management) were excluded from analysis due to the small number of students who attended courses.

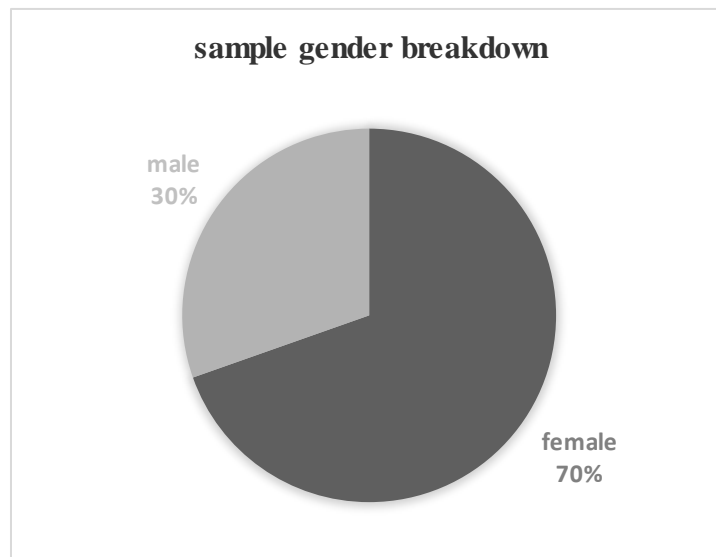


Figure 1 Sample gender distribution
Source: Authors

After the completion of the F-test and t-test the following results have been received:

Table 4 Combined display of the differences in academic success between female and male students

	Subjects (classes)	p-value	Grade point average	
			Male	Female
1	Introductory accounting	0,0608	2,89	3,25
2	Introductory economics	0,0138*	2,76	3,33
3	Business mathematics	0,0030*	3	3,94
4	Computer information systems 1	0,7713	3,64	3,71
5	Management	0,4334	3,15	3,42
6	Business English 1	0,5041	4,03	4,17
7	Accounting	0,0071*	2,63	3,48
8	Introductory finance	0,2741	2,77	3,11
9	Business statistics	0,1166	3,11	3,58
10	Commerce Law	4,71E-05*	2,56	3,45
11	Computer information systems 2	0,1100	3,8	4,15
12	Business English 2	0,2003	4,04	4,31
13	Financial accounting 1	0,3665	3,11	2,69
14	Managerial accounting	0,0217*	3,53	4,14
15	Cost accounting	0,8713	4	4,07
16	Finance for businesses 1	0,3082	3,33	3,59
17	Revision	0,4633	2,86	3,04
18	Finance for businesses 2	0,4475	3,21	3,46
19	Payments	0,2085	3,27	3,70
20	Bank accounting	0,0022*	3,21	4,30
21	Accounting information systems	0,0008*	3,29	4,24
22	Business marketing	0,0004*	3,18	4,21
23	Entrepreneurial design	0,5107	4,33	4,55
24	Entrepreneurial infrastructure	0,8238	3,5	3,64

25	Internship	0,1425	4,67	4,87
26	Financial accounting 2	0,7073	3,5	3,25
27	Entrepreneurship	0,4815	4,25	4,46
28	Income tax	0,1829	4,57	4,06
29	Cash flow accounting	0,5841	2,88	3,12
30	Italian language	0,9610	4,88	4,87
31	German language	0,7310	4,67	4,78
32	Public procurement	0,4793	4,25	3,96
33	Insurance and reinsurance	0,3141	3	3,70
34	Value added tax	0,5675	4,67	4,41

* statistically significant difference ($p < 0.05$)

Source: Authors

It is evident from Table 4 that female students had a higher average score in 28 out of 34 classes, however, statistically significant difference ($p < 0.05$) between genders were found in 8 courses: Introductory economics, Business mathematics, Accounting, Commerce law, Managerial accounting, Bank accounting, Accounting information systems, and Business marketing. For those 8 classes it may be rejected the null hypothesis and conclude that the female students performed better academically. Male students had a higher average score in 6 out of 34 classes, however, none of these 6 cases was significantly different from female student group. Consequently, it can be concluded that female students performed significantly better in 8 classes while in the remaining 26 there is no difference found between male and female student performance.

5.2. The interaction between gender and year of study

After the division of all classes by the year when students are enrolled in them and separated students by gender the average grade was calculated for each gender and for each academic year. It was done to examine whether gender differences in academic performance depend on student's year of study.

Table 5 Interaction between student's gender and year of study

	First year		Second year		Third year	
	male	female	male	female	male	female
Number of successfully finished classes	253	726	135	505	55	351
Grade point average	3,26	3,69	3,37	3,80	4,13	4,12
T-Test	$p < 0,05$		$p < 0,05$		$p > 0,05$	

Source: Authors

Results from Table 5 indicate that grade point average rose from year to year for both genders.

Based on the results of the t-test it can be concluded that first- and second-year female students performed significantly better academically than their male colleagues. There are no significant differences between genders for the third-year students. Another interesting issues that's illustrated by the table is the diminishing number of classes male students finished successfully as a percentage of all finished classes. As a first year students males finish 26% of all finished classes and as a second-year this number goes down to 21%. Finally, as third-

year student males finish only 14% of all completed classes. This leads to conclusion that males give up on university studies more often than females. On a positive note, the ones who stay committed to their studies perform equally well as their female colleagues.

5.3. The influence of age on student success

In order to evaluate whether age contributes to differences in academic success student sample was divided in two groups. The first group included students who are 30 or younger. The second group consisted of individuals who were 31 and older. 74 students were part of group one (30 or younger) and 51 students were in the second group (31 or older).

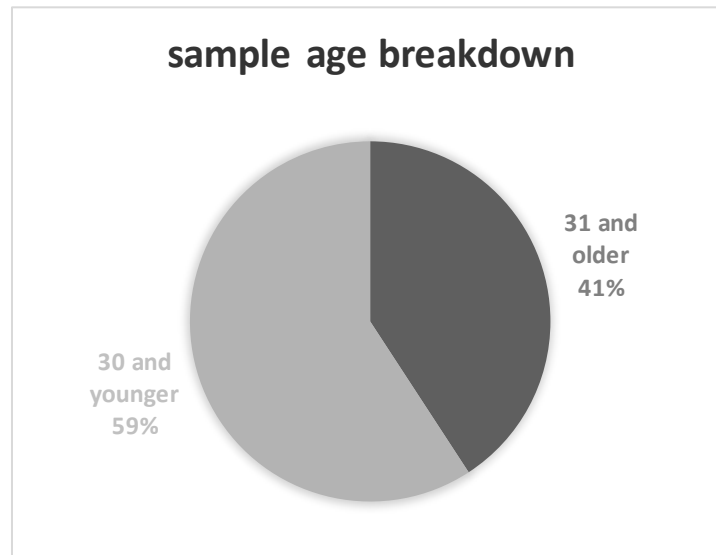


Figure 2 Sample age distribution

Source: Authors

After conducting F-test and t-test results displayed in Table 6 emerge.

Table 6 Combined display of the differences in academic success between younger and older students

	Subjects (classes)	p-value	Grade point average	
			30 and younger	31 and older
1	Introductory accounting	0,1280	3,05	3,30
2	Introductory economics	0,0303*	3	3,42
3	Business mathematics	0,1867	3,55	3,87
4	Computer information systems 1	0,8142	3,67	3,72
5	Management	0,0009*	2,91	3,89
6	Business English 1	0,0890	4,27	3,93
7	Accounting	0,0723	3,05	3,55
8	Introductory finance	0,0118*	2,72	3,39
9	Business statistics	0,0288*	3,21	3,77
10	Commerce Law	0,0761	3,02	3,42
11	Computer information systems 2	0,0000*	3,73	4,47

12	Business English 2	0,3294	4,31	4,13
13	Financial accounting 1	0,3225	2,91	2,65
14	Managerial accounting	0,000*	3,62	4,43
15	Cost accounting	0,6926	4	4,11
16	Finance for businesses 1	0,0746	3,36	3,73
17	Revision	0,5519	3,05	2,94
18	Finance for businesses 2	0,0110*	3,09	3,76
19	Payments	0,0697	3,38	3,86
20	Bank accounting	0,0407	3,72	4,35
21	Accounting information systems	0,0693	3,82	4,27
22	Business marketing	0,0662	3,67	4,21
23	Entrepreneurial design	0,8000	4,55	4,5
24	Entrepreneurial infrastructure	0,3763	3,44	3,86
25	Internship	0,3102	4,77	4,88
26	Financial accounting 2	0,1804	2,93	3,48
27	Entrepreneurship	0,0057*	4,17	4,71
28	Income tax	0,1058	3,9	4,36
29	Cash flow accounting	0,0270*	2,68	3,39
30	Italian language	0,1152	4,8	4,95
31	German language	0,5490	4,67	4,83
32	Public procurement	0,3161	3,82	4,11
33	Insurance and reinsurance	0,9913	3,64	3,63
34	Value added tax	0,1531	4,18	4,58

* statistically significant difference ($p < 0.05$)

Source: Authors

It is evident from Table 6 that older students had a higher average score in 28 out of 34 classes, however, statistically significant difference ($p < 0.05$) between age groups were found in 9 courses: Introductory economics, Management, Introductory finance, Business statistics, Computer information systems 2, Managerial accounting, Finance for businesses 2, Entrepreneurship and Bank accounting. Since older students had better grades in these 9 classes it may be rejected null hypothesis. Younger students had a higher average score in 6 out of 34 classes, however, none of these 6 cases was significantly different from older student group. Consequently, it can be concluded that older students performed significantly better in 9 classes while in the remaining 25 there is no found difference between older and younger student performance.

Another age division was explored to evaluate the impact of age on academic success. To evaluate previous results the students were separated in younger group (35 and younger) and older group (36 and older). 96 students were in the first group and 29 were in the second group.

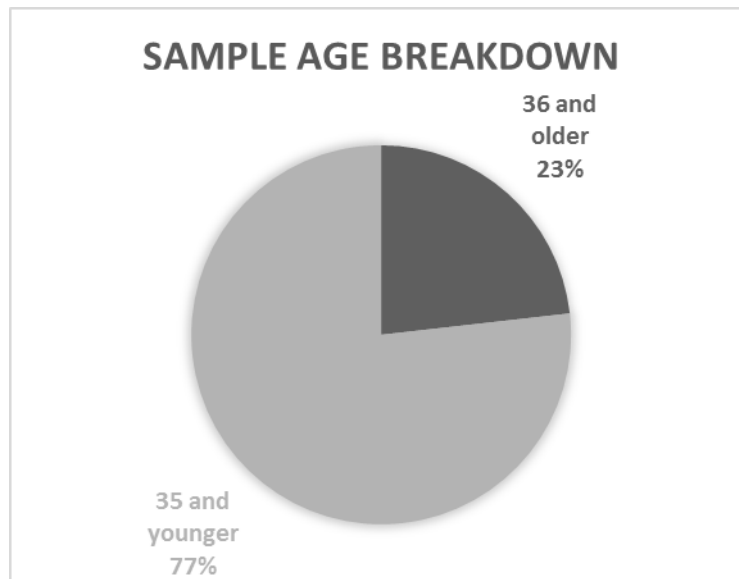


Figure 3 Sample age distribution 2

Source: Authors

Results from this additional comparison of younger and older age group support earlier results. Older group had a higher average score in 26 out of 34 classes, and once again, statistically significant difference ($p < 0.05$) between age groups were found in 9 courses: Introductory economics, Management, Computer information systems 2, Managerial accounting, Entrepreneurship, Introductory accounting, Commerce law, Finance for businesses 1, and Business marketing. Students 35 and under had a higher average grade in 7 out of 34 classes, however, none of these 7 cases was significantly different from older student group. Subsequently, it can be concluded that younger student group did not outperform older student group in any of the subjects, while older student group did outperform younger group in 9 classes. Although composition of classes slightly changed in two different age-driven split of the sample, older student group showed consistently higher academic success compared to their younger colleagues.

6. Conclusion

This research finds that female students performed better in 8 courses: Introductory economics, Business mathematics, Accounting, Commerce law, Managerial accounting, Bank accounting, Accounting information systems, and Business marketing. Male students did not significantly outperform their female colleagues in any of the 34 classes.

Women are on average more sensitive and more introvert than members of the male population. As there is no difference in the average intelligence between genders, superior academic performance of women can be explained by better attendance of classes, maintaining better attention during classes, and studying regularly (Pastuović, 1997). Character of the person plays a major role as well.

Research conducted by the Scandinavian scientists with students of business administration did not find any evidence of gender differences in academic success except in statistics where female students outperformed their male colleagues (Busch, 1995). In some other studies research finds significantly better performance of female students in classes saturated by verbal content (Geffen, Moar, O'Hanlon and Clark, 1990).

Additionally, this study shows that students age 31 and older perform significantly better than their younger colleagues in 9 classes: Introductory economics, Management, Introductory finance, Business statistics, Computer information systems 2, Managerial accounting, Finance for businesses 2, Entrepreneurship, and Bank accounting. Similar results emerge from dividing sample in 35 year olds and younger group and an older group. Once again older group of students performed better in 9 classes: Introductory economics, Management, Computer information systems 2, Managerial accounting, Entrepreneurship, Introductory accounting, Commerce law, Finance for businesses 1, and Business marketing. This finding refutes conventional wisdom that older students lack learning skills and are unable to master new materials. Similar results are found by Richardson (1995). He concludes that the older students achieve significantly better results in understanding the material, while they were weaker in material reproduction.

Knox (1977) concluded that the majority of middle-age adults can learn as successfully as younger adults, assuming equal motivation for education. Since motivation is the driving force behind human behavior it is possible to achieve better results when motivation is higher. Motivation differs between younger and older students since they differ in where they are in their life cycle. Needs and motivation change over life time and are driven by cognitive, social, and emotional factors.

Some motives driving adult education are career development, expectations of others (eg, the employer), and economic motivation. Younger adults are mostly motivated by professional reasons while middle aged adults develop various pragmatic motives (Pastuović, 1999). The study analyzed the impact of gender and age on academic success without including factors like socioeconomic status and environmental drivers which should be addressed by future studies and is a limitation of this research.

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The models of analysis of the media industry and Croatian media modernism

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Abstract. The aim of this paper is to compare the trends in the development of the modern media industry with the development trends of Croatian media companies. The rapid development of the media industry is linked to the end of Keynesianism and the liberalization of the global economy. Scientists from the fields of media approached the study of media in two fundamental aspects. The model study is divided into a critical approach, a closer study of the media from the perspective of political economy, and economic approach, closer to studying media from the position of political economy, and an economic approach, closer to studying media from the aspect of media economy and media management. With the development of a post-industrial society and the globalization of the media industry, the firm borders between various categories of the media industry have disappeared. The convergence and digitalization of production processes enabled the distribution of content to several different platforms. The technological development also enabled a process which became known as fogged borders, and the firm borders which bordered corporations, markets and entire industrial branches began to fade. All of this has resulted in a phenomenon which scientists recognize as a society of media spectacle. The Croatian media industry followed the initial trends of technological development. The digitalization of production processes developed the assumption of the distribution of factors that create the effect of society spectacle. The global financial crisis and recession stopped further positive trends of technological advancement in Croatia.

Key words: *financial management, communication studies, media industry, publishing, postmodern*

1. Introduction

The development of the media industry, in its early days, is associated with Gutenberg's invention of the printing press and the development of publishing. The Industrial Revolution and the adaptation of the steam engine to a table with movable letters would cause a revolution in publishing. Radical Innovation in printing technology will mark the end of the scholastic and the beginning of modernity. At the same time Enlightenment will develop and bring irreversible changes in social relations. The media industry was born in the cradle of modern, but its full maturity is achieved in the twenty-first century and the era of postmodernism.

Approaches to the study of the phenomenon of the media industry in the twenty-first century will make a sharp shift from the practice in modern. Such an approach will be especially emphasized after the 1990's and the digitization of manufacturing processes. Kung (2013: 6)

points out that the 1980's and 1990's were characterized by liberalization of the market, deregulation and globalization, and scientists were most focused on researching industrial structure and the rapid growth of corporations. Digitization and the convergence of production processes realized conditions for the distribution of the same content to different media. Smith and Hendricks (2010: 5) point out that technology has always been closely associated with the world of media. New technological solutions and devices were simply what people must have.

At the same time, the environment of the media industry is constantly expanding and opening new horizons that are becoming a market target of media corporations. Stacey (1991: 125) notes that only part of the boundary or fence between the organization and the environment created from the organization itself, which implies that the borders are not fully defined and sharp and are partially obscured. This created conditions for the development of media corporations whose borders of business activities cannot be clearly defined. Problems that are put before the management of media corporations require comprehensive knowledge ranging from finance and management to knowledge of specialized technology skills. In addition, the problem of management and leadership require special management skills of management teams comprised of experts from completely different fields of science. Daft (2015: 274) notes that this leads to blurred boundaries and hierarchical power and authority in making management decisions

When placing content on the market, the media industry has a specific impact on society and social processes as a whole. The study of media from social relations gives it a whole new dimension. McLuhan, in the mid-twentieth century, saw the media as an extension of the human senses. Marchand (1989) points out that McLuhan was more than original in his provocative attitudes. The basis for this claim came from the famous McLuhan's dictum "the medium is the message". The media create new patterns of thinking and behavior. Looking at the past, McLuhan observed that individuals and the communities were designed by the dominant media of the time.

With the development of a comprehensive media market, conditions were created with blurred boundaries between the real world and the one that is formed under the influence of media. The media industry will give a dominant contribution to the creation of a spectacle society in the postmodern. McLuhan's saying "media is a message" suggests that the fundamental role of the media is not its content, but the way it shapes our perception of the world around us. Baudrillard has developed this theory with a very pessimistic accent, and in "the theory of simulacra," pointed out that the media forms the way society works, perceives events and defines the general culture of the society. According to Baudrillard, what we see, hear or learn in the media, becomes our everyday life (BAU 2014: 245).

The primary task of the management is to increase the value of organizations and thereby create added value for owners, shareholders and other interested parties in the business process. The management of organizations must anticipate and align the processes of environment with the resources of the organizations so the final product, and with media organizations this is the content, would find its way to the consumer who buys it. According to financial results that are cited in this part of the business process, the US media corporations are convincingly the best. However, in addition to financial results, as well as performance indicators to shareholders, American corporations have a dominant influence on the creation of media images on the geographical areas where they operate.

2. Approach models for studying the media industry

The basic model approach to the study of the media industry is between two basic approaches of the study of the media phenomena. On one hand, the emphasis is on the study of economic factors that determine the operations of media organizations. On the other hand, the emphasis

is on the study of power and the creation of influence through the media on social groups and society as a whole. The model is shown in Figure 1.

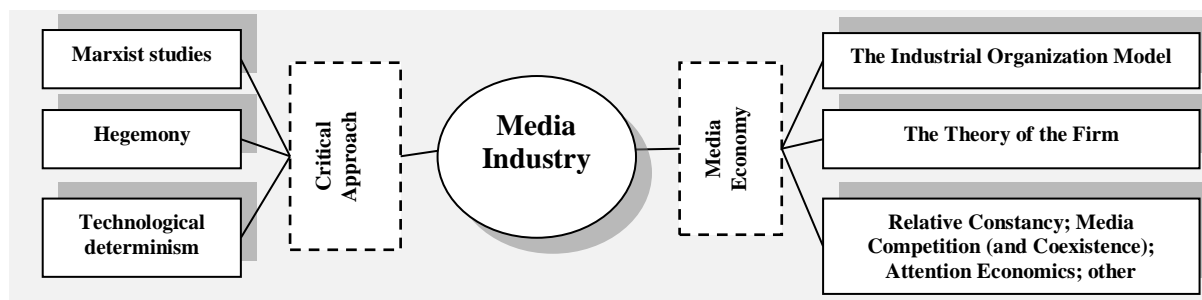


Figure 1: Approach models for studying the media industry

Source: Albarran, 2010, 22 (own illustration)

Models that are based on the study of the media industry through the analysis of financial data and economic performance of business media organizations are theoretical and applied models. The theoretical model was created by traditional neoclassical economics and analyzes the behaviour of consumers, businesses and relationships within the given market through supply, demand price level, flexibility, concentration in the industry and so on. The applied model is built on a theoretical model, it is expanded and analyzes the strategy of the organization its implementation within the industrial framework. They are divided into two basic research approaches and several smaller ones as derivatives to the fundamental approaches. Two basic approaches are: a model of industrial organization and the theory and model enterprises, and derivatives of the existing are: the model of relative stability, media competition (and cohabitation), the economic model of attention and other models (Albarran, 2010: 21).

Models that are based on theoretical and applied approach emerged on positivist tradition. They have developed mainly in Anglo-Saxon countries and traditions were created on the basis of the mathematical statistical approach to the study of the media industry. The model approach to the study of the media on the basis of tradition of political economy moves its focus of study from a purely positivist approach to a critical approach to the study. A critical approach is based on a study of the impact of media on the target audience, the creation of media monopolies of global media corporations, on the impact that the media has in different social groups, different cultural influences in society and the like. Albarran (2010: 27) divides them into: a tradition of Marxism, hegemony and technological determinism.

2.1. The model of an industrial organization

The model of an industrial organization is a traditional model by which scientists determined the relations within various industrial markets. With the development of the media industry, the model began to be applied to this industry as well. The model consists of determining the various parameters which indicate the number of competitors within selected markets and their mutual relations.

The model of industrial organization is known as the S-C-P model (Structure-conduct-performance). It was first mentioned by Bain (1959) in the book *Industrial Organisation*. Bain's market analysis was directed towards the study of monopolies and oligopolies and efficiency of business performance in given conditions. To get an answer to these questions, it was necessary to analyze the structure of the market, the performance of individual businesses and results of operations in order to compare the results of individual business entities within the set framework (Harris, Hunter, Lewis 1995: 98). Somewhat later, Bain and Maisson developed the S-C-P model, and connected the oligopoly theory with the theory of differentiation of businesses. Based on the results of empirical research of a large number of

businesses, they have proven that the structures and relationships in the market are dominant in the business decisions of individual participants in the market and they do not have the strength to counteract the dominant role of the market (Hovenkamp 2015: 214). The S-P-C model has been developed and supplemented over the years. Several important authors participated in the development of the model, and the most famous of them was Michael Porter. An already existing model was the framework within which Porter was to develop: 1. A model of five competitive forces; 2. A model of generic strategies; 3. Model of maps of strategic groups (Barney, Hesterly 2006: 128).

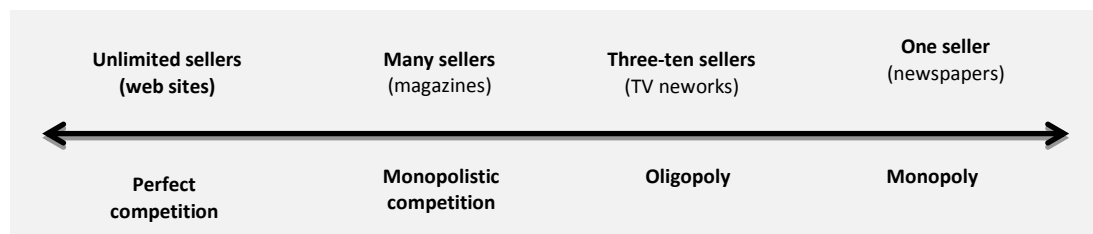


Figure 2 The Theory of the Firm – Market Structure
Source: Albarran, 2010., 23.

Figure 2 shows a simplified model of industrial organization for the media industry. The model ranges between two extremes: perfect competition on one side and monopolies on the other side. The principal objection to this model is that it simplifies relations on the market too much. The model was developed at a time of relatively stable relations in the market and it relies on an equal or relatively predictable number of competitors within the model. After the fundamental relationships in the market are determined, the study of the behavior of buyers and sellers in the market is then approached. Studying the process in the market concentrates on five basic factors: pricing policy, product strategy and advertising, research, investment and compliance with legal legislations (Albarran 2010: 22).

The performance of the market is defined as coordinating the offer of the supplier in relation to the demands of the customer. The four basic criteria are: production efficiency in relation to the size of the organization, the amount of profit, the ratio between production costs and marketing costs, advances in research and development (Harris, Hunter, Lewis 1995: 98). The final step in using the model of industrial organization includes an analysis of the overall performance of the market. In measuring performance, the emphasis is on financial performance, usually comparing competitors within the same market or the overall industry. Financial variables obtained by analyzing the performance of businesses are used to analyze the performance of the overall market (Albarran 2010: 22).

Figure 2 shows only four categories of the media industry which are viewed separate from each other. Today it is difficult to separate different categories of the media industry because of the development and distribution of the same content through multiple platforms. Another fundamental objection to this model is its static nature. Especially after the 90's and digitization, the changes in the media market, in terms of the number of competitors within certain categories of the media industry, were constant and very dramatic. With the development of vertical media organization, through vertical integration and diversification, especially after the great wave of takeovers and mergers, there have been frequent changes of attitude in certain markets and the redistribution of the total market

2.2. The company theory model

The previously mentioned weaknesses of the model of industrial organization have led scientists to further develop the model. The company theory model, in its essence, is a continuation of the model theory of industrial organization. The static nature of the model of industrial organization, as one of its fundamental weaknesses, was particularly emphasized in

the process of digitizing and the completion of convergence of the media industry. Vertically integrated media corporations changed the initial structure of distribution and, within their own value chains, developed different categories of the media industry.

The company theory model was created as a product of efforts used to determine the primary objectives and reasons for the existence of production organizations. With time, the theory of companies adapted to the changes of the environment and changed the focus of the study. Cantillon already in 1755 opened the first discussions of the tasks of organizations, but the focus of his study was more focused on the entrepreneurial process than a company organized as a production operator. Adam Smith will be remembered as the most important pioneer of research in this area. He was the first to point out the benefits that division of labour and specialization within an organization brings to the total community. According to Smith, the reason for the existence of an organization is to coordinate and motivate the specialization of human economic activity (Mantysaari 2012: 6).

Marx will follow Smith's theory of labour division in order to turn the focus of the study on the distribution of work results. The classical economic theory from the Smith period will then give room to neoclassical theories of the late 19th and early 20th century. Behavioural models and the system theory will be developed through the achievements of Taylorism to the theory of excellence. What is common to all these developmental theories is that they come from modern and study the organization as a manufacturer of physical products with a clear boundary of the production activities. The post-modern and post-industrial society will delete the clear boundaries of organizations and their environment. The company theory model will experience drastic changes, especially if this is reflected in the case of media organizations.

Modern media corporations through the process of taking over and merging have created new relationships in the media market. Time Warner is the result of the merge of Time Inc. and Warner Communications. The publishers of the magazine, as part of the media industry which was already in its mature stage, joined up with a company providing high technology services. The complete business operation resulted in a completely new form of business strategy. Everything was moved to the network, a joint effort developed a whole range of new categories of media industry within the associated corporations. While the theory of industrial organization model built its foundation on the macro approach, the company theory model moved its focus of observation to a micro approach.

2.3. Marxism and the critical theory

The model of political economy, in the tradition of Marxism, is moving away from the tradition of classical and neoclassical economic doctrine. According to the tradition of Marxism, the focus of the study is moving away from studying the results of the system, towards the causes and consequences of the operation of the system. In search of a better understanding of how the capitalist system is developed and what will happen to it in the future, Marx lays the foundation two key theories, historical and dialectical materialism. The first seeks to explain the laws of historical development, and the second to explain the law of international contradictions of capital (Dewdney, Ride 2014: 19).

The Marxist political economy provides a historical analysis of the development of capitalism, including the development of production forces and production relations, the production of surplus value, including the legality of the distribution of that surplus, the production of goods, analysis of social classes and their relationships (Hardy 2014: 6). The approach to the analysis in the context of the political economy involves the research of social relations, the specificities of relations of power, which in interaction affect the production, distribution and consumption of resources (Mosco 1996: 25). Marx's work, primarily capital, but also its entire scope, will be a source of inspiration for generations of philosophers, and scientists from other fields. Attention to the Marxist approach was directed to analyzing

questions of how the economic base of society produced social superstructure, and was particularly focused on the ideological role of the media in a capitalist society (Dewdney, Ride 2014: 20).

The tradition of political economy in the field of media and communication, and on the traditions of Marxism, was continued in the middle of the twentieth century by German philosophers gathered in a Frankfurt School. The founders of the school, which were later joined by Jurgen Habermas as well, continue to develop the tradition of Marx's historical materialism. Their fundamental work and orientation, which will later receive the title of "critical theory", directly referred to the role of media and media technology in the capitalist society of mass production and subsequently became a reference point for a discussion about digital media (Dewdney, Ride 2014: 20). The critical theory assumes that the media (in all forms) are symbolic forms of expression. Like other forms of symbolic expression (literature, theatre, painting and other forms of cultural expression) the media communicate values, beliefs and attitudes of the structural manner. Thus the media assign a particular meaning to an event, an individual or a selected topic (Fourie 2007: 133).

The basic idea of this approach is its orientation toward analyzing the relationships that are formed between the base and the superstructure of society, where economic circumstances determine cultural development. In other words, the extent of the cultural superstructure of individuals is determined by their economic status, or how much does technological development and economic prosperity determine the development of ideology in society. Hardy (2014: 9) lists three basic fields of analysis which deals with the critical political economy of media:

1. How does the communication industry function, with emphasis on the ownership structure, financing and other forms of income and support (advertising system), and what impact on the media do policies and state institutions have.
2. Organizational system of production within media organizations and the control system. Analysis is oriented towards media freedom in a way that it is independent of environmental conditions that may be reflected in the financial results, level of advertising, the reaction of government authorities and other bodies or a combination of different forms of environmental impacts.
3. The relation between media content production and its distribution on the one hand, in relation to the audience that it is intended for the other hand. In other words, the way individual content in the media intended for certain groups in society is produced and distribute.

With the development of capitalism, some new social circumstances occurred which created completely new relations in society, but also relations among different classes in society. In the seventies, poststructuralists accept the fundamental Marxist-related settings for the media and media culture and adapted them to the new conditions of production and distribution in society. Under the influence of Marxism, this new route is named *cultural materialism*.

Cultural materialism has tried to uncover and understand how cultural significance and value is created in practice and claimed that the ratio of base and superstructure does not have the meaning it had at the time Marxism began. By changing the social circumstances, the old argument was not adequate to the new conditions of economic and cultural production (Dewdney, Ride 2014: 20). Poststructuralists accept cultural materialism, and the most significant in this was Michael Foucault. Cultural materialism, as a direction of scientific study of the media and the media industry, continues to analyze the balance of power within the media industry, ownership structure and influence, uneven standards and the opposites to the development of the cultural industry, and seeks to explain the situation and directions of

development of the cultural industry at a global level under the predominant role of neoliberal ideas.

2.4. Hegemony

Lipowitz (2000) points out that the concept of hegemony is a part of the Marxist concept, and it was first introduced by the Italian philosopher Antonio Gramsci. He was the first of the philosophers to introduce the concept of cultural hegemony and study how the ruling class remains in power in capitalist countries. Gramsci was the first to use the word hegemony, which comes from the Greek word that could be translated as the lead. He refers to the concept of hegemony to explain the way in which economic and cultural "leadership" shows their dominance in society, the way it happens and a situation approved by the remaining majority in society (Long Wall 2013: 356). In Gramsci's work is a strong influence of Marxism and some of his theories today have lost that edge they once had. The concept of civil society, known since the time of Aristotle, under the influence of Marxism translated as a bourgeois society. This emphasizes the Marxist approach to the division of society into classes in which the classes of owners rule over the classes of workers.

Gramsci stressed that hegemony is imposed by the ruling class. Hegemony is not just an ethical-political, but also an economic phenomenon. It is defined as a system of governance and domination which is imposed. Economic interests are reflected through ideological consciousness. At the beginning it is created as articulation of narrow economic interests that later evolve into the development of the ideological class consciousness (Gundogan 2008). Referring to Gramsci, Fourie (2007: 132) points out that hegemony is created and maintained as a structural force in society. A structure that supports the hegemony of the school (education), government (politics and politicians), church (religion), the judiciary system and mass media. Through this structure we learn how to think about particular topics and even what to think. The hegemonic culture was created by those who have control and manage the system - in other words, they are those who have access to structures that through this approach have the power to influence other people. Gramsci states (Wall, Bennett, Slater 2008: 103) that some of the elite in society have a dominant position because others allow it. In doing so, one can notice the ideological conception of media that serves to convince the society that it is in their best interest to accept the dominance of the ruling structures. Marx in *German Ideology* wrote that the thoughts of the ruling class in every epoch are the ruling thoughts or class that dominates the material levers of society and at the same time dominate as a ruling class as well as a spiritual class.

The American philosopher Noam Chomsky says that popular cultures can serve to divert the attention of society and individuals from actual situations, from the real issues, such as issues of employment and livelihoods. Only the intellectual elite and the educational part of the society, as well as most of the professional specialists, should urge acceptance with the values and arguments of the ruling class (Wall, Bennett, Slater 2008: 103). For example we can use a global and television show called "Big Brother" with exceptional ratings. It originated as an idea from the writings of George Orwell in the book 1984, and quickly proved to be a real and global phenomenon.

2.5. Technological determinism

The intellectual heritage of technological determinism can be traced through the enthusiasm and faith in technology as a liberating force since the eighteenth century and the Enlightenment. With such a tradition they are connected by at least two different directions, one enthusiastically, the other critically which contributes to the development of technological determinism. Both views support the theory that technology and science is the most important driver of social change (Smith, Marx, 1994: 2). The concept of determinism implies a

situation where one factor determines all other aspects of life (Fourie 2007: 151). Technological determinism is a reductionist theory which assumes that technological development defines social progress. Technological Determinism observes technology as the foundation of society at all levels in the past, present and future (Nogaršek, Vintar 2011: 455). Economic determinism implies that the economy determines all social and cultural processes. Biological determinism implies that biological factors determine all other behaviours. With technological determinism it is assumed that innovation and technological development determines all social processes, culture, economy and politics (Fourie 2007: 151).

One of the best theories of technological determinism in the media is the theory from Marshal McLuhan where "the medium is the message" with what his mentor Harold Adam Innis agreed with (Fourie 2007b: 250). Both Canadian scientists see the media as the essence of civilization. Innis believed that the social, political, cultural and economic development of all historical periods is directly linked to the development of the means of mass communication in that period (Fourie 2007: 151). The pre-historic period is marked by drawings in caves. The transition to a new era, especially the developed Egyptian culture already knew about papyrus and leaving permanent records. Greece and Rome had a highly developed tradition of record on scrolls. Modern times will bring print and electronic media. The digitization and convergence of the media industry and media will open the door to postmodern. Media corporations will use strategies of diversification and vertical integration to develop business models that will include many different forms of content distribution of media content. The industrial era will blur the strict and sharp boundaries between different forms of production and the distribution of media content.

3. The global media industry in the context of global changes

Already in the introduction we pointed out that modern media and technological advancements are very closely linked. Smith and Hendriks (2010: 5) note that we are surrounded by media from the moment we get up in the new day and until late at night when we go to sleep. Media and media content have been served to us, but we are not even aware of it at all times. The media industry and content distribution achieves profits, but at the same time create a media environment that influences the perception within the community and forms opinions through creating the culture of a society.

Six mega corporations control 90% of the total media market in the United States. They control and dominate the market of news and entertainment in the United States (Tay 2015; Dwayne, Jin 2011; Bettig, Hall 2012). According to turnover, the six largest media corporations are: Time Warner, Disney, News Corporation, NBC - Universal, CBS and Viacom (Dwayne, Jin 2011: 181). Six of the largest, except for News Corporation, are originally American while News Corporation was founded in Australia. Albertazzi and Coble (2013: 72) add to this group another two European companies, Bertelsmann and Vivendi, and Japanese Sony. Six of the largest media corporation are also owners of the biggest Hollywood film studios (Wall, Long, 2013: 247).

The rapid growth of global media corporations emerged after the 1990's, and the strong momentum in this process is directly linked to the digitization of the production process. Digitization will enable the convergence of production and distribution of media content which will lead to the flourishing of the process of takeovers and mergers in the global media market. Jin and Frasers agree with this statement (2011: 180) and they complemented the research in 2010 which showed that media corporations are entering the process of de-convergence and downsizing to cut costs and focus only on the most profitable parts of the corporation. According to the financial indicators, the US media industry achieves the best returns on assets (ROA) of 12.1% compared to its global competitors. Corporations from the

Asian and Pacific region with 6.3% and European corporations with 5.7% are below the global average of 7.5% return on assets (ROA) (Lozić et. al., 2015).

4. The Croatian media industry in the context of global changes

Unlike global trends in the media industry, the Croatian media industry did not follow the processes of consolidation and expansion in the market environment. The process of convergence and takeovers in the market, which started in the United States, at the beginning of the century was conveyed first to Europe and later in Asia, did not happen in Croatia. Indeed, while the US is already going process of de-convergence, the Croatian media industry had not moved from the modern and modernist approach in the management of media companies.

Financial results of Croatian news organizations are more than worrying. In the analysis we took nine Croatian media companies. Seven publishing houses (Novi list, EPH, Večernji List, Školska knjiga, Profil, Mozaik and Algoritam) and two television organizations (Nova TV and RTL). All media companies in Croatia have a negative return on assets in the period from 2009 - 2013, other than Školska Knjiga which made a return of 0.9%. In addition, Nova TV has made a rate of indebtedness of 129.2% in the five year period (Lozić et.al. 2015).

Table 1 Recapitulation of viewing audience of television channels in Croatia(2015)

	Target segment	4+ (October)	18-54 (October)	4+ (November)	18-54 (November)	4+ (December)	18-54 (December)
	Channel	SHR (%)	SHR (%)	SHR (%)	SHR (%)	SHR (%)	SHR (%)
Whole day	HTV 1	14,11	11,22	15,75	12,65	15,05	11,71
	HTV2	7,78	7,92	6,89	7,12	7,07	7,27
	HTV3	1,72	1,51	1,64	1,31	2,40	2,08
	HTV4	3,08	1,99	3,72	2,54	4,38	2,74
	Nova TV	23,39	22,94	24,06	23,60	23,50	23,32
	Doma TV	5,11	5,27	4,81	5,43	4,70	5,30
	RTL	17,62	18,46	16,04	17,08	14,15	15,18
	RTL2	4,34	5,43	4,52	5,60	4,63	5,64
	RTL Kockica	2,82	2,99	3,42	3,91	3,24	3,72
	CMC	1,27	1,57	1,20	1,50	1,49	1,76

Source: Agency for Electronic Media in Cooperation with AGB Nielsonom (own illustration)

By researching the viewership of TV programs, for the last three months of 2015 it was found that Nova TV had the highest viewership, in front of the RTL and the first channel of the state television. The viewership was made according to the results of the Agency for Electronic Media in cooperation with AGB Nielson. Display in Table 1. The results of viewership were divided into two categories according to the age of the viewer: from 4 years or more, and 18 to 54 years of age. In both distributions, Nova TV had the highest viewership. In second place is RTL, and the third is the first channel of the state television. RTL Television has achieved financial ratios of 90.1% debt and return on assets of -13.4% (Lozić et. al. 2015).

Table 2 Viewership of television shows in Croatia (2015)

Rank	October (4+)			November (4+)			December (4+)		
	Channel	Show	SHR (%)	Channel	Show	SHR (%)	Channel	Show	SHR (%)
1.	Nova TV	The News	41,32	Nova TV	The News	46,42	Nova TV	The News	43,02
2.	HTV2	Football	39,14	Nova TV	Your Face Sounds Familiar	42,93	Nova TV	Soap	42,05
3.	Nova TV	Your Face Sounds Familiar	38,62	Nova TV	Farm	40,34	Nova TV	Happy New 2016	43,58
4.	Nova TV	Farm	38,76	HTV1	Sport	56,18	Nova TV	Farm	41,00
5.	HTV 1	Weather Report	54,10	RTL	Box	50,65	Nova TV	Soap	39,60

Source: Agency for Electronic Media in Cooperation with AGB Nielsonom (own illustration)

According to the viewership ratings of television shows, The evening news of Nova TV holds first place in the ratings in all three months. Display in Table 2. In addition, according to the

report of the Agency for Electronic Media, the show *Your face sounds familiar* of Nova TV, made by far the largest share % in viewership since television viewership has been monitored in Croatia. The same broadcaster has the show *Farm* which is located within the five most popular shows in the three analyzed months. In December, all of the five most watched television shows based on the criteria share (%) were broadcasted by Nova TV.

In Table 2 there is a relatively small representation of the shows of RTL, but it should be noted that the percentage of viewership rises sharply when the category 18-54 years is observed. Viewership rises sharply due to the contribution of *Big Brother*, which appears regularly in the top ten according to the share (%). The highest viewership of the program state television is associated with broadcasts of sporting events and news programs related to weather forecasts, shows for agriculture and short news through the morning.

5. Open questions for discussion

By analyzing the domestic media from different angles and value aspects, it can be concluded that there are significant differences between the various aspects of development and operations. On one hand, the Croatian media industry has followed technological developments and trends dictated by technologically developed media corporations, as well as trends that have dominated the developed media markets. Production and technological progress has not significantly lagged behind the global development trends. This goes side by side with the production of entertainment shows that are broadcast live, and the contents are simultaneously broadcast on several different media. From terrestrial television, through cable operators all the way to social networks which allow interaction of the audience and the show's participants.

On the other hand, television companies that achieve the highest viewership also had the greatest losses. Two analyzed television stations (Nova TV and RTL) produce contents that, individually speaking, surpass by far the viewership of content produced and broadcast by the state television. The biggest viewership does not also mean financial security from the aspect of financial management. It remains an open question on how much funds can realistically be collected from advertising and how that contributes to the costs of content production. With publishers of newspapers and books there is an apparent crisis in decreased readership, and also a decrease in sales of advertising space.

Taking into consideration all the models which can be accessed by the analysis of the media market, we remain open to discussion with questions relating to the national media market:

- How long can the current governance model to media companies in Croatia survive due to the steady decline in revenue, an increase in operating costs, and retail and an impoverished market in Croatia?
- How are the management of media companies in Croatia ready to change management paradigm that is inherited from the era of modern? While at the global level, in all industries, sharp boundaries are deleted between the corporation and the environment, and corporations diversify business and vertically integrate, in Croatia the media companies are still dominated with modern styles of management that do not allow the demolition of solid fences and barriers between different forms of media content production.
- How long will investments last in the technological progress of Croatian media companies with regard to the losses they achieve?
- How are we as a society aware of the fact that the most popular shows on television are soap operas and direct transfers of the "Orwellian type", and will such content be increasingly sought for in the future? At the same time, all publishers of books other than Školska Knjiga are falling, and newspaper circulation is at historically low levels.

- How much can a society develop in the future when it predominantly consumes soap operas, sitcoms of questionable quality, sports and "light music"?

6. Conclusion

By using the model of studying the media industry on the Croatian media industry, we obtained results that partially agree with global trends while the second part shows the specifics of the development of Croatia, but partly also the regional media industry. Part of the results following global trends regards the study of media from a critical approach or political economy. The results of the analysis, which refer to the economy of the media, show disturbing results of business operations of the Croatian media industry.

By studying the Croatian media industry in the context of cultural materialism, we can notice how global trends were transferred and affirmed in the Croatian media. The domestic media industry is dominated by television and contents it emits. Regardless of the often repeated *mantras* of culture and cultural heritage, the local media is dominated by programs associated with soap operas and realty shows. The ownership of the media who control the media space and production of media content introduces us to another important determinant of the media market in Croatia, and that is the hegemonic influence and culture that is created through the media. The influences coming from foreign media markets, through the culture of watching soap operas and active participation in realty shows opened the debate in the direction of creating a global media village that has left very deep roots in Croatia as well. McLuhan's theory that assumes that media is dominant in the message he is sending gives the explanation of creating a global community of media spectacle. The technological development and more developed electronic devices for content distribution increasingly dominate the content being broadcast. The Croatian media industry followed the trend of technological development, while at the same time it becomes part of the global media market. Benjamin's claims about the technical reproducibility of art, and the continuation of these statements later appeared in studies of mcdonaldization, hollywoodization or disneyization of the global media market are completely true in the Croatian media industry. Just as Horkheimer and Adorno confirmed in the *Dialectic of Enlightenment* that culture is produced industrially just as consumer goods, and it can no longer take critical thinking except as product consumption, Croatian media contents with the largest audience shares are products without a true cultural content.

When analyzing the Croatian media industry in the context of the economy of the media, there are significant differences and deviations from global trends. By studying the Croatian media industry through the model of industrial organization theory and the company theory model, the greatest difference was observed in the field of newspaper publishing and magazines. While global trends in the newspaper industry are based on the monopoly of the newspaper industry in certain geographic areas, in our country this process has not yet come to an end. In Zagreb we have two daily newspapers, while in the late 1960s the process of monopolization of the newspaper industry in major US cities such as New York, Washington and Los Angeles began. The market of magazines in Croatia has a process of financial collapse for magazine and newspaper circulation which is decreasing year to year. Organizational modernism and ossified management practices, with the assistance of the state, stopped the changes in the market of printed books in the Croatian market. At the same time, technological development has enabled the emergence of several television operators as well as unlimited access to the Internet which creates the assumption of perfect competition.

The modernist way of managing newspaper publishers takes us to the area of analysis in the context of the company theory. Processes that are known in the global market since the 1980s and the end of Keynesianism did not have an impact in the domestic media market. Media organizations have remained unchanged watching borders organizations or borders of their

business activities. While American, and later the corporations from other continents, spread to new markets and took over smaller media corporations, the Croatian media industry has ignored the changes adopted by the post-modern and post-industrial society.

Research of the media industry on a global level, but also in each country individually, requires a holistic approach to problem analysis. Comparing the media industry in the context of critical theory in relation to the global media industry, we conclude that there is substantial similarity in the development of global and national markets. The Croatian media market follows the trends of certain television content, while publishing activities, according to income, are increasingly lagging behind broadcasting. At the same time media companies follow technological development in order to distribute global media content.

In the context of the economy of the media, the Croatian media market has worrying financial results in all categories of the media industry. Not only that most publishers in the process are heading towards bankruptcy but also television operators do not achieve profit margins that are at least approximately equal to global trends. The question is what is the way of phasing out of this situation and if there is a way out of such a small, poor and static market? The combination of different factors that have a strong impact on the Croatian media industry, lead the overall situation to a rather chaotic state.

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Vocabulary Learning Strategies at the Tertiary Level

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Abstract. In order to achieve full academic and professional potential, experts in different professional fields need to be highly proficient in English. This implies full mastery of vocabulary as an essential part of language knowledge. The present study explores most and least frequently used vocabulary strategies employed by 120 business and engineering students from the University Department of Professional Studies, University of Split, Croatia. Further, the relationship between vocabulary learning strategy (VLS) use and students' vocabulary knowledge is analyzed together with differences in VLS use and vocabulary proficiency across disciplines. The results of the study suggest that the most frequently used are context-based vocabulary learning strategies, and least employed are self-initiated independent vocabulary learning strategies. The findings reveal a statistically significant negative correlation between formal VLS and receptive vocabulary knowledge and positive correlation between context-based VLS and productive vocabulary knowledge. The study also suggests that there are statistically significant differences in the level of students' proficiency on vocabulary tasks as well as in their VLS use. In conclusion, the importance of providing students with VLS instruction should be emphasized to make them aware of appropriate strategy use. Consequently, students would be able to self-direct their language learning.

Key words: *vocabulary learning strategy use, receptive vocabulary knowledge, productive vocabulary knowledge*

1. Introduction

In order to be able to communicate effectively in a foreign language, language learners need not only to increase their vocabulary size, but also to use the acquired vocabulary fluently across all four language skills (Nation, 2001). According to Schmitt (2008), it has been estimated that 98% text coverage is needed to function normally in written and oral discourse. In other words, knowledge of 8000-9000 and 6000-7000 word families is required to communicate effectively in speech and writing respectively. Since lexical items carry the meaning and limitations in vocabulary knowledge may inhibit the exchange of information, the question of facilitating vocabulary acquisition has often been an issue for language teachers (Read, 2004). Owing to the shift of focus and responsibilities from teachers to learners in the last few decades, learners have been encouraged to develop VLS and select those strategies that seem to be the most appropriate for them. As a result, a number of studies on VLS have emerged so far targeting a number of research questions and providing different VLS taxonomies (Gu and Johnson, 1996; Lawson and Hogben, 1998; Pavičić, 1999; Pavičić Takač, 2008; Schmitt, 1997). There is no doubt that language learners on average use different VLS, as has been indicated by aforementioned research studies, but it is still not possible to reach any definite conclusions in this area (Pavičić Takač, 2008). For example, Lawson and Hogben (1996) found that VLS most frequently used by both top-scoring and bottom-scoring groups of Australian students learning Italian were repetition strategies. The

results further indicated that the use of simple repetition strategies, together with paraphrasing and the use of some mnemonic devices, facilitated word recall. Similarly, Schmitt (1997) revealed that VLS used most frequently by Japanese learners were mechanical repetition and bilingual dictionaries. According to the results of the study conducted by Gu and Johnson (1996) Japanese students seldom use one single strategy. A very small group of high achievers reported learning vocabulary above all through extensive reading, whereas the second best group reported using a variety of strategies, such as guessing, dictionary strategies, note taking, and even memorization strategies. The least proficient group was in favour of memorization strategies. The findings of the study that involved primary school learners in Croatia indicated a rather extensive use of VLS, among which the most frequently used ones were listening to songs, remembering words from films and TV programmes, translating words into L1 and remembering words if they are written down (Pavičić Takač, 2008).

The present study explores the relationship between vocabulary learning strategy (VLS) use employed by 120 business and engineering students from the University Department of Professional Studies, University of Split, Croatia, and their vocabulary knowledge. The following research questions are put forth:

1. Which strategies are most and least frequently used by students included in this study?
2. What is the relationship between VLS use and learners' vocabulary test scores?
3. Are there any differences in VLS use and learners' vocabulary test scores across disciplines and among low-, middle- and high-scoring students?

The following hypotheses will be tested:

H1: Students will generally prefer using strategies for formal vocabulary practicing whereas strategies for self-initiated independent vocabulary learning will be least employed.

H2a: There will be statistically significant positive correlation between formal vocabulary practicing strategies and receptive vocabulary knowledge.

H2b: Statistically significant positive correlation will be found between context-based vocabulary learning strategies and productive vocabulary knowledge.

H3: There will not be any major differences across disciplines. High-scoring students will use the most strategies.

2. Method

2.1 Participants

The sample comprised 120 (64 males and 56 females) first- and second-year students from the University Department of Professional Studies, University of Split, Croatia. The age ranged from 18 to 24 ($M=20.13$, $SD=1.39$) years. Participants consisted of 60 business students and 60 information technology students. All students were native Croatian speakers. They have been learning English in elementary and high school from nine to fourteen years ($M=12.43$, $SD=1.29$). Their mean high school grade in English was 3.83 ($SD=0.89$). Apart from learning English formally, 28% of the participants learned English as an extracurricular activity as well. Finally, 71% of the participants revealed that they had never been exposed to vocabulary strategy learning instruction. Those participants who had been instructed on how to use vocabulary learning strategies reported that the instruction actually helped them in learning new words. All the participants were full-time students who were attending a credit-bearing 30-lesson English course.

2.2 Measures

2.2.1 VLS questionnaire

Since a number of researchers, such as O'Malley & Chamot, McDonough, and Cohen (as cited in Kudo, 1999) believe that learning strategies are culture-specific, the pilot version of the Vocabulary Learning Strategy Questionnaire developed by Pavičić (1999) was used in the research on the grounds that it is especially applicable in the Croatian setting. Although it was later refined, the author herself recommended this pilot version "as a more comprehensive inventory of VLS suitable to various levels and ages of learners" (Pavičić Takač, 2008:151). The questionnaire consisted of 69 items (with responses presented on a three-point-Likert scale, ranging from *never*, *sometimes* to *often*). On the basis of factor analysis, five categories of strategies were formed as follows: *self-initiated independent vocabulary learning* (VLS 1), *formal vocabulary practicing* (VLS 2), *surface approach to vocabulary learning* (VLS 3), *context-based vocabulary learning* (VLS 4) and *association-making vocabulary strategies* (VLS 5).

2.2.2 Vocabulary test

In this study, a vocabulary test, rather than a final grade, was applied as an outcome measure. It was developed specifically for the purpose of this study in order to measure students' vocabulary knowledge. Four tasks were included in the test: matching task, multiple-choice task, gap-filling task without any clues and sentence-building task where students had to use a given word in a meaningful sentence. Scores obtained on the first two tasks revealed students' receptive vocabulary knowledge whereas students had to show their productive vocabulary knowledge in the third and fourth tasks.

2.3 Procedure

Business students had 4 lesson hours of Business English whereas Information Technology students had 2 lesson hours per week. Vocabulary learning strategies were administered at the beginning of the course during regular classes. Each student completed the Croatian version of VLS questionnaire (Pavičić, 1999) in 15–20 minutes. After the main purpose and the significance of the study were explained to the students, they voluntarily took part in the research. A vocabulary test was applied to assess students' receptive and productive vocabulary knowledge. It took them 35–45 minutes to complete the test. Data collected by means of a questionnaire were matched with the results on the vocabulary test. Demographic profile (age and gender) as well as data on participants' previous foreign language learning experience and their attitudes to vocabulary learning strategy instruction were collected by a background questionnaire.

2.4 Data Analysis

In the first step the reliability of the instruments was calculated. The VLS questionnaire had an alpha reliability coefficient of 0.90 ($\alpha=0.90$). A statistical data analysis was performed by using SPSS 21.0 for Windows. Descriptive and inferential statistics were employed in order to analyze the data. Firstly, mean scores, frequencies and standard deviations of the VLS were computed and vocabulary test scores calculated. Secondly, VLS strategies were factor analyzed using the principal component analysis with Varimax rotation. Principal component analysis in the sample resulted in 20 components with the eigenvalue greater 1. Items were then Varimax rotated to five factor solution which explained 39% of the total variance. Thirdly, the relationship between the frequency of VLS use and vocabulary test scores was investigated using Pearson product-moment correlation coefficient. Further, the independent-sample t-test was used to determine whether there were any differences in VLS use and vocabulary test scores across disciplines. Finally, one-way analysis of variance (ANOVA)

with post-hoc tests was performed to find out if low-, middle- and high-achieving students differ in their VLS use.

3. Results

3.1 Descriptive data

Table 1 reports the descriptive statistics for five categories of VLS items obtained by factor analysis, labelled as follows: *self-initiated independent vocabulary learning* (VLS 1), *formal vocabulary practicing* (VLS 2), *surface approach to vocabulary learning* (VLS 3), *context-based vocabulary learning* (VLS 4) and *association-making vocabulary strategies* (VLS 5).

Table 1 Descriptive statistics for VLS categories

	Min.	Max.	Mean	SD
VLS 1	14	36	20.70	4.852
VLS 2	10	30	21.22	4.205
VLS 3	6	17	10.03	2.586
VLS 4	12	24	20.49	2.638
VLS 5	10	27	20.00	3.336

In order to obtain more detailed insight into the VLS use, the mean scores for individual items were calculated. The results presented in Table 2 show most and least frequently used strategies.

Table 2 Descriptive statistics for most and least frequently used individual VLS

Most frequently used VLS				
Item	M	SD	Mode	Percentage
41	2,73	0,480	3	75%
47	2,62	0,651	3	70,8%
9	2,67	0,491	3	67,5%
69	2,63	0,533	3	65,8%
45	2,58	0,545	3	60%
Least frequently used VLS				
28	1,14	0,455	1	90%
29	1,28	0,621	1	81,7%
18	1,26	0,558	1	80%
59	1,33	0,568	1	72,5%
20	1,42	0,656	1	67,5%

Note: M=Mean, SD=Standard deviation; 41.I remember a word if I encounter it many times; 7. I listen to songs in a foreign language and try to understand it; 9. If I cannot remember a word in conversations, I use another one with a similar meaning; 69. I pick up words from the Internet; 45. I try to guess the meaning of a new word from the context; 28.I tape record the words and then listen to the tape; 29. I write down words when I watch films and TV programmes; 18. I make word cards; 59. I ask somebody to test me on words (e.g. parent, sibling, friend); 20. I plan for vocabulary learning in advance.

As shown in the Table 2, all most frequently used strategies reported by the students in this sample are *context-based vocabulary learning strategies* (VLS 4). In contrast, four strategies least preferred by the students are included in the category labelled *self-initiated independent vocabulary learning* (VLS 1).

3.2 Correlations

Correlations between five categories of VLS items and tested vocabulary knowledge are presented in Table 3. As for the vocabulary test, four different tasks were included: matching, multiple choice, gap-filling and sentence-building. Since matching task is not significantly correlated with any of the VLS category on the one hand, and VLS 5 category does not correlate with any task in the vocabulary test on the other, they are not included in this table.

Table 3 Correlations between VLS categories and vocabulary test tasks

VLS categories	Tasks		
	Multiple choice	Gap-filling	Sentence-building
VLS 1	-.127	.379**	-.248**
VLS 2	-.318**	.217*	-.250**
VLS 3	-.217*	.287**	-.245**
VLS 4	.057	-.045	.261**

Note. N=120; *p < 0.05; **p < 0.01

As shown in Table 3, scores on multiple choice task were significantly and negatively correlated with categories VLS 2 and VLS 3, namely with formal vocabulary practicing and surface approach to vocabulary learning. Next, scores on the gap-filling task are significantly and positively correlated with VLS 1, VLS 2 and VLS 3 categories indicating that those students who perform better in the gap-filling employ more frequently self-initiated independent vocabulary learning strategies, formal vocabulary practicing strategies and surface approach to vocabulary learning strategies. Furthermore, there is a significant and negative correlation between sentence-building task scores and VLS 2 and VLS 3 categories, but significant and positive relationship with VLS 4 category that includes context-based vocabulary learning strategies. This suggests that those students who tend to rely on the context and use media in learning a foreign language are better in building sentences. These findings partially supported hypothesis 2b (H2b).

3.3 T-test

In order to determine whether there were any differences in vocabulary test scores and VLS use across disciplines, *t*-test was used.

Table 4 Proficiency on vocabulary tasks across disciplines

Proficiency on vocabulary tasks across disciplines					
	Business studies		Information technology		t
	M	SD	M	SD	
Matching	93.00	13.992	79.88	23.945	-3.664***
Multiple-choice	64.98	22.724	74.78	16.610	2.697**
Gap-filling	74.90	22.875	60.23	25.461	-3.319***
Sentence-building	47.67	21.657	63.33	29.736	3.300***

Differences in VLS use across disciplines					
	Business studies		Information technology		t
	M	SD	M	SD	
VLS 1	22.47	5.338	18.93	3.555	-4.268***
VLS 2	22.08	4.200	20.35	4.062	-2.298*
VLS 3	11.15	2.673	8.92	1.951	-5.227***
VLS 4	19.68	2.931	21.30	2.028	3.513***

Note. N=120; *p < 0.05; **p < 0.01, ***p < 0.0005, M=Mean, SD=Standard deviation, t=T-test value

Firstly, the results of the *t*-test presented in Table 4 indicate statistically significant differences in proficiency on vocabulary tasks between business and information technology students. It was found that business students scored better results in matching (M=93.00; SD=13.992) and gap-filling tasks (M=74.90; SD=22.875) while information technology students performed better on multiple-choice (M=74.78; SD=16.610) and sentence-building tasks (M=63.33; SD=29.736). Secondly, the results reveal statistically significant differences in VLS use across disciplines. Business students used VLS 1 (M=22.47; SD=5.338), VLS 2 (M=22.08; SD=4.200) and VLS 3 (M=11.15; SD=2.673) significantly more frequently (p=0.000, p=0.023 and p =0.000, respectively) than information technology students (VLS 1 - M=18.93; SD=3.555; VLS 2 - M=20.35; SD=4.062 and VLS 3 - M=8.92; SD=1.951). With reference to VLS 4 use, the results suggest that information technology students (M=21.30; SD=2.028) used them significantly more frequently (p=0.001) than business students (M=19.68; SD=2.931).

3.4 One-way analysis of variance (ANOVA)

Finally, a one-way analysis of variance (ANOVA) with Tukey post-hoc tests was used to explore potential differences in the frequency of VLS use and in language learning beliefs among high-, middle-, and low-scoring groups on four vocabulary tasks. Only those values that show statistically significant differences are presented in the tables below.

Table 5 VLS use by proficiency on vocabulary tasks

Levels of proficiency on the matching task								
	Low		Middle		High		F	p
VLS categories	M	SD	M	SD	M	SD		
VLS 2	22.38	4.048	18.90	4.582	21.58	3.973	4.315	0.016
Levels of proficiency on the multiple-choice task								
VLS 2	23.26	3.783	20.81	3.669	19.84	4.571	7.016	0.001
Levels of proficiency on the gap-filling task								
VLS 1	18.29	2.408	20.20	4.445	23.02	5.594	11.395	0.000
VLS 2	19.69	4.945	21.83	3.644	21.87	3.811	3.408	0.036
VLS 3	9.17	1.636	9.55	2.320	11.13	3.035	7.440	0.001
Levels of proficiency on the sentence-building task								
VLS 1	21.73	5.235	19.33	3.942	18.63	3.218	4.746	0.10
VLS 2	21.82	4.282	21.11	4.051	19.00	3.480	3.568	0.031
VLS 3	10.38	2.652	10.30	2.569	8.32	1.565	5.354	0.006

Note: VLS 1=self-initiated independent vocabulary learning; VLS 2=formal vocabulary practicing; VLS 3=surface approach to vocabulary learning

The results shown in Table 5 indicate that there are significant differences in matching task between low- and middle-scoring students ($p=0.032$) as well as between middle- and high-scoring students ($p=0.023$) in the use of *formal vocabulary practicing strategies* (VLS 2). Students with low and high scores on the matching task use these strategies significantly more frequently than middle-scoring students. The results further reveal that students scoring low on the multiple-choice task use *formal vocabulary practicing strategies* (VLS 2) more frequently than middle-scoring ($p=0.020$) and high-scoring students ($p=0.01$). A different pattern of results emerged for productive vocabulary tasks. Those students with high scores on the gap-filling task use *self-initiated independent vocabulary learning strategies* (VLS 1) more frequently than low-scoring ($p=0.000$) and middle-scoring students ($p=0.012$). Similarly, *surface-approach vocabulary strategies* (VLS 3) are significantly more frequently used by high-scoring students in comparison with low-scoring ($p=0.002$) and middle-scoring ones ($p=0.010$). Compared to their low-scoring peers, they also employ *formal vocabulary practicing strategies* (VLS 2) statistically more frequently ($p=0.053$). A statistically significant difference among the groups was found in the use of *surface-approach vocabulary strategies* (VLS 3) for the sentence-building task. These strategies are significantly less frequently used by students scoring high on the sentence-building task in comparison to both, low-scoring ($p=0.005$) and middle-scoring students ($p=0.025$). Students scoring low on the sentence-building task employ *self-initiated independent vocabulary learning strategies* (VLS 1) and *formal vocabulary practicing strategies* (VLS 2) statistically more frequently than high-scoring students ($p=0.031$; $p=0.024$, respectively).

4. Discussion

The findings of this research indicate that business and information technology students generally use different vocabulary learning strategies. Out of fourteen most frequently used strategies, those with the highest mean score relate to *remembering a word encountered many times*, *listening to songs in English language*, *picking up words from the Internet, films and TV programmes* and *guessing the meaning from the context*. Although the first hypothesis (H1), according to which students would most favour formal strategies, is not confirmed, our findings related to the frequent use of *context-based vocabulary learning strategies* (VLS 4) are in line with most previous studies (e.g. Atay & Ozbulgan, 2007; Fan, 2003; Gu & Johnson, 1996; Pavičić, 2000; Schmitt, 1997). The use of these strategies may be attributed to the extent to which children and young adults in Croatia are exposed to authentic English language input via different media. This input-rich environment, that provides opportunities for encountering and acquiring new vocabulary on a subconscious level, is strikingly similar to an English as a Second Language (ESL) environment (Kojic-Sabo & Lightbown, 1999). Further, students reported being much in favour of *using a word with similar meaning if the target word cannot be remembered in conversations*. Namely, students seem to have acquired an extensive vocabulary that makes it possible for them to access synonyms rather quickly.

Furthermore, consistent with the previous findings (e.g. Schmitt, 1997; Pavičić, 2000; Kudo, 1999), students in this study sometimes tend to use some *formal vocabulary practicing strategies* (VLS 2), such as *bilingual dictionary use*, *translation of the target word into L1*, *repeating a word in order to remember it* as well as *asking for help* indicating that this subset of formal practicing strategies seems to be fairly frequently applied in the Croatian educational setting. It may be concluded that this attitude toward formal learning seems to be the result of teaching practices in general, and teachers' approaches to error correction and testing that the students have been exposed to in the course of their education.

The strategies least frequently used by students are, not surprisingly, found among those classified as *self-initiated independent vocabulary learning strategies* (VLS 1) and *formal vocabulary practicing strategies* (VLS 2). The finding that *recording words and listening to*

the tape, writing down words while watching TV and reading, making word cards, "acting out" the meaning of new words, reading and leafing through a dictionary and planning learning in advance are the least frequently used strategies, is completely in agreement with the findings presented in the study conducted by Pavičić (2000). It seems that some of these strategies are age-dependent, i.e. more appropriate for younger learners (e.g. *making word cards, "acting out" the meaning of new words*). The others, on the other hand, appear to integrate incidental learning and self-initiated activities (*writing down words while watching films / TV programmes and while reading books*). This probably implies that these incidental learning situations, typical for the input-rich Croatian setting, are related to enjoyable leisure time activities during which students are not likely to invest additional cognitive efforts into the vocabulary learning process.

The second research question deals with the relationship between VLS use and vocabulary test scores. In contrast to our hypothesis (H2a) that there will be a positive correlation, the results indicate a statistically significant negative correlation between *formal vocabulary practicing strategies* and receptive vocabulary knowledge tested by using the multiple-choice task. Unlike the study conducted by Kojic-Sabo and Lightbown (1999), our results reveal that making conscious efforts to memorize certain vocabulary items, does not necessarily expand students' receptive vocabulary knowledge. A negative correlation between a multiple-choice task and VLS 2 suggests that the more students practise decontextualized words formally, the more likely it is that they will not be able to identify the correct word among distractors. The H2b hypothesis, implying a positive correlation between context-based vocabulary learning strategies and productive vocabulary knowledge, is confirmed. Our findings may well point to the fact that the exposure to the authentic English language input via movies that are subtitled and not dubbed, the use of the Internet, playing computer games and listening to songs has a positive effect on the development of students' productive vocabulary knowledge.

The third research question focuses on differences in students' VLS use and vocabulary test scores across disciplines. Contrary to our expectations stating that there will not be any major differences between two groups of students (H3), the results of the present study reveal that there are statistically significant differences in the level of students' proficiency on vocabulary tasks as well as in their VLS use. It was found that business students were significantly better on matching and gap-filling tasks which could be explained by their preference to study for exams by formally practicing and making self-directed and conscious efforts to memorize certain vocabulary items. The results revealed that business students are significantly more frequent users of the above mentioned strategies in comparison to information technology students. This is in agreement with findings of some previous studies (e.g. Peacock & Ho, 2003; Gu, 2002) indicating that students from different disciplines employ strategies in a different way. Favouring context-based vocabulary learning strategies seems to be discipline-specific for information technology students who scored better on multiple-choice and sentence-building tasks. This is, not surprisingly, probably due to their daily exposure to the English language not only in leisure time but also for the purpose of their professional courses.

Finally, with reference to differences in vocabulary strategies used by business and information technology students, the third hypothesis (H3) is not confirmed. High-scoring students do not use all the strategies significantly more frequently than low- and middle-scoring students. The research results indicate that the largest number of vocabulary strategies are used only by those students who gained the highest scores on the gap-filling task. This means that the extensive use of strategies does not necessarily result in better vocabulary acquisition.

5. Conclusion

The results of this study indicate that students on average use an extensive inventory of VLS. The majority of strategies reported to be most frequently used were *context-based vocabulary learning strategies* and the least employed were mostly *self-initiated independent vocabulary learning strategies*. Further, it can be concluded that some strategies are universally accepted, e.g. bilingual dictionary use, repetition strategies, or contextual guessing. Some are socio-culturally-specific since children and young people in Croatia are extensively exposed to authentic English language through media, but not elsewhere. Some strategies may be characterized as discipline-specific because in some disciplines they are more frequently used than in others. Moreover, the study also indicated that formal, self-directed and conscious and context-based learning might enhance vocabulary acquisition. However, not all vocabulary strategies employed by students seem to be appropriate for all task types. Therefore, it seems particularly important to provide students with VLS instruction so that they could become aware of the relevance of strategy use in vocabulary learning and consciously employ those strategies they find the most appropriate in terms of their effectiveness for the given task. As a result, they would become able to self-direct their learning and start reflecting on their learning process.

6. Implications for further research

Results of this study provide preliminary indication that students are in favour of using a variety of strategies. However, further research should explore those strategies, or combination of strategies, used by the most proficient students (Peacock and Ho, 2003) as well as consider the effectiveness of VLS use in relation to different task types. Moreover, another issue related to vocabulary learning emerged from this study. Since the use of some VLS categories was negatively correlated with vocabulary test scores. It seems safe to assume that some other factors besides strategy use (e.g. personality, students' beliefs, motivation, extracurricular time devoted to vocabulary learning, etc.) have a great impact on vocabulary learning outcomes, which is another issue that should be further investigated.

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Some Issues in the Elaboration Course Theory of Probability and Mathematical Statistic on E-learning Platform MOODLE

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Abstract. The paper presents the university course Theory of Probability and Mathematical Statistics created on the electronic platform MOODLE at Trade Co-operative University of Moldova (TCUM) for distance learning. This e-course is presented in three sections: Random events; Random variables; Elements of Mathematical Statistics. Topics include a brief summary of the theory (Lecture Notes - LN). Subsequently the exposed Lecture Notes are accompanied by multiple problems and worked examples with explanations (Exercises Solved - ES). All themes end with a series of problems to be solved (Suggested Exercises - SE). The answers to all outstanding issues (Answers - A) and tables needed to solve some of them are provided in the latter part of the paper. Self-Assessment Tests are provided at the end of each topic and are structured in three levels of learning the material studied: knowledge, implementation and integration. The Base of Questions has the same structure as the Self-Assessment Tests, and it also oversees the completion and operational processing of its contents. A Summative Evaluation of Knowledge Tests is provided at the end of each compartment. Finally, consulting the connections, readers will find many other titles of books and electronic sources that will effectively serve to strengthen and deepen the knowledge acquired from studying this course. In the Questionnaire option, users have the opportunity to express their opinions on the usefulness and effectiveness of this instrument and the means of training and learning the proposed course, which is always welcome and expected by the authors of the opposite present.

Key words: *probability, mathematical statistics, E-learning, MOODLE*

1. Introduction

This paper describes the conceptual landmarks of creation and development of the university course Probability Theory and Mathematical Statistics (TP and MS), on-line created for distance learning on electronic platform Moodle. The ideas and the main directions of the development of its architecture, this electronic course has formulated in [1]. Its contents are adjusted and made on the site of Trade Co-operative University of Moldova (TCUM): HYPERLINK "http://www.uccm.md/" www.uccm.md/. The course is based on:

1. The traditional university course TP and MS, for students at the TCUM. During its implementation on the electronic platform Moodle the manual of the course was perfected, completed and updated at current conditions and was reissued as manual [2] in 2013.
2. The experience gained is a result of participation in traineeships in *e-learning*, organized within the project TEMPUS 516597 - Tempus 1- 2011-1-FR Creating a Thematic University Networks in Applied Sciences and Economic Sciences in Moldova.

The course is presented in three chapters: I. Random events. II. Random variables. III. Elements of Mathematical Statistics. Chapters integrate the next 12 themes:

1. Classical and geometric probabilities;
2. The addition and the multiplication of probabilities;
3. The total probability formula. Bayes's formula;
4. Repeated experiments;
5. Discrete random variables;
6. Continuous random variables;
7. Classical random variables;
8. Two-dimensional discrete random variables;
9. Two-dimensional continuous random variables;
10. Statistic population. Selection;
11. Parameter estimation;
12. Correlation. Regression lines.

Topics include a brief statement of the theory (*Lecture Notes - LN*). Subsequently the exposed *LN* are accompanied by problems and worked examples with explanations (*Solved Exercises - SE*). All themes ends with a number of issues proposed for solving (*Suggested Exercises - SE*). At the end of the topics are given answers to all unsolved issues (*Answers - R*).

Self-Assessment Tests (S-AT). *S-AT* are presented at the end of each topic and are structured as follows:

1. *S-AT 1.1, ..., S-AT 12.1 (true / false)*. Here each question has two answers: true or false. These test questions provide the first level of assimilation of the material studied, so knowledge of basic definitions and concepts.

2. *S-AT 1.2, ..., S-AT 12.2 (mathing)*. This test contains two or more questions and here it is necessary to indicate the correct answers from a given list of answers. The test is intended to contribute, using the analogy, the symmetry, the comparison etc., to acquire deeper knowledge of the studies and is considered to be the second level.

3. *S-AT 1.3, ..., S-AT 12.3 (multiple choice)*. In this test are presented questions that have multiple answers, which must be determined. Using deduction and induction, is oriented to observe and study deeply the basic properties and the features, with some more special shades of the notion studied. It is considered the second level.

4. *S-AT 1.4, ..., S-AT 12.4 (calculated simple)* and *S-AT 1.5, ..., S-AT 12.5 (calculated)*. This includes questions and problems which classifies the test of third level: to answer the question asked we perform a calculus, solving some problems and presenting numerical answer of the question. Calculus is carried out by a formula indicated in *Base of Questions*, where data is chosen randomly from a specified domain. The domain is common, if the test is of *calculated* type and is individual, if the test is of *calculated simple* type.

5. *S-AT 1.6, ..., S-AT 12.6 (calculated multiple choice)*. The test can contain one or more questions and a list of answers from which to be given the answer to every question (they, answers, may be more to each question). Missing correct answer is penalized. The answer is not presented numeric, in some numbers. It is presented algorithms for calculating of problems with true or false segments of them. These algorithms do not containing variables or textual parameters, but random numerical values of the data of problem. The test may be considered as level two or three, depending on the complexity of the proposed question.

Game-Test are presented in each 12 themes and are used for training and self-assessment, using the animated games.

Base of Questions (BQ). So it is organized the *BQ* and it has the same structure as the *S-AT*, which also facilitates the completion and operational processing of its contents. At the end of each compartment are proposed summative assessment tests of the knowledge, organized on the basis of *S-AT*.

Primarily, the course it is addressed to students of higher education institutions. So, it can be used by high school students, as well of economists, engineers, which use probabilistic and statistical methods in their work.


2. The architecture of the PT and MS course on electronic platform Moodle

The *General* compartment include the following components: *Forum*, *Annotation* of the E-learning course TP and MS, *Curriculum* of the course TP and MS at TCUM, the *Manual* of the course reissued [2] in 2013, *Glossary*, *Chat*, *Initial Test* for the initial evaluation, *Questionnaire* where users have the opportunity to express their opinions on the usefulness and effectiveness of this course and which are always welcome and expected by the authors of this E-learning course presented.

General

Theory of Probability and Mathematical Statistics (TP and MS)


Teoria Probabilităților și Statistica Matematică (TP și SM)



Forum - Știri

Announcements and general news


Anunțuri și știri cu caracter general



Annotation - Adnotare

Annotation of the E-learning course TP and MS


Adnotare a disciplinei TP și SM, pentru studiu electronic




Curriculum

Curriculum presentation of discipline TP și MS in the specialties at TCUM.


Prezentare Curriculum a disciplinei TP și SM în cadrul specialităților la UCCM.




Manual




TP and MS.Introduction - TP și SM. Introducere




TP and MS. Contents - TP și SM. Cuprins




TP and MS Glossary - TP și SM Glosar



Chat-Discuții



Initial Test - Test de evaluare inițială



Questionnaire - Chestionar

Attention !!! The questionnaire can be completed only once!

Do not push **Submit questionnaire** until answer all your questions!

Atenție !!! Chestionarul poate fi parcurs doar o singură dată!

Nu apăsați **Submit questionnaire** pînă nu răspundeți la toate întrebările!

Figure 1 The *General* compartment of E-learning course TP and MS

TP.Theme 1: Classical and geometric probabilities - TP. Tema 1: Probabilități clasice și geometrice

LN - Lecture Notes, *SE* - Solved Exercises, *SE* - Suggested Exercises, *A* - Answers

NC- note de curs, *ER*- exemple rezolvate, *EP* - exemple propuse pentru rezolvare, *R* - răspunsuri









-  TP. Theme 1: LN+SE --- TP. Tema 1: NC+ER
-  TP. Theme 1: SE --- TP. Tema 1: EP
-  TP. Theme 1: A --- TP. Tema 1: R
-  TP. Theme 1. Glossary --- TP. Tema 1. Glosar
-  Self-Assessment Test. TP.Theme 1 --- Test de autoevaluare. TP.Tema 1
-  Game - Test. TP. Theme 1 --- Test - Joc. TP. Tema 1
-  Chat at TP.Theme 1 - Discuții la TP.Tema 1
-  Assessment Test. TP.Theme 1 --- Test de evaluare. TP.Tema 1

Figure 2 TP. Theme 1: *Classical and geometric probabilities* of E-learning course TP and MS

Each of the 12 themes of the course TP and MS, developed on the Moodle platform contains the following components: *Lecture Notes (LN)* - contains the theory, *Solved Exercises (SE)* - are presented the solved issues and exercises, *Suggested Exercises (SE)* - contains problems to be solved, *Answers (A)* - are given the answers to all outstanding issues, *Glossary* - contains a list of terms with their definitions, *Self-Assessment Tests* - for training and self-assessment, *Game-Test* - for training and self-assessment using the animated games, *Chat* - for conversations on the topic, *Assessment Tests* - for estimating knowledge on the topic.

At the end of the course themes TP and MS are presented the Tables and Bibliography, which are necessary to solve problems and further documentation in the field.

Tables. Bibliography - Tabele. Bibliografie

Table 1. Laplace local function values - $\varphi(x)$

Tabelul 1. Valorile funcției locale Laplace - $\varphi(x)$

Table 2. Laplace integral function values - $\Phi(x)$

Tabelul 2. Valorile funcției integrale Laplace - $\Phi(x)$

Table 3. Poisson function values - $P(m)$

Tabelul 3. Valorile funcției Poisson - $P(m)$

-  Table 1. Laplace local function values --- Tabelul 1: Valorile funcției locale Laplace
-  Table 2. Laplace integral function values --- Tabelul 2: Valorile funcției integrale Laplace
-  Table 3. Poisson function values --- Tabelul 3: Valorile funcției Poisson
-  Bibliography --- Bibliografie

Figure 3 Tables and Bibliography of E-learning course TP and MS

The *Base of Questions (BQ)* is organized and has the same structure as the *Self-Assessment Tests (S-AT)*, which also facilitates the completion and operational processing of its contents.

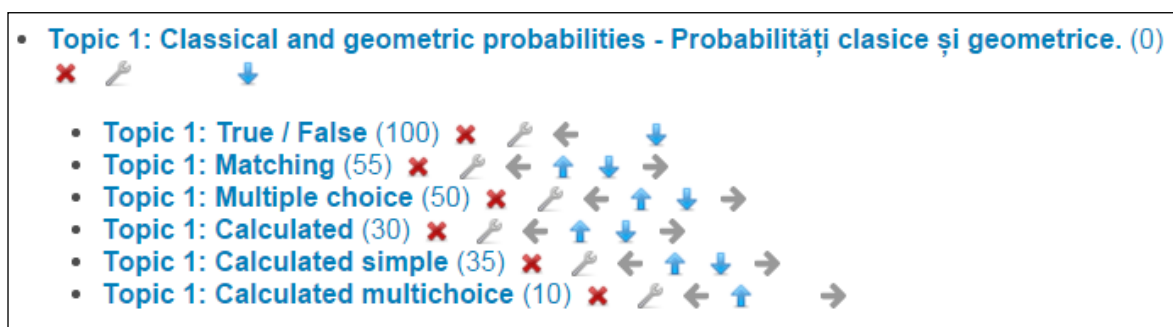


Figure 4 TP. Topic 1: *Classical and geometric probabilities* - category of *Base of Questions*

At the end of *BQ* is organized the category *Probation*, which allows to facilitate the work with tests. Here tests are analyzed and prepared for introduction in *BQ*.

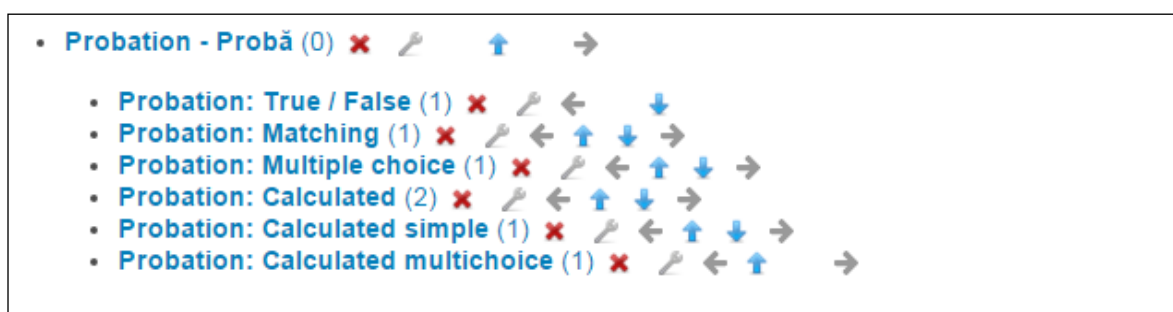


Figure 5 *Probation* - category of *Base of Questions*

3. The creation and development of cognitive tools on e-Learning platforms

Next we expose the possibilities of creation and development of tools for mobile devices with the impact in education and economics, hereinafter referred to as "*Games*". Due to the development of modern information technology, nowadays it is possible to create cognitive applications in relatively short time with modest resources by users who are not professionals in the field of computer science. This possibility is the first due to the fact, that nowadays on the market appeared instruments and programs which can offer enthusiasts the chance to develop such applications. Currently, because of technologies, video games of the medium level can be created by one user, including mobile devices equipped with *Android OS* and *iOS* operating systems. They are well suited instruments for teaching students of the disciplines placed on e-Learning platforms. These kind of video games contribute to the development of interest in the field of study, because they are attractive and cognitive. The possibility of placing mobile games in the courses presented on electronic distance learning platforms, resulted that the discipline of study is easily accessible anywhere, anytime and to anyone. The creation of these cognitive tools, *Games* named, with desire to diversify the training process, adjusting it to the today requirements, presents one of the main reason of the work described in the paper.

3.1 Game Design Software Tools and Stages of Development

A user who wants to build video *Games* must have some experience in the application of modern technologies and programs for their development, namely:

1. *Knowledge of the game graphics editing.*
2. *Knowledge sound editing game.*
3. *Programs building game.*
4. *Exporting and testing platforms for the game.*

Knowledge listed is sufficient for a beginner, but not enough for an advanced informatics specialist.

Editing graphics of the game can be performed with universal graphic editor Photoshop or/and 3D editors that allows developing three dimensional graphics.

Sound Editing can be done with the editor Audacity. This is a free software that allows editing and converting audio in any format.

Building programs of the game. There is a range of programs for developing games. A powerful and called software package is Scirra Construct2.

Exporting and testing the game developed. At this stage will use different software tools, that export and platform game ported their numbers of end-user equipment, for example, Google Android. Please, note that some platforms may be used Online. They allow exporting the easiest way. After testing device occurs, the tested game can be launched on Internet.

Short exposure of the main benchmarks of the concept of creation and development of games in autonomous meaning and /or in distance E-learning courses are sketched in Fig. 6.

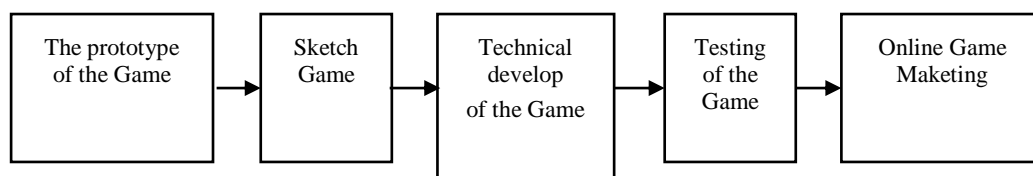


Figure 6 Flow chart of creation and realization of the Game

The prototype of the game is the essence and core of the whole creative process both conceptually and de facto for the final software product, is the start key of this research and implementation in the disciplines and autonomous. At this stage is projecting architecture of the game, its design and functionality, deciding what actions will spend in the game, the impact on the end user, how the user will interact.

Sketch game includes elements, characters and figures which will be presented in the game. Here decides how it will be presented an element or another, sounds, animations, buttons, control methods, etc. *Sketch game* can be seen as a *logical scheme* what is meant to make *the prototype of the game*.

Technical development of the necessary elements of the game. This stage is the most complex part, where each *element* of the game is designed. At this stage fully manifests the knowledge, skills and experience of the *creator* which is called *developer*, and / or other persons involvement occurs by mutual agreement establishing the necessary elements. This step is crucial, because the game is created exactly here, it needs to demonstrate quality, performance and attractiveness.

Testing the game is the next step after the *Technical development* and consists of adjustment and debugging of the programs and components of the game. Testing the game takes place on the device predestined, or on those devices running operating system that were developed for the game (in our case can be Android, iOS, Windows Phone). The purpose of testing is misconfiguration detection and correction, debugging, providing constructive process of completing the game in context with the requirements that inevitably arise as a result of interaction between the *developer* and the *end user*, etc. After testing, the game, can be *loaded* on the electronic platform that, for example on Google Play, for further use.

3.2 Autonomus applications of the Games

Following the steps described above, the authors has done a lot of games: Arcade Games, Run and Jump, Puzzle, Platform video games etc., they all are adjusted to minimum resources and time short record of achievement. These games have been designed to platforma Google

Android and can be *downloaded* for free virtually on any mobile device. The developed play Games can be used free and with payment, respecting the copyright of their creator. Free applications enjoy the greatest popularity and as a result have more downloads, allowing charging them through advertising and that it is a very effective way to popularize them.

Development time. Those mentioned above are practically ineffective, if not taken into account the time in which the steps are developed. Time of preparation is the key factor that can put us in advantage or disadvantage. In this case, the advantage is the use of technologies, tools and methods allowing product development in a shorter - record time. Using the methods and steps described in the paper, a Game can be developed from two weeks to two months, depending on the capabilities, speed and discipline working of the *elaborator*.

It is worth mentioning, that by applying technologies and steps described above, tools and personal experience, record time of creation of such a game was 14 hours. In this record time the stages were achieved: *the prototype of the Game, sketch Game, the technical development of the Game, testing of the Game*, followed by the publication of the game, including the promotion of the free initial level.

Basic tools that lead to creation of these Games, with performing the steps described above are:

1. *Adobe photo shop* - graphic editor. Here were created and processed images, colors, including two- types dimensional *sprite* graphics, scanning, removing faults and exporting the necessary extensions.
2. *Audacity-free* - software applied to the processing sounds, extremely useful when editing, modifying and optimizing sound objects exported.
3. *Construct 2* - Main program for creating games, in which were developed techniques and were imported all the frames of the project needed to finish the game.
4. Beyond the *testing phase* of the game, followed uploading Online game platforms. It allows the millions of users to download and install the Game created on the desired device. At this stage was used platforma *Google Play Store*. Here we show how an account will be opened and how to load the Game, extensions and other necessary details.

3.3 Applications of the Games on e-Learning Platform Moodle

The created games can be successfully achieved, if they will be implemented on the open distance learning platforms Moodle, Claroline, Docheos, Ilias etc. One of these applications is the university course PT and MS, on-line created for distance learning on electronic platform Moodle at TCUM. *Game-Test* are presented in each 12 themes and are used for training knowledge in a more attractive manner. We present below one of theme: Game - Test TP. Theme 1.

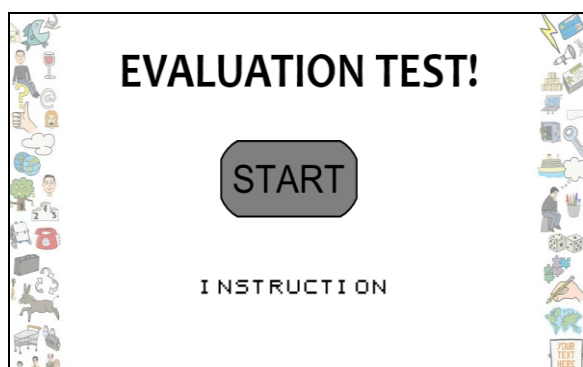


Figure 7 Release Game - Test

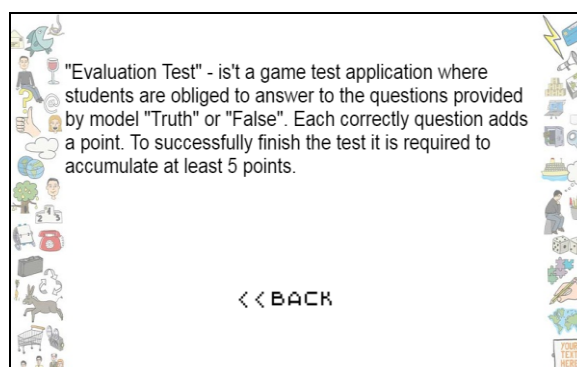


Figure 8 Testing Rules

In Fig. 7 we have buttons, *Start* and *Instruction*. The option *Start* launches the *Game-Test* and the option *Instruction* displays Testing Rules, submitted in Fig. 8. Next, see Fig. 9, on every page of game shows up three questions accompanied by the buttons *True*, *False*. By pressing one of buttons we give the answer, which may be true or false. After pressing the button, they both disappear and this excludes repeating the answer. The correct answer is accompanied by a pleasant sound, a mascot who smiles and announcement *Correct Answer*.

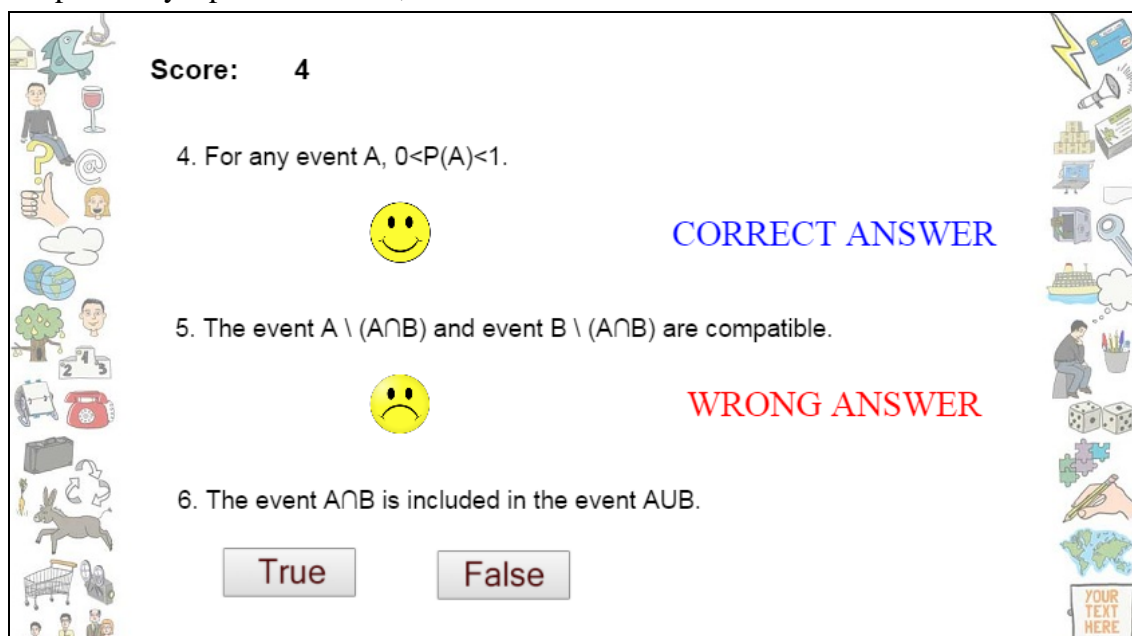


Figure 9 The execution of the Game - Test

The incorrect answer is accompanied by an unpleasant sound, a sad mascot and announcement *Wrong Answer*. At the end of the test appears the final results, presented in Fig. 9 and Fig. 10.

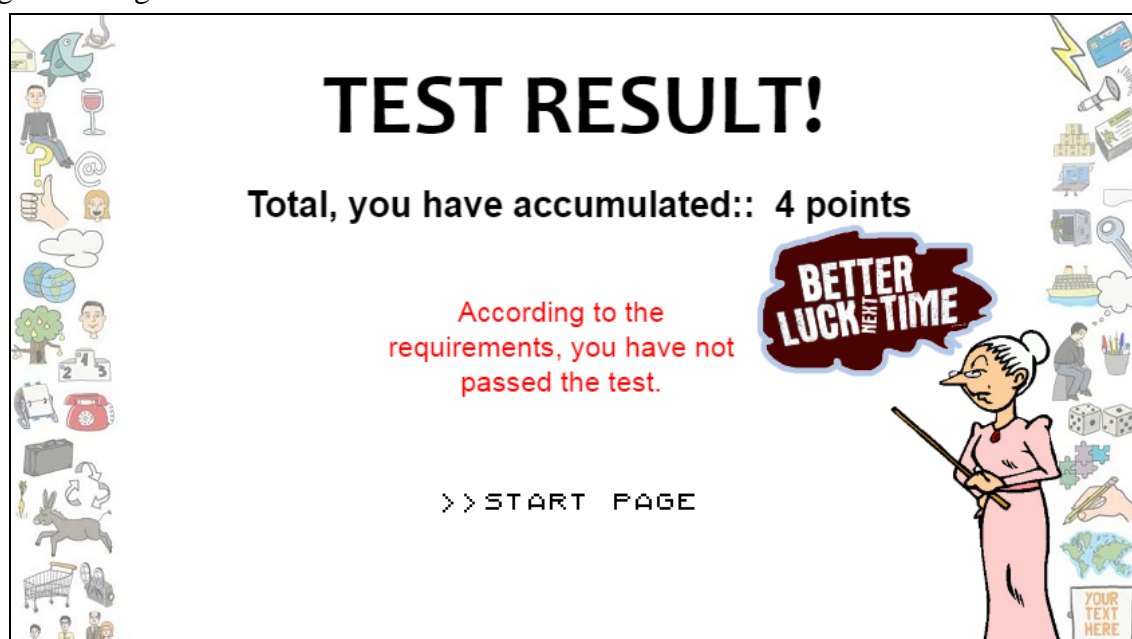


Figure 10 Display negative result

If final result is negative, then appears the image from Fig. 10. Here is announced their accumulated points and an invitation to return to the test. If the result is positive, then we have the image from Fig. 11. Here, also, we have announced their accumulated points and

congratulations that I passed the test. Test conditions can be modified depending on the testing needs.

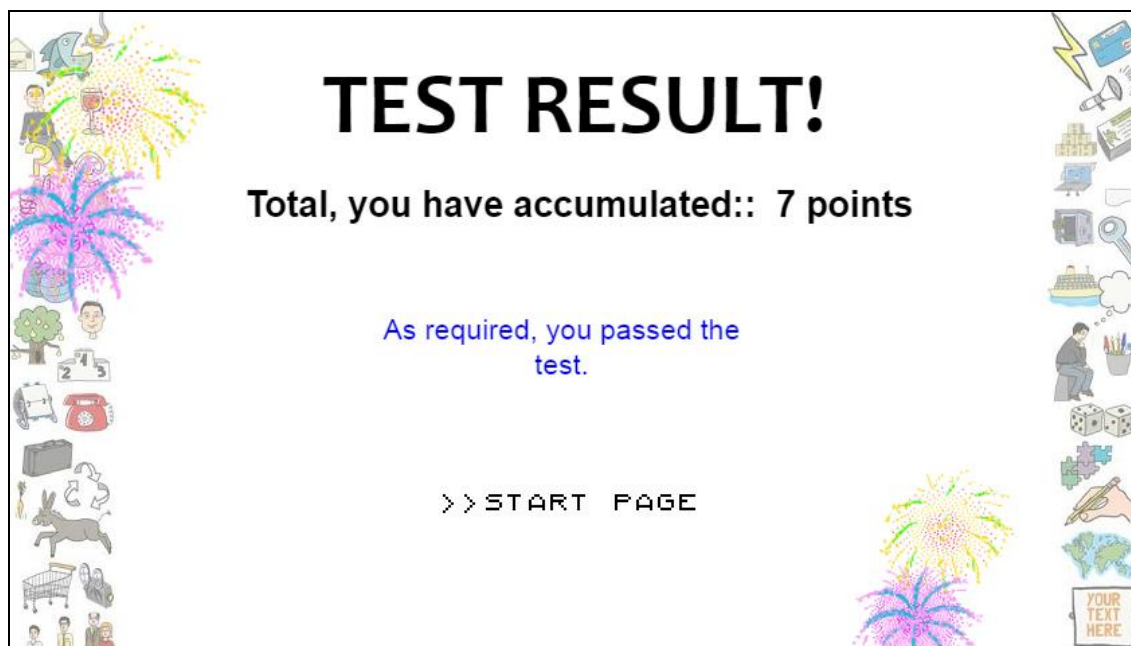


Figure 11 Display positive result

4. Conclusions

The creation and development of university courses on electronic platforms is a purely academic field, very actual today. Nevertheless, creating games is very appealing and as results is a more attractive domain. The tandem of these two areas, at first sight are quite different but can lead to good results in training activities of the young generation. This interesting interactive process require patience, passion and perseverance. It is a creative activity with its own history, from the 80's of last century and currently continues to develop quickly, being one of the most popular activities in the computing market.

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Twitter and Teaching: to Tweet or not to Tweet?

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Abstract. As increasingly more new skills are necessary for graduates entering the workplace or seeking employment, business leaders, politicians and educators suggest that if students are to succeed in today's world, they will require 21st century skills. However, there is no single agreed-upon set of skills. We argue that social media skills are becoming ever more important for employment and society should class them as important 21st-century skills from maintaining well-rounded social media profiles to more advanced data science and analytic skills. At the same time, such a demand affects the teaching process since teachers have to acquire new knowledge about the available tools. Twitter as a microblogging platform is definitely one of the tools that is a part of 21st-century social skills. Thus, by integrating it into the teaching process, Twitter can generate new experiences for both sides, the students and the teachers. In this paper, we conduct a descriptive review of the recent literature that covers Twitter use in teaching. We reviewed results from the top 100 retrieved research results in Web of Science on Twitter and teaching in the domains of social science, science technology, and arts and humanities. We analysed the results quantitatively in terms of content, methods, and methodologies and qualitatively as the description of results found in selected papers that meet certain criteria. This paper also discusses different research departure points for use in further research of the topic.

Key words: *Twitter, teaching, social media, learning, collaboration*

1. Introduction

There is no single set of 21st-century skills although the hundreds of suggestions include life skills such as agility, flexibility, and adaptability; workforce skills such as collaboration, leadership, initiative, and responsibility; applied skills such as accessing and analysing information, effective communication, and determining alternative solutions to problems; personal skills such as curiosity, imagination, critical thinking, and problem solving; interpersonal skills such as cooperation and teamwork; non-cognitive skills such as managing feelings [1]. The National Science Teachers Association [2] believes the 21st-century skillset includes “core subject knowledge, learning and innovation skills, information, media and technology skills, life and career skills, adaptability, complex communication and social skills, non-routine problem solving, self-management/self-development and systems thinking”.

Effective use of social media or, more broadly speaking, sensible use of Web communication technologies is also an important 21st-century skill. Since it is important to use both social media accounts such as LinkedIn, Twitter, or public Facebook to generate interest and further a career, it is equally important that users screen their social media profiles, enable privacy

settings, and ensure that if or when employers search for a prospective employee there is nothing about the candidate that casts them in a negative light to a hiring committee. However, social media, especially Twitter when used correctly, has tremendous benefits within the field of education and more widely, especially within the field of teaching.

The overall research aim of this paper, therefore, is to develop a better understanding of how Twitter is used within teaching. The objectives of the study are to:

- Explore methods of researching the extent to which the teaching world uses Twitter
- Develop a better understanding of current research examining Twitter and teaching
- Develop a better understanding of the theoretical frameworks used in research articles related to Twitter and teaching
- Examine the availability of research articles examining Twitter within teaching.

The primary findings of this paper will interest teachers across higher education by exploring the possibilities of using Twitter in their lectures, researchers interested in teaching and pedagogy methods, and to universities and faculty management. The next section presents the methodology.

2. Methodology

For the purpose of this research, we searched using keywords Twitter + Teaching in the Web of Science database in the domains of social science, science technology, and arts and humanities. We retrieved the first 100 for analysis and selected them according to the publication date, newest to oldest. We also collected a list of the articles and searched for availability of the papers on Google Scholar and other sources (such as the University of Sheffield's Primo Central index). For this particular analysis, we were limited to the papers that were freely and legally available to the researchers conducting research. The researchers could use only the papers that were available via university subscriptions, but a large number of papers were accessible and freely available. We conducted an analysis using a framework that is reported elsewhere [3]. This is a descriptive literature review, descriptive because it focuses on the methodology, methods, findings, and interpretation of each reviewed paper (as opposed to integrative reviews that attempt to find common ideas and concepts from the reviewed material). We divided the presentation of the results in two parts; the first is quantitative in nature (showing distributions of availability, methods and methodologies), and the second is qualitative (presenting results of findings from the studies we analysed).

3. Results

3.1 Quantitative results

The table below displays the distribution of papers grouped by category:

Table 1—Distribution of papers

Groups of papers	Number of Papers
Not available	32
Twitter + student teachers	22
Social media in learning, including Twitter	22
Not relevant	8
Scientific conference	3
e-learning	2
ICT education	1
Teachers engagement on Twitter	1

Sina Webo (Chinese microblogging service)	1
Scientific journals	1
Scientific research impact	1
Student data mining	1
Technology Acceptance Model used	1
Twitter used in research (mobile app)	1
Total	97

There are 97 papers (out of 100 initially retrieved) we analysed further, because we found that some of them were not scientific papers, for example, theses, data sets, and repeated papers. Table 2 below displays the papers that cover only Twitter in teaching.

Table 2—Twitter used solely within teaching research

Methodology	Count	Methods
Quantitative	10	Online questionnaire, questionnaire, survey, Twitter data, online questionnaire, Twitter -based network of interactions, survey
Qualitative	9	Literature review, tweets analysis, content analysis, Twitter data, literature review, exercise presentation, case study on Twitter data, Twitter data content analysis
Mixed	3	Case study + survey, virtual ethnography + quantitative analysis of the tweets produced, action research

3.2 Qualitative descriptive analysis

In this section, we present findings from the 22 papers in which the use of Twitter within the teaching process was the main focus of the study. Our results, outlined below, are presented in order of retrieval, i.e., articles published more recently are reported on first.

Knight & Kaye [4] set out to understand how students use social network sites (SNS) with a primary focus on Twitter. The article explored how it facilitates the academic-student relationship and disparity between them. One of the main issues raised is the problem that SNS come and go, and teachers have to adapt to the dynamics. This study shows that Twitter is mostly used for information seeking and sharing, to follow famous people and to network with friends. It was also found that there are different uses between teachers and undergraduates. Teachers mostly use it for information sharing and students for information seeking. In terms of academic use, students use Twitter to contact specific tutors to ask specific questions and ask course-specific questions. The first five of the students' perception of usefulness was that Twitter provides details on practical issues, posts course-related updates, reminds them about upcoming assignments, posts questions related to courses, and provides specific assignment reports. For the faculty staff members, the most perceived usefulness is to advertise university activities, share research ideas and publications, advertise department activities, ask course-related questions, and post related updates.

Purdam [5] analysed how people use Twitter in the task-based learning (TBL) process. The results of the paper point to the importance of critical data skills in the age of big data, how Twitter data are a new form of data and how it is possible to implement Twitter within a TBL learning framework. The challenge is to develop tasks for students before the course starts.

Gonzalez and Gadbury-Amyot [6] in their paper pointed out that students viewed the use of Twitter positively and found it helpful with their courses. They also reported they were open to using Twitter in the future, that its use increased student engagement in the course and they

found Twitter an excellent resource for question and answer sessions. The challenge of using Twitter related to the teachers' social media skills; however, it could increase the interaction between students and instructor, facilitate prompt feedback from the instructor, and encourage active learning, which are all considered best practices for teaching and learning.

In another paper [7] students showed great interest in Twitter, in particular when they improved, advanced and gained familiarity with the tool. In the final phase, they became aware of the development of their competence acquisition. Implementation of using Twitter in teaching was not a problem for teachers since it promotes a pleasant and motivating learning environment. The first phase was rich and conducive to students, who easily shared the new content generated between them. Some tweets turned students to resources available on the Internet. Such actions point to student interest in a wide integration of materials into their learning. Problems related to setting up an online community around hashtags. So, guidance provided by teachers played a useful role in increasing interaction within a group with the aim of developing a class learning community.

In another study the authors [8] indicated that Twitter represents an educational resource, which is truly multi-disciplinary and breaks down boundaries between professional groups. It could be useful in conferences, and there is an opportunity to reach out to trainees and others seeking continuing professional development and to provide both reliable resources and somewhere to foster debate and discourse on topical themes.

Another paper identified [9] four key success factors for faculty who wish to incorporate Twitter in their pedagogical toolset: 1. Strong initial faculty presence on Twitter. 2. Justification for technology and Twitter in the classroom. 3. Mandatory Twitter participation. 4. Rewards for active professional tweeting versus social tweeting or reactive retweets.

Within another paper, the authors [10] provided tips and suggestions on uses of Twitter in sports-related teachings. They are:

- Use Twitter within the classroom
- Use Twitter to communicate outside of the classroom
- Retweet
- Reply and retweet favourite student responses
- Use Twitter to connect with organizations and businesses
- Use Twitter to connect with coaches, athletes, and sports media
- Assign students to follow Twitter during a live athletic event
- Have students search for examples of class discussion topics outside the classroom
- Interact with alumni
- Archive tweets to create a class story
- Incorporate grades or offer extra credit in order to increase Twitter participation.

In one study [11], the authors elaborated and proposed reasons why teachers should tweet while in the classroom. Twitter promotes active participation, allows more reserved students to participate in class discussions, engages learning, and helps students who are introverted. It is engaging and interactive; it is more engaging than posting comments on a forum; it is less formal. It encourages students to speak up when class size is large and can make the class much more interesting. It is a good tool to communicate and share ideas. It allows soft-spoken students to share their thoughts. Professors can even read the tweets after class and address the questions raised.

Class participation is not limited by time, and Twitter provides a new platform for students to interact and share knowledge with each other. It could be useful as another avenue to participate in class; it is innovative and an interesting learning method, and tweeting provides more opportunities for students to share anytime during the class and encourages students to discuss actively. It supports knowledge exchange between classmates. Live feeds also make participation dynamic and simultaneous and enhance classroom interaction virtually. Students can post ideas or supplementary materials (links, pictures, articles, videos, etc.), and students like unconventional ways of learning. Twitter speaks the language of the young students and adds variety and interest for students, and students can compete for the sake of the grade. It adds quality to the discussion, rejuvenates the idea of class participation, where class participation is no longer just about receiving marks, but about interacting with other students, thereby breaking the barrier of groupthink.

One study [12] showed that online media tools can integrate into daily educational practices and augment learning and collaboration. One of the problems is that students want to keep their social media identities personal rather than integrate them into their professional lives. Its novel use of social media, however, is a useful educational tool, allowing ease of access to a repository of presentations. Students using the Twitter feed found it easily and accessible and useful and felt its use should continue.

In another study [13], the authors proposed a model for how to develop lectures using Twitter, how to focus on engagement strategies, lectures, extensions, and assessment.

In one more broadly positive study, the authors [14] proposed Twitter as a tool for evaluating classes. It gives the possibility of expressing views freely and taking part in the process of improving teaching the subject. It is a powerful and effective tool thanks to its spontaneity and immediacy. It should be complementary with final deeper and more rigorous assessment, its formative and continuing value allows teachers to approach the perspective of students, their views and interests, enabling faculty to act, change, and improve the course at any time during the process. Using Twitter motivates the student and creates a sense of belonging and effective integration into the subject; students are active in the process and identified with the results. Twitter is a positive and beneficial experience, a popular and novel means that is usually well-received by students. Part of the success depends on perceiving clearly the goal of using the tool. To achieve this, it is necessary to democratize the classroom; the student should have equal status and freedom with the teacher, and teachers should promote an evaluation for improvement and learning that overcomes the sanctioning and hierarchical model that still prevails in the university classroom.

In another study [15], the top ten nodes with the highest in-degree were primarily hashtags, suggesting that people were connecting around thematic markers of common interest, referring to them and making them popular. Another study of the same datasets [16] confirms that the learners were more focused on the topics of interest than on those suggested by course facilitators, and that those topics emerged in the course and groups of people who adopted them maintained them.

According to the authors [17] of one particular study, Twitter allows one to connect, engage, learn, and educate oneself and others in real time on a global scale. This paper had an interesting list of potential pitfalls of Twitter. Here are selective pitfalls that apply to a wider audience since this paper dealt with medical education. Twitter is susceptible to misinformation, and to combat lack of trust, it is important to follow reputable individuals to overcome this pitfall. Students should only retweet links and information that are from reliable sources. Another aspect is sharing research results over Twitter since it is easy to lose meaning in the 140 characters. It is also important to recognize that online behaviour becomes a part of a user's permanent Internet identity. Whatever is written on Twitter stays on Twitter

and Google indexes it so we have to take care about what we tweet. Another aspect is an employer's policy for tweeting, and before engaging in tweeting, consult the employer and policies. This study's authors pointed to Twitter Chat as a highly valuable tool that bonds and connects individuals on a specific topic. Twitter Chat is a discussion that takes place in real time at a pre-arranged time on a pre-arranged subject. Twitter allows one to connect, engage, learn, and educate oneself and others in real time on a global scale.

This research [18] shows the more class participants are familiar with Twitter, sessions run more efficiently and effectively. Students and teachers can discuss questions outside the lecture time and can integrate discussion in after-class sessions. Sometimes questions are for specialists in the domain that can broaden the number of participants in the class. Also, research shows that student-tutor relationships have benefited, and students perceived tutors as more approachable both in person and online. However, using Twitter could increase demand of the tutor's time outside the class.

Below, we present a figure from a research paper [19] based on the results of research conducted on using Twitter within the classroom:

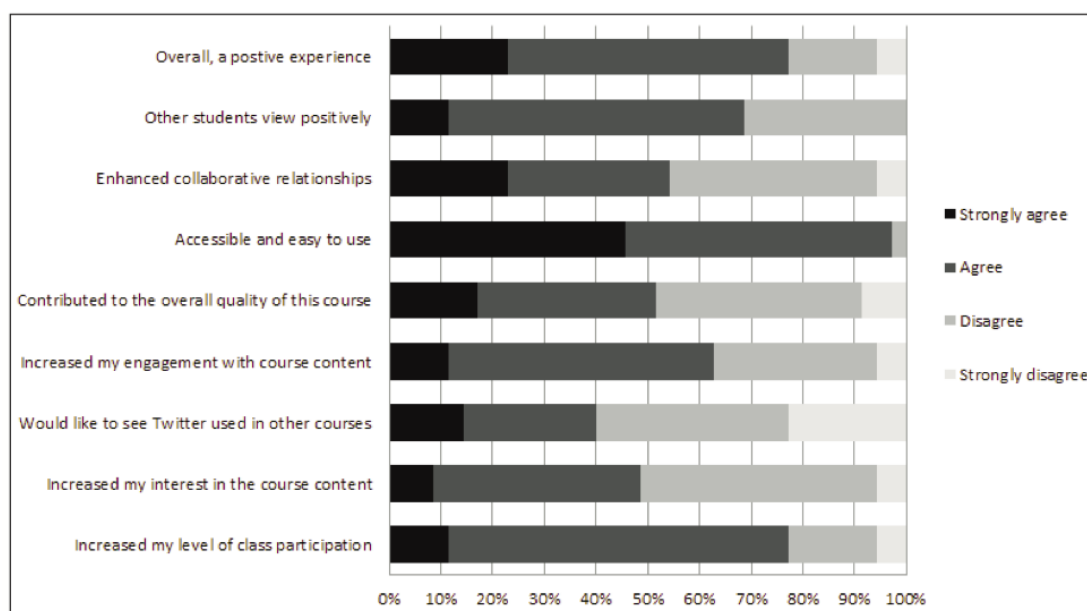


Figure 1—Student perception of Twitter use (from [19])

The results of one particular research article [20] brings the following findings: the amount of Twitter usage was associated with increased student engagement, including organizing social lives and sharing information; course-related tweeting showed no evidence of a relationship to interpersonal relations between students and their tutors. Additionally, Twitter usage also did not relate to class attendance. This research points out that using Twitter for teaching does not in itself improve the relationship between a tutor and learners. The authors suggest that the medium might best be exploited to increase connections between students themselves, students and their tutors, and students and educational resources. Also, they call for careful consideration about whether tweets should become educational or personal since they could have different effects.

Another article [21] analysed Twitter as mandatory backchannel. A backchannel is defined as an electronic discussion that occurs simultaneously in real time during a lecture or conference where students may post questions, comments, or respond to other posts. The authors point out that for a backchannel to succeed, students have to have the devices in the classroom

(mobile, PC, laptops, tablets), and at the start of the course, an instructor should evaluate their skills. For successful incorporation of Twitter as a backchannel, it is important that the faculty member commits to implementing it in the education and learning process. Also, to make Twitter as backchannel work, lecture designs should support Twitter interaction in the class (to allow for periodic consistent backchannel check-in, which is also supported by best pedagogical practices). The overall experience of the authors is positive towards using Twitter in education processes.

In one research article [22], the authors argue that Twitter could serve as a scaffold for developing reading comprehension and writing skills required for reading and composing various genres of scientific text. In the disciplines that have large quantities of complex materials to learn from, Twitter could provide entry to the domain. Also, because of its participatory and multimodal text nature that is constantly updated, Twitter can serve as a more engaging text for adolescents than traditional science textbooks.

One particular study [23] points out that by using Twitter, teachers could interact with a much wider audience. This provides numerous opportunities for outreach of various kinds.

They are presented in Table 3, below.

Table 3—Different ways to use Twitter in teaching (from [23])

Blog writing	Spread awareness about the subject and domain and reach an audience that is much wider than your class and reach new potential readers.
Interaction with students	Usually, dedicated Twitter users from the faculty will use Twitter to interact with students. To overcome oversharing, it is possible to use multiple accounts, one for tweets that students will see, and one for private posts.
Creating public awareness	Promote external events relevant to classes
Addressing social issues/being a citizen-scientist	Through Twitter, students could interact and find out about relevant topics more in-depth and from different perspectives, such as work-life balance, the demands of tenure, and bias against women/minorities)

Another paper [24] raised interesting concerns related to publishing research results on Twitter. It is possible for someone to “steal” an idea or research since these results are important to an academic career. There are two possible answers: First, the concept of plagiarism is not new, and chances of it happening increase as researchers publish more material, and second, publishing research results on the Internet can actually reserve the rights because it has the time and date stamped when published. So actually, it secures output from plagiarism or at least gives the opportunity to pursue the plagiarists. The paper’s research showed 72 percent of respondents in the survey thought Twitter helped learning, but used during the lecture, it had a tendency to distract and intrude. But it could be useful between lectures (as pointed out already in some of the research presented above). Also, scientists who teach can use Twitter to interact with their professional colleagues, so they have a more up-to-date and wider network that will enhance the quality of their lectures.

Another research article [25] points out that Twitter makes following course notifications easier and relevant information more informally received. It could strengthen communication with the other students since they can receive education whenever they want. Also, it strengthens communication between student and teacher. The students’ willingness to learn

increases and courses became more interesting. Students have the opportunity to benefit from knowledge of other people by using the hashtag (#) about subjects they do not understand.

Also as one of the benefits is that students can keep up-to-date and can comment on the current issues. By integrating Twitter with Dropbox, a cloud storage site, it becomes easier to reach course materials and develop joint projects. Sharing course materials in this environment enriches and provides great convenience on sharing homework and projects. It creates positive effects on students' opinions, but it also contributes to students' social and cultural development, and it provides a platform for collaborative studies. Students observed in this research expressed that it helped improve their ability to make comments about course content, and it helped reach educational materials through Dropbox, We Video, an SaaS video editing program, and ThingLink, an image sharing site, mobile applications that show that integrating Twitter with other platforms could boost teaching productivity.

In Table 4 below, we present two main streams of proposed strategies of using Twitter in working with students and as a research tool proposed by the authors in [26]. One stream of strategies is dealing with student engagement and another with how research uses it.

Table 4—Strategies for using Twitter in work with students and as a research tool (from [26])

Strategies for engaging students	Twitter as a research tool
Establish a course profile and use hashtags and, by doing so, keep tweets organized.	Use #hashtag search to find about phenomena.
Collate classroom views and provide instant feedback	Use advanced search functions provided by Twitter and find specific phrases and words, names of people, locations, and hashtags
Create a bulletin board and update students with relevant information (assignment deadlines, seminar topics, and further reading)	Save searches and visit them later in the research process
Reinforce learning activities by using Twitter to set course-related tasks	The discover function on Twitter uses connections to display shared stories and provides updates on new content
Promote knowledge sharing and understanding by getting students to tweet about what they learn while the course is continuing	Add relevant tweets to favourites that are accessible at a later date. Also, looking into favourites of other people can provide a rich source of information.
Get students to share books, journals, and online materials	
Share links to websites	
Foster peer support mechanisms and extend classroom discussion. By doing so, break down barriers between students and develop a sense of belonging to community of the class	
Provide a recap at the end of each class to reinforce key learning points	
Establish flexible office hours and use Twitter to provide quick responses and clarifications on student concerns	

Engage with professional communities and find interesting figures to follow	
Map trends and get students to map views and find out what people are discussing	

In this section, the authors presented findings from a qualitative analysis of a collection of papers. The aim was to describe findings from different research projects objectively and follow suggestions that descriptive literature reviews focus on describing individual studies/papers as proposed in [27]

4. Discussion

In the studies presented above, social media and learning theories prevail as departure points in the research. In our view, there is a lack of variety in the theoretical background within the identified studies that could limit research findings. We would like to discuss different theoretical departure points that could be employed in the research of how Twitter is used in teaching. To start with, we would like to point to the framework proposed by Spiranec and Banek [28], which covers different approaches in information literacy as shown in Table 5.

It is possible to define information literacy as the ability to recognize information needs and identify, evaluate, and use information effectively as stated by [29]. The description includes information technology experience, information sources experience, information process experience, information control experience, knowledge construction experience, knowledge extension experience, wisdom experience [29]. All of them are applicable in the findings. Different approaches presented in Table 5 can help us establish a better understanding of potential avenues of research.

Table 5—Different approaches in information literacy education (Source: [28])

Source approach	The focus is on information sources and bibliographical tools and takes the information system and not the user as its point of departure.
Behavioural approach	The main teaching interests are still bibliographical tools and information sources, but they also provide a generalized structure for information seeking, which users can apply in various situations, practices, and contexts.
Process approach	It covers different aspects of information seeking from the user perspective, focusing on how users experience information seeking and create meaning.
Communication approach	This approach largely consists of an awareness of the importance of understanding the socio-cultural conditions for the production, mediation, and consumption of information and emphasizes the social and communicative aspects of information processes, which are context-sensitive

In the same paper, Spiranec and Banek proposed as a concept Information Literacy 2.0 that has the following features. The accent in teaching is in interpretations and a negotiation, in terms of content focus, on recognizing information contexts, addressing authority, reliability, and accuracy issues. Characteristics are that solutions are nonexclusive solutions and multiple information paths exist. Perception of the information system is on the personal level, and it is

subjective. Information spaces are of unorganized structures, and users are creators of the content and need education to do so.

Methodologically, Information Literacy 2.0 is integrated; it is happening in e-learning and a hybrid environment with a strong focus on Web 2.0 services. We prove that most of the features proposed under the framework of Information Literacy 2.0 are presented in the research findings. So, we would like to propose Information Literacy 2.0 as one of the theoretical departures that are useful to find out more about using Twitter in teaching.

Another departure point we could see in the theory of information behaviour could be defined through these often-used four terms: information behaviour, information-seeking behaviour, information-searching behaviour and information-use behaviour. The definition based on Wilson [30] is in Table 6.

Table 6—Four Terms Used in information behaviour research (source [30])

Information behaviour	Totality of human behaviour in relation to sources and channels of information, including both active and passive information-seeking, and information use
Information-seeking behaviour	Purposely seeking for information as a consequence of a need to satisfy some goal. In the course of seeking, the individual may interact with manual information systems or with computer-based systems
Information-searching behaviour	Behaviour the searcher employs in interacting with information systems of all kinds. It consists of all the interactions with the system, whether at the level of human computer interaction or at the intellectual level, which will also involve mental acts, such as judging the relevance of data or information retrieved.
Information-use behaviour	Consists of the physical and mental acts involved in incorporating the information found in the person's existing knowledge base. It may involve, therefore, physical acts such as marking sections in a text to note their importance or significance, as well as mental acts that involve, for example, comparison of new information with existing knowledge.

Other than information behaviour, we could explore possibilities of approaching phenomena from the perspective of information systems research. Lee and colleagues proposed going back to basics, going back to a socio-technical systems paradigm. They point out that an information system consists of social, technological, and informational components, which are not separate but interrelated [31]. As a useful framework for information systems analysis, we would like to propose the Delone and McLean model of IS success [32] that proposes information, system, and service quality as variables that influence intention to use and user satisfaction with IS. They are correlated, and they will influence net benefit of the IS success. Those variables provide very powerful and an often-used framework for IS analysis.

We would like to also mention an activity theory used in human computer interaction research [33]. The main phenomenon of the research is activity. And, as we see in the above research, finding most of them report on the activities conducted in the class and between classes. As

Kuutti [33] put it, “An activity is a form of doing directed to an object, and activities are distinguished from each other according to their objects. Transforming the object into an outcome motivates the existence of an activity”. “Tools” mediate the relationship between subject and object; “rules” mediate the relationship between subject and community, the “division of labour” mediates the relationship between object and community. Those six variables (subject, object, tool, rules, division of labour, and community) enable rich analysis of Twitter usage in the classroom and between.

5. Conclusion

In this paper, we have provided an overview of research that focused on examining Twitter use in the classroom. The descriptive nature of this paper will provide a valuable resource for those considering using Twitter in the classroom. We found that the main obstacle is that usage of Twitter within teaching is left to the individual teachers and their interest in developing their own skills in social media and using it to improve their teaching process. At the same time, social media skills are important for the students’ professional development. Obligatory top-down implementation of Twitter use in the classroom from the universities’ governance bodies sounds extremely difficult to achieve. However, students need to acquire such knowledge whilst they are studying. In the end, it is the teacher’s responsibility whether to use Twitter in the classroom. However, the extra efforts teachers put in are not usually recognized by the educational system they operate in. As Albert Einstein once put it, “It is the supreme art of the teacher to awaken joy in creative expression and knowledge”.

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Track 1

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Sažetak. Iako je prva mirovinska reforma u Republici Hrvatskoj provedena prije više od jednog desetljeća, točnije 2002. godine, ni danas većina obveznika uplate mirovinskih doprinosa ne zna što u budućnosti mogu očekivati od svojih mirovina. Financijska pismenost građana Republike Hrvatske, po mnogim provedenim istraživanjima, nije na prihvatljivoj razini. Postoji čitav niz programa kojima se pokušava popraviti sadašnje stanje, ali to je proces koji zahtijeva dosta vremena. U međuvremenu, građani donose upravljačke odluke koje će odrediti njihovu financijsku budućnost.

Uredbom o izmjenama i dopunama Zakona o obveznim mirovinskim fondovima (NN 93/15) donesenoj na sjednici Vlade Republike Hrvatske održanoj 26. kolovoza 2015. godine, pred djelatne vojne osobe, policijske službenike i ovlaštene službene osobe mlađe od 40 godina stavljena je mogućnost odabira. U roku od 15 dana trebali su donijeti odluku o ostanku u drugom mirovinskom stupu ili izlasku iz njega. U ovom radu na praktičan način izradit će se projekcija budućih mirovinskih prihoda za oba odabira.

Ključne riječi: mirovinski fondovi, mirovina, financijska pismenost

1. Uvod

U posljednje vrijeme se sve češće može čuti kako je mirovinski sustav u Republici Hrvatskoj neodrživ te da su reforme istog neizbježne. Svima je više manje poznata činjenica da je broj zaposlenih i broj umirovljenika u Hrvatskoj skoro pa izjednačen, a ako ćemo biti potpuno objektivni, realno bi bilo reći da je omjer čak i nepovoljniji uzme li se u obzir činjenica da je velik broj ukupno zaposlenih u javnom sektoru. Iz svega navedenog jasno je da je pitanje dana kada će ovako ustrojen mirovinski sustav doživjeti krah te da je nužno, što je prije moguće, pristupiti reformama mirovinskog sustava.

Već neko vrijeme se kao jedna od mogućih reformi spominje zamrzavanje uplata u drugi mirovinski stup i prebacivanje sredstava u prvi mirovinski stup, tj. u proračun. Brojni ugledni ekonomisti zaziru od ove ideje te smatraju da bi rezultat bio upravo suprotan onome što je potrebno za trajno stabiliziranje proračuna i snižavanje javnog duga.

S druge strane, javnost nije upoznata s mogućim posljedicama i učincima ovakvih reformi i općenito nema dovoljno znanja o davanjima državi i koristi od istih pa stoga nemaju ni predodžbu što bi za njih bilo bolje u budućnosti.

Temeljem prethodno navedenog proizlazi i glavni cilj rada, utvrditi isplativost ulaganja u drugi mirovinski stup naspram prelaska u prvi mirovinski stup te postojanje znanja i vještina i općenito financijske pismenosti osiguranika prilikom donošenja odluka koje znatno mogu utjecati na kvalitetu života.

Rad se sastoji od 5 poglavlja. U ovom poglavlju napisano je nekoliko uvodnih rečenica o temi i ciljevima rada. U drugom poglavlju opisan je mirovinski sustav kakav je na snazi u Hrvatskoj danas. Treći dio odnosi se na financijsku pismenost građana i na nedavnu izmjenu zakona o prebacivanju sredstava iz drugog u prvi mirovinski stup za određene osiguranike spomenute u sažetku rada (NN 93/15). U četvrtom poglavlju prikazana je praktična projekcija budućih mirovinskih prihoda. Peto je poglavlje rada zaključak.

2. Mirovinski sustav Republike Hrvatske

Mirovinski sustav važan je dio sustava socijalne sigurnosti svake suvremene države pa tako i u Republici Hrvatskoj. Hrvatska ima otprilike milijun i četristo tisuća obveznika koji plaćaju mirovinsko osiguranje, a s druge strane njih preko milijun i dvjesto tisuća ostvaruju pravo na mirovinu na temelju davanja iz plaće za vrijeme trajanja radnog vijeka.

U Hrvatskoj je, nakon Drugog svjetskog rata, na snazi mirovinski sustav međugeneracijske solidarnosti koji podrazumijeva da aktivni osiguranici, tj. njihova poduzeća i druge pravne osobe plaćaju doprinose kojima se financiraju mirovine aktualnih umirovljenika. Krajem 20. stoljeća, u većini država pa tako i u Hrvatskoj, mirovinski sustav utemeljen na generacijskoj solidarnosti zapao je u probleme. Razlozi tome, za većinu zemalja, su uglavnom negativni demografski trendovi, sve starija populacija, sve manja stopa fertiliteta.

U Hrvatskoj je ipak rat bio glavni uzrok problema. Posljedica rata i tranzicije od socijalističkog ka tržišnom gospodarstvu bila je bitno smanjenje broja osiguranika s jedne strane i povećanje broja umirovljenika s druge strane. Kada tome dodamo loše oblikovan mirovinski sustav jasno je da su promjene bile nužne. Stoga se 1998. donosi Zakon o mirovinskom osiguranju (NN 102/98) kojim započinje reforma mirovinskog sustava u Republici Hrvatskoj kojom se mijenja i dorađuje postojeći prvi stup temeljen na generacijskoj solidarnosti, ali se istovremeno uvodi i drugi mirovinski stup temeljen na kapitaliziranoj štednji te treći mirovinski stup, dobrovoljno osiguranje (oba se počinju primjenjivati od 01. 01. 2002. godine).

Ciljevi hrvatske mirovinske reforme bili su: transformirati i srediti pravno i financijsko stanje mirovinskog sustava, smanjiti priljev novih osiguranika, usporiti rast mirovinskih izdataka, povećati ovisnost mirovina od doprinosa, pojačati individualnu odgovornost građana za sigurnu starost, dugoročno stabilizirati i učiniti održivim mirovinski sustav.

2.1 Mirovinska reforma - prva faza

Hrvatska mirovinska reforma provedena je u dvije faze. Prva faza bila je racionaliziranje postojećeg mirovinskog sustava međugeneracijske solidarnosti i to pomoću parametarske mirovinske reforme što znači da se ciljalo na smanjenje mirovinskih troškova i njihovo prilagođavanje gospodarskim mogućnostima. Neke od značajnijih parametarskih mjera koje su uvedene u Hrvatskoj su: podizanje dobi odlaska u mirovinu i to svake godine, počevši od 1999. za šest mjeseci pa je tako već 2008. godine stupilo na snagu pravilo da muškarci odlaze sa 65 u mirovinu umjesto ranijih 60, a žene sa 60 umjesto sa 55 godina. Podizanjem dobi odlaska u mirovinu smanjuje se priljev novih umirovljenika i financijski pritisak na mirovinski fond.

Druga važna mjera je povećanje razdoblja zaposlenosti koje ulazi u obračun mirovine. Prema starom zakonu za obračun mirovine uzimalo se 10 najpovoljnijih godina staža u kojima je zaposlenik imao najviše plaće. Novim zakonom uređeno je da se svake godine razdoblju

obračuna mirovine dodaju tri godine pa tako već od 2010. godine u obračun mirovine ulazi cijeli radni vijek osiguranika. Povećanje razdoblja obračuna uzrokuje smanjenje mirovinske osnovice pa time i niže mirovine.

Treća važna inovacija u mirovinskom sustavu odnosila se na način indeksacije (usklađivanja) mirovina. Do reforme se indeksacija mirovina svake godine vršila prema plaćama zaposlenih pa se, zahvaljujući tome, održavala približno ista zamjenska stopa mirovina u odnosu na plaće. Budući da plaće zaposlenih u pravilu rastu brže od cijena (troškova života), pri povećanom broju umirovljenika i smanjenom broju zaposlenih bilo je teško održati indeksaciju prema plaćama zaposlenih. Na kraju je, kao kompromisno rješenje, usvojena tzv. švicarska formula prema kojoj se usklađivanje vrši 50 % prema troškovima života, a 50 % prema plaćama.

Neki od ključnih poteza još su bili i pooštavanje uvjeta za odlazak u prijevremenu starosnu mirovinu, propisani su teži uvjeti odlaska u invalidsku mirovinu, a izmijenjen je i postupak utvrđivanja invalidnosti. Pored opće, uvedena je i profesionalna invalidnost što znači da osoba koja izgubi radnu sposobnost za određene poslove može obavljati druge poslove primjerene njenim radnim sposobnostima. Ukinuti su neki instituti koji su prije bili pri mirovinskom sustavu itd.

Sve navedeno doprinijelo je financijskoj održivosti mirovinskog sustava te je došlo do stabilizacije broja umirovljenika i poboljšanja omjera umirovljenika i zaposlenih. S druge strane, parametarska mirovinska reforma donijela je pad mirovina umirovljenih osiguranika nakon 1999. godine i još neke probleme koji, kako vrijeme odmiče, sve više vaze za rješavanjem.

2.2 Mirovinska reforma - druga faza

Druga faza mirovinske reforme počela se primjenjivati od 01. 01. 2002. godine i bila je nešto radikalnija. Donijela je promjenu strukture mirovinskog sustava. Dakle, u drugoj fazi uveden je drugi mirovinski stup, tj. kapitalizirana individualna štednja u koju se izdvaja jedna četvrtina doprinosa. Sve osobe mlađe od 40 godina (2002. godine) bile su obavezne pristupiti drugom mirovinskom stupu, a osobe između 40 i 50 godina mogle su birati žele li ili pak ne žele biti osiguranici i drugog mirovinskog stupa.

Osiguranici drugog mirovinskog stupa mogu slobodno birati mirovinski fond u koji će ulagati svoje doprinose. Doprinosi osiguranika, akumulirani na osobnim računima, kapitaliziraju se u različitim poslovnim akcijama. Cilj je ostvariti što veću dobit, povećati ulog odnosno kasniju mirovinu osiguranika. Riječ je dakle o individualiziranim mirovinama koje ovise o uloženim doprinosima osiguranika i ostvarenoj dobiti u fondovima.

Treći stup mirovinskog osiguranja uveden je za one koji bi željeli dodatno ulagati i osigurati bolje primitke u starosti te u slučaju invalidnosti ili smrti hranitelja. Ova je vrsta, za razliku od prije spomenutih, potpuno dobrovoljna, a i financijski je potpomognuta od države što daje dodatan motiv za štednju.

Dodatnu mirovinu ostvarenu uplatama u dobrovoljni mirovinski fond isplaćuje izabrano mirovinsko osiguravajuće društvo neovisno o ostvarenoj mirovini iz I. i II. mirovinskog stupa, a jedini uvjet za isplatu je navršeni 50 godina života.

Državnim poticajnim sredstvima država stimulira ulaganje u dobrovoljni mirovinski fond i to u iznosu od 15 % na uplaćeni godišnji iznos.

Dobrovoljno mirovinsko društvo ulaže sredstva članova fonda u različite vrijednosne papire te na taj način oplođuje uloge osiguranika.

2.3 Izmjene u obveznom mirovinskom osiguranju - model A, B i C

U veljači 2014. godine na snagu stupa novi Zakon o obveznim mirovinskim fondovima (NN, 19/14). Najvažnija izmjena spomenutog zakona je mogućnost odabira tri različita portfelja od

strane osiguranika koji dio plaće odvajaju u II. mirovinski stup individualne kapitalizirane štednje. Portfelji se označavaju slovima A, B i C, a razlikuju se po rizičnosti ulaganja pa samim time i po visini prinosa na ulaganje.

Portfelj A je agresivniji portfelj koji je po strukturi imovine većinom izložen hrvatskim i stranim dionicama i to maksimalno do 55 % neto imovine pojedinog mirovinskog fonda. Ovaj portfelj je najpogodniji za mlađe osobe kojima je do umirovljenja ostalo preko 30 godina pa mogu bit tolerantniji na eventualne oscilacije u kretanju prinosa.

Drugi, B portfelj, je manje rizičan od prvog. Kod ovog modela minimalno 50 % imovine fonda mora se ulagati u nisko rizične obveznice, a maksimalno 35 % imovine fonda može se ulagati u dionice.

C portfelj je najmanje rizičan. Ovaj portfelj uopće ne smije biti izložen dionicama pa je time i najpogodniji za one koji nisu skloni riziku. Za portfelj C važnija je sigurnost od ostvarivanja većih zarada.

Iako su osiguranici ti koji odlučuju koji portfelj će odabrati, sukladno odbojnosti prema riziku, ipak postoje određena pravila npr. ako je osiguraniku preostalo 10 godina do umirovljenja mora odabrati ili će automatski biti prebačen u portfelj srednjeg rizika odnosno portfelj B. Također, ako je osiguraniku ostalo 5 godina do umirovljenja automatski se prebacuje u nerizični portfelj C.

Oni mlađi koji imaju više od 10 godina do umirovljenja mogu birati između sva tri portfelja, a osiguranike koji se ne odluče sami Regos će automatski svrstati u portfelj srednje rizičnosti - portfelj B.

3. Financijska pismenost građana

Financijska pismenost važna je kako bi građani mogli donijeti ispravne financijske odluke koje će u konačnici rezultirati pozitivnim ekonomskim rezultatima. Financijska pismenost predstavlja kombinaciju informiranosti, znanja, vještina, stavova i ponašanja potrebnih za donošenje ispravnih financijskih odluka. U promicanju financijske pismenosti najveći su utjecaj imale međunarodne organizacije kao što su OECD, Svjetska banka i Europska komisija.

Nekako se ne možemo oteti dojmu da naše financijske institucije profitiraju od financijske nepismenosti velike većine građana. Kada se tome još doda i asimetrija informacija između financijskih institucija i građana, problem postaje još i izraženiji. Nužno je stoga jače promicati svijest i pismenost potrošača s ciljem boljeg razumijevanja financijskih proizvoda. O tome je studiju napravila i Svjetska banka još 2010. godine ("Hrvatska – Dijagnostički pregled zaštite potrošača i financijske pismenosti") u kojoj su zaključili da u Hrvatskoj i ne postoji adekvatna kampanja promicanja pismenosti potrošača. Zbog toga je Ministarstvo financija 2012. godine započelo pripremati strateški dokument za unaprjeđenje financijske pismenosti građana Republike Hrvatske koji je svijetlo dana ugledao tek 2014. godine pod nazivom "Nacionalni strateški okvir financijske pismenosti potrošača za razdoblje od 2015. do 2020. godine" (NN 11/15). Dokument je usvojen od strane Vlade Republike Hrvatske skupa s prijedlogom Akcijskog plana unaprjeđenja financijske pismenosti potrošača za 2015. godinu.

Razna istraživanja pokazala su da je financijska pismenost važna za sve zemlje, bez obzira na razvijenost zemlje, ali isto tako pokazala su i da financijska pismenost ne ovisi o razvijenosti zemlje, dapače, iznenađujući su bili rezultati jednog istraživanja na stanovništvu SAD-a prema kojemu spomenuti i nisu baš pokazali zavidnu financijsku pismenost.

Također je interesantna činjenica da su, prema istraživanjima, žene manje financijski pismene od muškaraca. Starija populacija zaostaje za mlađom populacijom, a izražena je i povezanost obrazovanja i visine prihoda sa financijskom pismenošću.

Istraživanje provedeno u Hrvatskoj pokazalo je da je najniža razina znanja kod građana iz manjih mjesta, mlađe dobi, nižeg obrazovanja, ženskog spola i nižeg dohotka te nezaposleni na koje bi politika financijskog opismenjivanja prvenstveno trebala biti usmjerena.

U Hrvatskoj je 2006. godine GfK - Centar za istraživanje tržišta d.o.o. proveo anketu o financijskoj pismenosti potrošača o bankovnim uslugama i poslovanju banaka općenito. Rezultati su bili poražavajući. Od 22 ponuđena proizvoda ispitanici su za čak dvije trećine njih odgovorili da su im potpuno nepoznati, odnosno poznati tek po imenu. Drugo istraživanje iste agencije u 2011. godini o ulaganjima u životna osiguranja pokazalo je da samo 15 % hrvatskih građana ulaže u taj oblik štednje.

Općenito se moglo uočiti da je štednja za starije dane tek na trećem mjestu po važnosti, iza štednje za hitne slučajeve i izvanredne okolnosti te štednje za djecu. Dakle, planiranje štednje za budućnost je na vrlo niskoj razini, a u značajnoj mjeri ovisi o informiranosti i povjerenju u pojedine oblike štednje. Stoga se može zaključiti da je potrebna promjena ponašanja pojedinaca, veća informiranost i pojačana edukacija kako bi imali primanja koja priželjkiju u budućnosti, a realno ih ne mogu očekivati samo na temelju obvezne mirovinske štednje.

Planiranje ulaganja važna je komponenta mirovinske pismenosti kao dijela financijske pismenosti. Prema OECD-u mirovinsko opismenjivanje je „proces u kojem se budući korisnici mirovina informiraju i poboljšavaju razumijevanje obveznog mirovinskog osiguranja i karakteristika mirovinskog sustava zemlje općenito da bi postali svjesni ograničenja tog sustava te razvili vještine i znanje o mogućnostima privatne štednje pomoću koje mogu povećati primjerenost mirovinskih primanja te se time osposobiti za poduzimanje učinkovitih mjera za poboljšanje svoje dobrobiti u trećoj životnoj dobi“.

S obzirom na prilike u našoj zemlji, mirovine koje se mogu ostvariti ulažući samo u obvezna mirovinska osiguranja ograničene su, čak štoviše, u većini slučajeva nedostatne za osnovne životne potrebe. Nužno je stoga podučiti osiguranike da postoje mogućnosti za dodatna primanja u starosti te na koji način do njih doći.

Važnost financijske pismenosti leži i u tome što ona smanjuje rizike individualnih pogrešnih odluka te time smanjuje i pojedinačno, ali i ukupno siromaštvo u zemlji.

Ciljevi mirovinske pismenosti nisu toliko različiti od ciljeva u drugim područjima financijske pismenosti. Kod mirovinske pismenosti naglasak je više na dugoročnom planiranju štednje kako bi se izbjeglo siromaštvo u trećoj životnoj dobi.

3.1 Mirovinske dvojbe za određeni broj osiguranika u Hrvatskoj

U Republici Hrvatskoj prije nepunih godinu dana donesena je reforma koja je zahtijevala financijsku odnosno mirovinsku pismenost o kojoj je bila riječ u prethodnom poglavlju. Naime, pred djelatne vojne osobe, policajce, pirotehničare, manji broj vatrogasaca čije se mirovine isplaćuju prema posebnim propisima stavljena je, takoreći preko noći, obveza da se odluče žele li i dalje ostati osiguranici i prvog i drugog mirovinskog stupa ili će svoja sredstva iz drugog mirovinskog stupa prebaciti u prvi mirovinski stup generacijske solidarnosti.

Tu obavijest dobilo je nešto manje od 40 000 osiguranika sa beneficiranim radnim stažem. Imali su dvije mogućnosti ili se izjasniti da ostaju ili se oglašiti na poziv što bi značilo da pristaju na reformu i prebacivanje njihovih sredstava iz drugog mirovinskog stupa u prvi.

Većina spomenutih osiguranika na poziv se oglašila. Je li to zbog neinformiranosti ili su pak racionalno sagledali situaciju i zaključili da im je to isplativije, nije poznato.

Onima koji su odlučili oglašiti se na poziv tj. prebaciti štednju u prvi mirovinski stup država će mirovine obračunavati prema posebnim propisima. S druge strane, oni koji su odlučili ostati u drugom stupu u mirovinu će prema općim propisima što bi značilo da će raditi do 65 ili 67 godine života.

Po posebnim se uvjetima u nekim situacijama s beneficiranim stažem može u mirovinu čak u 42. godini života pa se, uzimajući to u obzir, zaključilo kako individualna kapitalizirana

štednja zbog umirovljenja u ranijoj životnoj dobi ne može generirati dovoljno sredstava koji bi omogućili veće iznose mirovina te da je isplativije uplaćena sredstva prebaciti u prvi mirovinski stup generacijske solidarnosti.

Je li uistinu tome tako te što bi bilo isplativije za osiguranike obraditi će se u sljedećem poglavlju kroz projekciju budućih prihoda od mirovina ako je osoba bila osiguranik samo prvog mirovinskog stupa te, ako je uz prvi uplaćivala i kapitaliziranu individualnu štednju, tj. drugi mirovinski stup.

4. Projekcija budućih mirovinskih prihoda na primjeru hipotetskog osiguranika I i II stupa obveznog mirovinskog osiguranja koji mirovinu ostvaruje po povoljnijim uvjetima

Na sjednici Vlade RH održanoj 26. kolovoza 2015. godine, pred djelatne vojne osobe, policijske službenike i ovlaštene službene osobe mlađe od 40 godina koji prema Zakonu o pravima iz mirovinskog osiguranja djelatnih vojnih osoba, policijskih službenika i ovlaštenih službenih osoba (NN 128/99, 129/00 – Zakon o policiji 16/01, 22/02, 41/08, 97/12 i 118/12) mirovinu ostvaruje pod povoljnijim uvjetima odnosno ostvaruje staž osiguranja s povećanim trajanjem, stavljena je mogućnost odabira; u roku od 15 dana trebali su donijeti odluku o ostanku u drugom mirovinskom stupu ili izlasku iz njega.

U ovom poglavlju će se na hipotetskom primjeru izračuna mirovine osiguranika obveznog mirovinskog osiguranja pokušati dati odgovor na pitanje da li će uredba Vlade RH o izmjenama i dopunama Zakona o obveznim mirovinskim fondovima (NN 93/15) imati utjecaja na visinu mirovine i koliki bi taj utjecaj trebao biti.

Prvotno će se dati uvod u sam način (formulu) izračuna mirovine, a onda će se u drugom dijelu poglavlja izraditi projekcija mirovinskih prihoda za dva slučaja osiguranika; prvi za slučaj ostajanja u II. stupu (u tom slučaju osiguranik ostvaruje mirovinu iz oba stupa mirovinskog osiguranja) i drugi u slučaju izlaska iz II. stupa, odnosno prebacivanja sredstava u I. stup (u tom slučaju osiguranik ostvaruje mirovinu samo iz prvog stupa mirovinskog osiguranja)

4.1 Izračun mirovine¹

Svota mirovine računa se tako da se osobni bodovi pomnože s mirovinskim faktorom i aktualnom vrijednošću mirovine. U svotu mirovine uračunava se, odnosno sastavni je dio mirovine, dodatak na mirovinu, određen na način i pod uvjetima propisanim Zakonom o dodatku na mirovine ostvarene prema Zakonu o mirovinskom osiguranju (NN 19/07 i 114/11), koji iznosi 27,0 %.

Osobni bodovi ovise o mirovinskom stažu i plaćama koje je osiguranik ostvario za vrijeme radnog vijeka, a izračunavaju se tako da se prosječni vrijednosni bodovi² pomnože s ukupnim mirovinskim stažem i polaznim faktorom i jednako se računaju za sve vrste mirovina.

Mirovinski staž je skupni naziv za razdoblja provedena u obveznom mirovinskom osiguranju i produženom osiguranju (staž osiguranja) i razdoblja provedenih izvan osiguranja koja se pod određenim uvjetima priznaju u mirovinski staž (posebni staž)³.

¹ Prikaz izračuna mirovine se odnosi na izračun tzv. osnovne mirovine koja predstavlja novčano primanje iz mirovinskog osiguranja koje pod određenim uvjetima stječu osiguranici koji su od 1. siječnja 2002. osigurani i u obveznom mirovinskom osiguranju na temelju individualne kapitalizirane štednje.

² Prema članku 81. Zakona o mirovinskom osiguranju vrijednosni bodovi utvrđuju se na temelju plaća i osnovica osiguranja ostvarenih od 1. siječnja 1970., tako da se plaća, odnosno osnovica osiguranja utvrđena za svaku kalendarsku godinu podijeli s prosječnom godišnjom plaćom svih zaposlenih u Republici Hrvatskoj za istu kalendarsku godinu. Plaće ili osnovice koje su u bruto svoti dijele se s prosječnom bruto plaćom, a ako su u neto svoti s prosječnom neto plaćom. Prosječni vrijednosni bodovi utvrđuju se tako da se zbroj vrijednosnih bodova podijeli s razdoblje za koji su obračunati

³ Zakon o mirovinskom osiguranju (NN 157/13, 151/14, 33/15 i 93/15), članak 8

Polazni faktor ovisi o dobi osiguranika na dan stjecanja prava na mirovinu. Polazni faktor određuje u kojem se opsegu uzimaju vrijednosni bodovi pri određivanju mirovine. Vrijednosni bodovi uzimaju se u punom opsegu (polazni faktor 1,0):

- a. za invalidsku mirovinu
- b. za privremenu invalidsku mirovinu
- c. za obiteljsku mirovinu nakon smrti osiguranika
- d. za starosnu mirovinu
- e. starosna mirovina za dugogodišnjeg osiguranika iz članka 35. Zakona⁴
- f. za prijevremenu starosnu mirovinu iz članka 36. Zakona

Polazni faktor za određivanje starosne mirovine osiguranika, koji prvi put stječe mirovinu nakon navršene 65. godine života i ima 35 godina mirovinskog staža, utvrđuje se tako da se polazni faktor iz stavka 1. članka 85. Zakona o mirovinskom osiguranju povećava za 0,15 % po mjesecu za svaki mjesec nakon navršenih godina života osiguranika propisanih za stjecanje prava na starosnu mirovinu, a najviše za pet godina.

Mirovinskim faktorom određuje se u kojem se opsegu uzimaju osobni bodovi pri izračunu mirovine. Mirovinski faktor iznosi 1,0 za starosnu, prijevremenu starosnu i invalidsku mirovinu zbog opće nesposobnosti za rad.

Aktualna vrijednost mirovine (AVM) utvrđena je svota mirovine za jedan osobni bod.⁵

AVM koja se primjenjuje od 1. siječnja 2014. godine i 1. srpnja svake kalendarske godine određuje se tako da se AVM uskladi po stopi koja se dobije kao polovica zbroja stope promjene prosječnog indeksa potrošačkih cijena u prethodnom polugodištu i stope promjene prosječne bruto plaće svih zaposlenih u Republici Hrvatskoj u prethodnom polugodištu u odnosu na polugodište koje mu prethodi, tzv. „fiksna formula“ $50 \% : 50 \%$).

Konačna stopa usklađivanja AVM-a koja se primjenjuje od 1. siječnja svake kalendarske godine, počevši od 1. siječnja 2015., određuje se u visini razlike između stope godišnjeg rasta mirovine („rotirajuća formula“ 70:30, 50:50 ili 30:70, ovisno što je povoljnije) i stope usklađivanja mirovina utvrđene šest mjeseci prije toga dana, tj. od 1. srpnja kalendarske godine („fiksna formula“ $50 \% : 50 \%$).

AVM utvrđuje Upravno vijeće Zavoda na temelju podataka Državnog zavoda za statistiku, najkasnije tri mjeseca nakon isteka svakog polugodišta. Odluku o usklađivanju donosi Vlada Republike Hrvatske. Mirovine se usklađuju ako je realni rast bruto društvenog proizvoda prema podacima Državnog zavoda za statistiku u svakom od tri prethodna uzastopna tromjesečja najmanje 2,0 % u odnosu na isto tromjesečje prethodne kalendarske godine i ako je deficit državnog proračuna u istom razdoblju manji od 3 %.

Dodatak na mirovinu ostvaren prema Zakonu o mirovinskom osiguranju dobivaju korisnici mirovina koji su ostvarili pravo na mirovinu nakon 1. siječnja 1999., prema Zakonu o mirovinskom osiguranju, određuje se zavisno od svote mirovine i godine ostvarivanja prava na mirovinu.

Osnovicu za određivanje dodatka čini mjesečna svota mirovine koja se usklađuje svake kalendarske godine, odnosno dva puta godišnje (počevši od 1. siječnja, odnosno od 1. srpnja) prema (svakoj) novoj aktualnoj vrijednosti mirovine.

U svotu mirovine određenu prema članku 79., stavku 1. Zakona o mirovinskom osiguranju uračunava se dodatak na mirovinu određen na način i pod uvjetima propisanim Zakonom o dodatku na mirovine ostvarene prema Zakonu o mirovinskom osiguranju (NN 79/07, 114/11). Prema članku 79. stavku 2. Zakona o mirovinskom osiguranju dodatak na mirovinu određen na način i pod uvjetima propisanim Zakonom o dodatku na mirovine ostvarene prema Zakonu

⁴ Zakon o mirovinskom osiguranju (NN 157/13, 151/14, 33/15 i 93/15), članak 85

⁵ <http://mirovinsko.hr/default.aspx?id=76> [pristupljeno 25.3.2016.]

o mirovinskom osiguranju uračunava se u svotu mirovine, odnosno dodatak je sastavni dio formule za izračun mirovine.

Pravo na dodatak imaju:

- a. korisnici mirovine kojima je mirovina priznata i određena prema ZOMO-u⁶ (članak 74. do 81. i 184. ZOMO)
- b. korisnici mirovine ostvarene primjenom međunarodnih sporazuma o socijalnom osiguranju kojima je mirovina iz hrvatskoga mirovinskog osiguranja priznata i određena isključivo prema ZOMO-u
- c. redoviti članovi HAZU koji su mirovinu ostvarili nakon 26. prosinca 2002. i kojima je mirovina priznata i određena prema ZOMO-u i ako iznosi manje od najviše mirovine.

Pravo na dodatak nemaju⁷:

- a. korisnici osnovne mirovine
- b. korisnici obiteljske mirovine, određene nakon 1. siječnja 1999. od mirovine ostvarene prema propisima o mirovinskom i invalidskom osiguranju koji su važili do 31. prosinca 1998.
- c. korisnici najviše mirovine
- d. korisnici najniže mirovine
- e. korisnici mirovina ostvarenih i/ili određenih na temelju posebnih propisa pod povoljnijim uvjetima od uvjeta određenih prema ZOMO-u.

4.2 Praktični primjer izračuna mirovine ostvarene na temelju posebnih propisa pod povoljnijim uvjetima na hipotetskom slučaju osiguranika I. i II. stupa obveznog mirovinskog osiguranja

U ovom poglavlju će se na praktičnom primjeru hipotetskog osiguranika I. i II. stupa obveznog mirovinskog osiguranja, uz uzimanje određenih pretpostavki, projicirati mirovinski prihodi koje bi osiguranik ostvarivao ukoliko bi zadržao status osiguranika II. stupa obveznog mirovinskog osiguranja, odnosno ukoliko bi odlučio ostati osiguranik samo u I. stupu mirovinskog osiguranja.

Osiguranik koji ostvaruje mirovinu po povoljnijim uvjetima prema Zakonu o pravima iz mirovinskog osiguranja djelatnih vojnih osoba, policijskih službenika i ovlaštenih službenih osoba na temelju rješenja nadležnog ministra, odnosno čelnika tijela sigurnosno-obavještajnog sustava o prestanku službe zbog potreba službe osiguranik može ostvariti pravo na starosnu mirovinu, bez obzira na godine života, kada navrši mirovinski staž od najmanje 30 godina, od toga najmanje 15 godina mirovinskog staža na dužnostima, odnosno na poslovima na kojima se staž osiguranja računa s povećanim trajanjem.

Hipotetski osiguranik I. i II. stupa mirovinskog osiguranja ima prijavljeno prebivalište u Splitu (prirez 10 %), mjesečnu bruto plaću u iznosu 7 500 kuna te prema zakonu ostvaruje pravo na mirovinu po povoljnijim uvjetima. Pravo na starosnu mirovinu ostvaruje navršavanjem 30 godina mirovinskog staža, odnosno 2030. godine (za potrebe izračuna uzeta je 2000. godina kao godina u kojoj se zaposlio i postao osiguranik obveznog mirovinskog osiguranja temeljenog na međugeneracijskoj solidarnosti). 1. 1. 2002. godine također postaje osiguranikom novouvedenog II. stupa mirovinskog osiguranja temeljenog na individualnoj kapitaliziranoj štednji.

Mirovina iz I. stupa koju će osiguranik ostvarivati po zakonu se sastoji iz dva dijela: za staž ostvaren do početka osiguranja u II. stupu (1. 1. 2002.) dio mirovine osiguranicima se određuje jednako kao i osiguranicima osiguranim samo u I. stupu. Za staž ostvaren nakon početka osiguranja u II. stupu određuje se po istoj formuli kao i osnovna mirovina, pri čemu

⁶ Zakon o mirovinskom osiguranju

⁷ Zakon o dodatku na mirovine ostvarene prema Zakonu o mirovinskom osiguranju (NN 79/07, 114/11), članak 3

se uz prije navedene varijable u izračunu uključuje i faktor osnovne mirovine⁸ koji iznosi 0,75.

Mirovina iz drugog stupa projicirana je temeljem mjesečnih uplata osiguranika, uzimajući u obzir i prosječni zadani prinos, počevši od 1. 1. 2002. do kraja 2029. godine, pri čemu se ta sredstva odlaskom u mirovinu osiguranika isplaćuju dinamikom koju on sam odredi.

U donjoj tablici 1 nalaze se projicirane vremenske serije godišnje bruto plaće osiguranika, prosječne godišnje bruto plaće svih zaposlenih u RH te temeljem njih izračunati vrijednosni i prosječni vrijednosni bodovi. Vrijednosti ostalih varijabli potrebnih za izračun mirovine sljedeći su:

- a. Mirovinski staž iznosi 30 godina
- b. Polazni faktor je 1
- c. Mirovinski faktor je 1
- d. Aktualna vrijednost mirovine (AVM) iz izračuna je zadnja određena na datum 1. srpnja 2015. i iznosi 61,10 kuna. Istu je vrlo teško vjerodostojno projicirati kroz nadolazeće godine uslijed složenosti njenog izračuna (veliki broj međuovisnih varijabli) i značajnog utjecaja politike (Vlade) prilikom njenog određivanja.

Tablica 1 Izračun vrijednosnih bodova i prosječnih vrijednosnih bodova

Godina	Bruto plaća	Prosjek bruto plaća u državi	Vrijednosni bodovi	Ulaganja u 2. mirovinski stup
2000	66471,2192	58428	1,137660355	
2001	67827,7747	60732	1,116837495	
2002	69212,015	64392	1,074854253	3460,60
2003	70624,5051	67476	1,046661111	3531,23
2004	72065,8216	71820	1,003422745	3603,29
2005	73536,5526	74976	0,980801225	3676,83
2006	75037,2986	79608	0,942584898	3751,86
2007	76568,672	84546	0,905645117	3828,43
2008	78131,298	90528	0,863062235	3906,56
2009	79725,8143	92532	0,861602627	3986,29
2010	81352,8717	92148	0,882850108	4067,64
2011	83013,1344	93552	0,887347512	4150,66
2012	84707,28	94500	0,896373333	4235,36
2013	86436	95268	0,90729311	4321,80
2014	88200	95436	0,924179555	4410,00
2015	90000	96000	0,9375	4500,00
2016	91800,00	99840,00	0,919471154	4725,00
2017	93636,00	103833,60	0,901789016	4961,25
2018	95508,72	107986,94	0,88444692	5209,31
2019	97418,89	112306,42	0,867438325	5469,78
2020	99367,27	116798,68	0,850756819	5743,27
2021	101354,62	121470,63	0,834396111	6030,43
2022	103381,71	126329,45	0,818350032	6331,95
2023	105449,34	131382,63	0,802612531	6648,55
2024	107558,33	136637,93	0,787177675	6980,98
2025	109709,50	142103,45	0,772039643	7330,03
2026	111903,69	147787,59	0,757192726	7696,53
2027	114141,76	153699,09	0,742631328	8081,35
2028	116424,60	159847,06	0,728349956	8485,42

⁸ Zakon o mirovinskom osiguranju (NN 157/13, 151/14, 33/15 i 93/15), članak 93

2029	118753,09	166240,94	0,714343226	8909,69
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Vremenski niz godišnjih bruto plaća osiguranika dobiven je određivanjem vrijednosti za 2015. godinu koja je uzeta kao referenta vrijednost pri čemu su protekle i nadolazeće godine iz vremenskog niza određene verižno umanjivanjem odnosno povećanjem za 2 posto. Na isti način dobiven je i vremenski niz prosjeka bruto plaća u državi pri čemu su vrijednosti 2000. – 2014. godine preuzete sa stranica HZMO-a, dok su vrijednosti 2016. – 2029. dobivene verižno povećanjem za 4 posto. Procijenjeni godišnji prinos na sredstva u drugom mirovinskom stupu iznosi 5 %. Prosječni vrijednosni bodovi iznose 0,891655705 (zbroy svih vrijednosnih bodova po godinama podijeljen s ukupnim brojem razdoblja za koji se računaju. Završno će se prikazati izračun mirovine iz I. stupa za staž ostvaren prije osnivanja II. stupa, odnosno za staž ostvaren nakon početka osiguranja u II. stupu, prema novom Zakonu o mirovinskom osiguranju od 1. 1. 2014.

Izračun se vrši korištenjem formule za osnovnu mirovinu, ali bez korištenja prava na dodatak na mirovinu od 27 posto na što imaginarni osiguranik po zakonu nema pravo.

$$M = \underbrace{PVB * MS * PF}_{OB} * MF * AVM \quad (1)$$

Uvrštavanjem vrijednosti u gornju formulu dobivamo iznos mirovine iz I. stupa za staž ostvaren prije osnivanja II. stupa u iznosu 1634,404907 kuna.

Za staž ostvaren nakon početka osiguranja u II. stupu, prema novom ZOMO-u od 1. 1. 2014., također se koristi gornja formula pri čemu se, uz navedene varijable, u nju još mora uključiti i faktor osnovne mirovine od 0,75. Uvrštavanjem vrijednosti u gornju formulu dobivamo iznos mirovine iz I. stupa za staž ostvaren nakon osnivanja II. stupa u iznosu 1225,80368 kuna.

Zbrajanjem ovih dvaju izračunatih iznosa dobivamo ukupni iznos od 2860,208587 kuna, što odgovara iznosu imovine iz I. stupa mirovinskog osiguranja. Ukoliko još njoj pridodamo i kapitalizirana sredstva na individualnim računima koja su mjesečno uplaćivana i ostvarivala prinos od 5 posto godišnje evidentno je da bi ukupni mirovinski prihodi bili veći ukoliko bi osiguranik ostao u II. stupu.

5. Zaključak

Ovim radom stavljen je naglasak na važnost financijskog opismenjavanja fizičkih osoba kao temeljne pretpostavke u upravljanju osobnim financijama. Imajući u vidu trenutni problem održivosti postojećeg mirovinskog sustava temeljenog na međugeneracijskoj solidarnosti i individualnoj kapitaliziranoj štednji, više no ikad javlja se potreba da pojedinci (osiguranici) samostalno počnu donositi financijske odluke temeljene na informiranosti i financijskim ciljevima koje žele ostvariti. Jedan takav primjer obrađuje i ovaj rad, pri čemu su analizirana dva slučaja; u jednom slučaju osiguranik odabire ostanak samo u prvom stupu mirovinskog osiguranja, dok u drugom slučaju osiguranik zadržava status u drugom mirovinskom stupu, preuzimajući time dijelom i odgovornost za vlastite buduće mirovinske prihode.

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Zakon o dodatku na mirovine ostvarene prema Zakonu o mirovinskom osiguranju (NN 19/07 i 114/11)

Zakon o mirovinskom osiguranju (NN 157/13, 151/14, 33/15 i 93/15)

Zakon o obveznim mirovinskim fondovima (NN 19/14, 93/15), preuzeto 18. veljače 2016. sa: www.zakon.hr/z/708/Zakon-o-obveznim-mirovinskim-fondovima

Zakon o pravima iz mirovinskog osiguranja djelatnih vojnih osoba, policijskih službenika i ovlaštenih službenih osoba (NN 128/99, 129/00 – Zakon o policiji 16/01, 22/02, 41/08, 97/12 i 118/12)

<http://mirovinsko.hr/default.aspx?id=76> [pristupljeno 25.3.2016.]

Pension concerns and financial literacy

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Abstract. Although the first pension reform in Croatia was introduced more than a decade ago, more precisely in 2002, even today the majority of payers of pension contributions do not know what they can expect in the future from their pension. Financial literacy of Croatian citizens, after the results of many investigations, is not at an acceptable level. There are a number of programs that attempt to correct the current situation, but it is a process that requires a lot of time. Meanwhile citizens take management decisions that will determine their financial future.

Regulation on Amendments to the Law on Mandatory Pension Funds (Official Gazette, 93/15) adopted, at the session of the Croatian Government on 26 August 2015, before active military personnel, police officers and authorized officials under 40 years old, placed choice. Within 15 days they had to make a decision about remaining in the second pillar or getting out of it. In this paper, in a practical way, a projection of future retirement income for both selections will be displayed.

Keywords: *pension funds, pensions, financial literacy*

Prednosti i nedostaci novog Zakona o računovodstvu s osvrtom na male kompanije

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Sažetak. Sve zemlje članice Europske unije imale su obvezu uključivanja Direktive 2013/34/EU u svoje postojeće računovodstvene sustave najkasnije do 20. srpnja 2015. Navedena obveza rezultirala je donošenjem novog Zakona o računovodstvu 3. srpnja 2015. (NN 78/15). Direktivom 2013/34/EU se nastoji uskladiti financijsko izvještavanje kompanija s novonastalim tržišnim uvjetima te osigurati transparentnost i usklađenost na cijelom području Europske unije. Direktiva 2013/34/EU prvenstveno je usmjerena na olakšanje poslovanja malim trgovačkim kompanijama kroz smanjenje administrativnog opterećenja. Polazeći od činjenice da upravo male trgovačke kompanije snose najveći teret trenutnih tržišnih uvjeta te da iste predstavljaju zamašnjak gospodarstva, ovim radom će se komparirati nastale promjene zakonodavnog računovodstvenog okvira vezane upravo uz male trgovačke kompanije. Stoga će se u okviru ovog rada ukazati na prednosti i nedostatke proizašle iz novog Zakona o računovodstvu koje se odnose na male trgovačke kompanije.

Ključne riječi: *Zakon o računovodstvu, male trgovačke kompanije, prednosti, nedostaci*

1. Uvod

Direktiva 2013/34/EC Europskog parlamenta i Vijeća donesena 26. lipnja 2013. o godišnjim financijskim izvještajima, konsolidiranim financijskim izvještajima i srodnim izvještajima za određena društva mijenja dosadašnju Direktivu 78/660/EC (tzv. Četvrta direktiva) i Direktivu 83/349/EEC (tzv. Sedma direktiva). Direktivu 2013/34/EC sve zemlje članice Europske Unije imale su obvezu uvrstiti u svoje računovodstvene sustave (Cirkveni Filipović, 2015). Navedenom direktivom projiciran je cijeli niz promjena kojima se ističe prvotna namjera iste, a to je olakšanje poslovanja malim kompanijama kroz smanjenje administrativnih opterećenja. Stoga će se ovim radom ukazati na nastale promjene u računovodstveno-zakonodavnom okviru kao i utjecaj tih promjena na male kompanije.

2. Zakon o računovodstvu

Direktiva 2013/34/EC propisuje cijeli niz promjena koje sve zemlje članice Europske unije moraju implementirati u svoje nacionalne računovodstvene sustave. Sukladno Direktivi

2013/34/EC donesen je novi Zakon o računovodstvu (NN 78/15) koji je stupio na snagu 1. siječnja 2016. Navedeni zakon je donesen s ciljem usklađenja i harmonizacije hrvatskog računovodstveno-zakonodavnog okvira sa zakonodavnim okvirom Europske unije propisanim Direktivom 2013/34/EC. Značajnije novine proizašle stupanjem na snagu novog zakona mogu se sistematizirati kroz sljedeće:

- kategorizacija poduzetnika
- licenciranje računovođa
- knjigovodstvene isprave
- jedinstveni kontni plan
- rokovi čuvanja računovodstveno financijske dokumentacije
- sastavljanje temeljnih financijskih izvještaja.

Novim zakonom se čl.5. propisuje nova kategorija poduzetnika, tj. mikro poduzetnici te se propisuju i nove vrijednosti za kategoriziranje poduzetnika. Navedeno se može prikazati sljedećom tablicom:

Tablica 1 Kategorizacija poduzetnika prema novom Zakonu o računovodstvu (Cirkveni Filipović, 2015)

Opis	MIKRO PODUZETNICI (ako ne prelaze dva od tri kriterija)	MALI PODUZETNICI (ako ne prelaze dva od tri kriterija)	SREDNJI PODUZETNICI (ako ne prelaze dva od tri kriterija)	VELIKI PODUZETNICI (ako prelaze dva od tri kriterija)
Ukupna aktiva	2.600.000,00 kn	30.000.000,00 kn	150.000.000,00 kn	150.000.000,00 kn
Prihod	5.200.000,00 kn	60.000.000,00 kn	300.000.000,00 kn	300.000.000,00 kn
Prosječan broj zaposlenih	10	50	250	250

Pored kategorizacije navedene tablicom velikim poduzetnicima se smatraju i banke, štedne banke, stambene štedionice, institucije za elektronički novac, društva za osiguranje, društva za reosiguranje, leasing-društva, društva za upravljanje UCITS fondovima, društva za upravljanje alternativnim investicijskim fondovima, UCITS fondovi - otvoreni investicijski fondovi s javnom ponudom, alternativni investicijski fondovi, mirovinska društva koja upravljaju obveznim mirovinskim fondovima, mirovinska društva koja upravljaju dobrovoljnim mirovinskim fondovima, dobrovoljni mirovinski fondovi, obvezni mirovinski fondovi te mirovinska osiguravajuća društva, društva za dokup mirovine, faktoring-društva, investicijska društva, burze, operatori multilateralne trgovinske platforme (MTP-a), središnja klirinška depozitarna društva, operatori središnjeg registra, operatori sustava poravnanja i/ili namire i operatori Fonda za zaštitu ulagatelja (Cirkveni Filipović, 2015).

Novim zakonom propisuje se licenciranje osoba koja obavljaju računovodstvenu djelatnost, odnosno čl.7. st.4. novog zakona propisuje da ukoliko poduzetnik povjeri obavljanje računovodstvenih poslova drugim pravnim ili fizičkim osobama iste moraju biti licencirane za obavljanje tih poslova. Ova odredba bi trebala stupiti na snagu 1. siječnja 2018.

Novim zakonom se čl.9. propisuje obvezna forma knjigovodstvene isprave, koja je promijenjena temeljem Uredbe o izmjeni i dopuni novog zakona (NN 134/15), odnosno uredbom je iz novog zakona isključena obveza potpisa knjigovodstvene isprave i obveza prikazivanja konta na kojem će knjigovodstvena isprava biti proknjižena. Sukladno navedenom knjigovodstvena isprava treba sadržavati:

1. naziv i broj knjigovodstvene isprave
2. opis sadržaja poslovnog događaja i identifikaciju sudionika poslovnog događaja koja sadržava njihov naziv ili ime i prezime te sjedište ili adresu
3. novčani iznos ili cijenu po mjernoj jedinici s obračunom ukupne svote
4. datum poslovnog događaja ako nije isti kao datum izdavanja
5. datum izdavanja knjigovodstvene isprave

Novim zakonom, čl.11., propisuje se obveza primjene jedinstvenog kontnog plana kojega će formirati Odbor za standarde financijskog izvještavanja. Navedena obveza je temeljem Uredbe o izmjenama i dopunama novog Zakona o računovodstvu prolongirana za 1. siječnja 2017., a Odbor za standarde financijskog izvještavanja je obvezan objaviti jedinstveni kontni plan do 30. lipnja 2016.

Novim zakonom se čl.10. i čl.14. propisuju rokovi čuvanja knjigovodstvenih isprava i poslovnih knjiga i to:

- isplatne liste, analitička evidencija o plaćama za koje se plaćaju obvezni doprinosi – trajno
- isprave na temelju kojih su podaci uneseni u dnevnik i glavnu knjigu – najmanje 11 godina
- isprave na temelju kojih su podaci uneseni u pomoćne knjige – najmanje 11 godina

Nadalje, novim zakonom, čl.14., propisuje se obvezno čuvanje dnevnika, glavne knjige i pomoćnih knjiga u trajanju od najmanje 11 godina te se iste trebaju zaključiti najkasnije 4 mjeseca nakon završetka poslovne godine. Također se novim zakonom dopušta da se knjigovodstvene isprave i poslovne knjige mogu čuvati i van granica Republike Hrvatske, ali unutar Europske unije.

Novi zakonom se čl.19. propisuje da mali i mikro poduzetnici imaju obvezu sastavljanja bilance, računa dobiti i gubitka te bilješki uz financijske izvještaje, dok su srednji poduzetnici pored navedenih izvještaja obvezni sastavljati izvještaj o novčanim tijekovima i izvještaj o promjenama kapitala, a veliki su poduzetnici pored navedenih obvezni sastavljati i izvještaj o ostalom sveobuhvatnom dobitku.

Pored nabrojanih novina proizašlih iz novog računovodstveno-zakonskog uređenja postoji još promijenjenih stavki koje nisu u direktnom odnosu s malim kompanijama stoga su i izostavljene iz obrade.

3. Promjene Zakona o računovodstvu s osvrtom na male kompanije

Fokus na male kompanije proizlazi iz njihove uloge u gospodarstvu Republike Hrvatske. Svoju ulogu male kompanije opravdavaju prije svega kroz brojnost koja se može prikazati sljedećom tablicom:

Tablica 2 Struktura kompanija s obzirom na veličinu u 2011., 2012. i 2013. godini (Alpeza & Singer, 2015)

	2011.		2012.		2013.	
	Broj kompanija	%	Broj kompanija	%	Broj kompanija	%
Male kompanije	89.539	98,2	95.597	98,3	99.537	98,3
Srednje kompanije	1.292	1,4	1.309	1,3	1.268	1,3
Velike kompanije	359	0,4	348	0,4	350	0,4
Ukupno	91.190	100	97.254	100	101.191	100

Temeljem navedene tablice može se uočiti brojčana nadmoć malih kompanija koja se kroz promatrane godine potvrđuje kroz udjele od čak 98,2 %, 98,3 % i 98,3 % u ukupnom broju kompanija, što opravdava fokus ovoga rada na upravo male kompanije. Gospodarska kriza te trenutna tržišna kretanja uvelike su otežali uvjete poslovanja koji se reflektiraju kroz nesolventnost, netransparentnost, stečaje i zatvaranje poslovnih subjekata. Stoga se nastoje pronaći načini kojim bi se omogućilo pojednostavljenje poslovanje svim tržišnim subjektima. Jedan od prijedloga je i Direktiva 2013/34/EC koja je prvenstveno orijentirana na smanjenje opterećenja malim kompanijama za koje se ističe da predstavljaju generatore gospodarskog oporavka i razvoja. Shodno navedenoj Direktivi donesen je Zakon o računovodstvu (NN 78/15, 2015) iz kojeg je proizašla Uredba o izmjenama i dopunama novog Zakona o računovodstvu (NN 134/15, 2015). U nastavku će se analizirati eventualni utjecaj prethodno navedenih novina novoga Zakona o računovodstvu.

Kao najznačajnija novina ističe se uvođenje nove kategorije poduzetnika, odnosno mali poduzetnici se dijele na dodatnu kategoriju mikro poduzetnika za koje bi se Zakonom trebao osigurati jednostavniji postupak financijskog izvještavanja. Međutim, novi Zakon ne samo da ne osigurava jednostavniji oblik financijskog izvještavanja već propisuje obvezu sastavljanja bilance, računa dobiti i gubitka i bilješki uz financijske izvještaje u punom opsegu što predstavlja dodatno opterećenje u odnosu na stari Zakon koji je propisivao skraćeni oblik navedenih izvještaja za male kompanije. Samim time može se zaključiti da podjela malih kompanija na mikro i male kompanije ne stvara nikakve prednosti, već dapače, uslijed obveze sastavljanja financijskih izvještaja u punom opsegu predstavlja dodatno opterećenje za iste.

Nadalje, s ciljem adekvatnijeg vrednovanja računovodstvene djelatnosti novim Zakonom se predviđa licenciranje računovodstvene profesije koje bi trebalo stupiti na snagu počevši od 1.siječnja 2018. Ujedno se očekuje poseban Zakon ili Pravilnik kojim bi se propisali uvjeti licenciranja. Licenciranje je predviđeno samo za osobe koje pružaju računovodstvene usluge, ali ne i za osobe koje obavljaju računovodstvene poslove kod svojih poslodavaca, tek ostaje za vidjeti hoće li se postići prava svrha uvođenja ove odredbe (Omašić, 2015). S obzirom da je prema informacijama Financijske agencije u Republici Hrvatskoj približno oko 7.000 zaposlenih u 2.752 računovodstveno knjigovodstvena servisa nužno je žurnije i detaljnije pristupiti navedenom, te uključiti što više stvarnih aktera računovodstveno knjigovodstvenih poslova u formiranje što kvalitetnijeg okvira licenciranja računovodstvene profesije. Shodno

prethodno navedenom ova mjera bi trebala doprinijeti poboljšanju statusa računovodstvene profesije, ali ostaje za vidjeti što i kako će biti.

Glede zakonske novine vezane uz obveznu formu knjigovodstvene isprave može se zaključiti da se ovime želi povećati transparentnost poslovanja te efikasnost internih kontrola poslovnih subjekata. Navedeno bi trebalo omogućiti poslovnim subjektima precizniji i sigurniji uvid u vlastito poslovanje temeljem kojega projiciraju vlastite snage i vlastite slabosti, čime bi se osiguralo donošenje kvalitetnijih poslovnih odluka. Upravo su male kompanije te koje ne mogu priuštiti luksuz pogrešne poslovne odluke, stoga ova novina predstavlja pozitivan pomak u odnosu na stari Zakon.

Zakonska novina uvođenja jedinstvenog kontnog plana s ciljem transparentnijih poslovnih knjiga naišla je na otpor među poslovnim subjektima, prije svega zbog kratkog roka i visokog troška implementiranja istoga. Polazište Direktive 2013/34/EC je smanjenje administrativnih opterećenja što je u suprotnosti s iznesenim. Ujedno dok većina članica Europske unije nije zakonski definirala kontni plan i dopušta slobodu u korištenju kontnog plana postavlja se pitanje svrsishodnosti istoga. Kao što je i ukazano uvođenje jedinstvenog kontnog plana vodi suprotno od smjernica Direktive 2013/34/EC te povećava opterećenja na sve kompanije, a poglavito na male kompanije.

Zakonske novine vezane uz produljenje rokova čuvanja računovodstveno financijske dokumentacije doprinijeli su usklađenju s Općim poreznim Zakonom. Ujedno se poslovne knjige trebaju zaključiti najkasnije 4 mjeseca po završetku poslovne godine što doprinosi usklađenju s rokom za javnu objavu, rokom za predaju financijskih izvještaja za statističke potrebe te rokom za prijavu poreza na dobit. Sve navedeno osigurava usklađenost poslovanja i lakše praćenje potrebitih aktivnosti vezanih uz pripremu konačnih rezultata poslovanja. Usklađenost poslovnih aktivnosti doprinosi lakšem poslovanju malim kompanijama čiji su predstavnici često nedovoljno informirani i upadaju u određene administrativne probleme uslijed neispunjavanja potrebitih obveza.

4. Zaključak

Polazeći od činjenice da se novim Zakonom o računovodstvu trebalo isključiti ono što je godinama predstavljalo problem u poslovanju kompanija te doprinijeti stabilizaciji poslovanja kroz smanjenje administrativnih opterećenja postavlja se pitanje "računovodstvena bit ili računovodstvena forma". Naime, čitajući novi Zakon o računovodstvu i komparirajući proizašle zakonske novine u odnosu na stari Zakon o računovodstvu ne može se zaključiti da je došlo do smanjenja administrativnog opterećenja za male kompanije te se postavlja pitanje čemu kategorizacija mikro poduzetnika kada snose iste računovodstvene obveze kao i male kompanije. Također, nekim zakonskim novinama, odnosno obvezom sastavljanja financijskih izvještaja u punom opsegu za male kompanije te uvođenjem jedinstvenog kontnog plana doprinijelo se povećanju administrativnog opterećenja na male kompanije. Stoga se može projicirati zaključak da su napravljene promjene više kozmetičke prirode nego li stručne.

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The advantages and disadvantages of the new accounting law with an emphasis on small companies

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Abstract. All the European Union member states were obliged to include Directive 2013/34/EC in their existing accounting systems by 20th July 2015. The obligation resulted in the adoption of a new accounting law on 3rd July 2015 (NN 78/15). Directive 2013/34/EC seeks to harmonize the financial reporting of companies with the new market conditions and to ensure transparency and compatibility in the whole European Union. Directive 2013/34/EC is primarily focused on simplifying the work of small trading companies via a decrease in administrative burdens. Starting from the fact that small trading companies bear the biggest burden of the current market conditions and that they represent the driving force of economy, this paper will compare the resulting changes of accounting law precisely with relation to small trading companies. Therefore, the paper will point to the advantages and disadvantages resulting from the new accounting law relating to small trading companies.

Key words: *accounting law, small trading companies, advantages, disadvantages*

Financiranje ESCO modelom – primjer tvrtke Galeb d.d.

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Sažetak. Energetska učinkovitost okosnica je jedinstvene energetske politike Europske unije i jedan je od pet glavnih ciljeva strategije Europa 2020 - smanjenje potrošnje energije za 20 % do 2020. godine. Povećanje energetske učinkovitosti djelotvoran je način postizanja ciljeva održivog razvoja budući da energetska učinkovitost izravno pridonosi smanjenju emisija štetnih plinova u okoliš, jačanju konkurentnosti industrije, otvaranju novih radnih mjesta i povećanju sigurnosti opskrbe energijom. U kontekstu Kohezijske politike EU-a, Republici Hrvatskoj dostupna su značajna sredstva financijske potpore za provedbu projekata energetske učinkovitosti iz EU fondova u različitim sektorima kroz programe za financiranje i sufinanciranje hrvatskog Fonda za zaštitu okoliša i energetske učinkovitost (FZOEU). Jasan i mjerljiv utjecaj smanjenja potrošnje energije na konkurentnost poslovanja, uz dodatnu mogućnost subvencije projekata energetske učinkovitosti iz javnih izvora, rezultirali su pojavom inovativnog modela financiranja projekata ove vrste na domaćem tržištu. ESCO (*Energy Service Company*) predstavlja generičko ime koncepta na tržištu usluga iz područja energetike. ESCO model obuhvaća razvoj, izvedbu i financiranje projekata energetske učinkovitosti s ciljem smanjenja troškova za energiju i održavanje ugradnjom energetski učinkovitije opreme i optimiziranjem energetskih sustava pri čemu se osigurava otplata investicije kroz ostvarene uštede u određenom razdoblju. U ovom radu prezentiran je projekt ulaganja u energetski učinkovitu rasvjetu i kompresorsko postrojenje u proizvodnom pogonu tekstilne tvrtke Galeb d.d. odnosno sveobuhvatne aktivnosti pripreme, prijave, ugovaranja, provedbe i izvještavanja na projektu koji je financiran ESCO modelom ugovaranja energetske usluge i subvencijom FZOEU-a kroz program potpora male vrijednosti (*de minimis* potpore) te su prezentirani međusobni odnosi svih uključenih strana u projektu.

Ključne riječi: *ESCO model, energetska usluga, subvencije ulaganjima u mjere energetske učinkovitosti.*

1. Uvod

U Republici Hrvatskoj Zakon o energetske učinkovitosti (NN 127/14) uređuje područje učinkovitog korištenja energije, donošenje planova na lokalnoj, područnoj (regionalnoj) i nacionalnoj razini za poboljšanje energetske učinkovitosti te njihovo provođenje, mjere energetske učinkovitosti, obveze energetske učinkovitosti, obveze regulatornog tijela za energetiku, operatora prijenosnog sustava, operatora distribucijskog sustava i operatora tržišta energije u svezi s prijenosom, odnosno transportom i distribucijom energije, obveze

distributera energije, opskrbljivača energije i/ili vode, a posebice djelatnost energetske usluge, utvrđivanje ušteda energije te prava potrošača u primjeni mjera energetske učinkovitosti.

Ovim se Zakonom u zakonodavstvo Republike Hrvatske prenosi Direktiva 2012/27/EU Europskog parlamenta i Vijeća od 25. listopada 2012. o energetske učinkovitosti kojom se dopunjuju direktive 2009/125/EZ i 2010/30/EU i ukidaju direktive 2004/8/EZ i 2006/32/EZ (SL L 315,14. 11. 2012.). Na odnose koji nisu uređeni ovim Zakonom supsidijarno se primjenjuje niz propisa kojima se uređuje područje energetske učinkovitosti. Svrha je ovoga Zakona ostvarivanje ciljeva održivog energetskog razvoja, a u skladu sa zaključcima Direktive 2012/27 koji ističu izazove ovisnosti Unije o uvozu energije i oskudnim izvorima energije kao i potrebom za ograničavanjem klimatskih promjena i prevladavanjem gospodarske krize. Cilj povećanja energetske učinkovitosti potvrđen je kao jedan od krovnih ciljeva nove strategije Unije za radna mjesta, održiv i uključiv rast. Ostvarenje zajedničkog cilja povećanja energetske učinkovitosti za 20 % poželjno je ostvariti provođenjem različitih politika i mjera za povećanje energetske učinkovitosti te utvrđivanjem pojedinačnih nacionalnih ciljeva, sustava i programa koji obuhvaćaju cjelokupni energetski lanac.

Ulaganja u energetske učinkovitost s neupitnim potencijalom za uštedu električne energije te jasnim ciljem smanjenja krajnje potrošnje dodatna su prilika za rast i zapošljavanje u obrtnom i građevinskom sektoru, u proizvodnji i profesionalnim djelatnostima kao što su konzultantske usluge, arhitektura i inženjerstvo. Nadalje, poticanje ulaganja u energetske učinkovitost može riješiti pitanje troškovno učinkovitih velikih radova, a u pravilu duži period povrata investicije u obnovljive izvore energije svesti na prihvatljiv rok. Upravo je pitanje financiranja projekata energetske učinkovitosti dovelo do pojave novih modela financiranja poput ESCO koncepta, uz značajnu ulogu posredničkih tijela za korištenje i upravljanje strukturnim instrumentima EU, koja kroz programe i provedbu mjera energetske učinkovitosti pridonose rastu investicija u energetske učinkovitost u javnom i privatnom sektoru.

S ciljem smanjenja troška energije zamjenom energetski neučinkovite rasvjete i kompresorskog postrojenja, uz otplatu investicije iz ostvarenih ušteda u prihvatljivom roku, tvrtka Galeb d.d. u 2015. godini uspješno je realizirala projekt *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina* ugovaranjem energetske usluge s tvrtkom Veritas ESCO d.o.o., uz ugovaranje zajedničkog financiranja projekta energetske učinkovitosti davanjem sredstava subvencije od strane Fonda za zaštitu okoliša i energetske učinkovitost.

2. ESCO koncept

Novi koncept na tržištu usluga iz područja energetike nude tvrtke za pružanje energetskih usluga (engl. ESCO – *Energy service company*). ESCO modelom primjene mjera energetske učinkovitosti, privatna tvrtka provodi određeni projekt poboljšanja energetske učinkovitosti na imovini klijenta što obuhvaća razvoj, projektiranje, financiranje i izvedbu projekta na način da ESCO tvrtka ulaže vlastita financijska sredstva, znanje, tehnologiju i rad te upravlja rizicima u projektu energetske učinkovitosti, a projekt se financira isključivo iz ostvarenih ušteda za klijenta kroz određeni broj godina. Ostvarene uštede sadržane su u troškovima za energente i održavanje.

Područje poslovanja tvrtke za pružanje energetskih usluga podijeljeno je na javni i privatni sektor, a projekti poboljšanja energetske učinkovitosti obuhvaćaju zgradarstvo, toplinarstvo, industriju i javnu rasvjetu.

Djelatnost energetskih usluga u Republici Hrvatskoj regulira Zakon o učinkovitom korištenju energije u neposrednoj potrošnji (NN 152/08).

2.1 Ugovor o energetske učinku

Ugovor o smanjenju potrošnje energije temeljem poboljšanja performansi (engl. EPC - *Energy performance contracting*) oblik je „kreativnog financiranja“ kapitalnih poboljšanja i mehanizam poticanja investicijske klime gdje pružatelj energetske usluge, privatna ESCO tvrtka, investira u javnu ili privatnu imovinu drugih, a povrate investicije ostvaruje iz tijeka prihoda iz postignutih ušteda u višegodišnjem razdoblju.

Način ugovaranja energetske usluge reguliran je Uredbom o ugovaranju i provedbi energetske usluge u javnom sektoru (NN 11/15) te u skladu s postojećom zakonskom regulativom u Republici Hrvatskoj ovakvi ugovori spadaju u kategoriju Ugovora o energetskom učinku. Ovakav model financiranja u skladu je sa načelima javno-privatnog partnerstva te kao takav ne generira javni dug za naručitelja. U tom smislu, osim opskrbljivača energije i korisnika mjera energetske učinkovitosti, ovaj ugovorni sporazum uključuje i treću stranu koja osigurava kapital za te mjere i zaračunava korisniku naknadu koja odgovara dijelu energetskih ušteda koje su posljedica mjera za poboljšanje energetske učinkovitosti. U osnovi, ESCO tvrtka neće dobiti svoju uplatu ukoliko projekt ne donosi očekivanu uštedu.

Ugovorni pristup temeljen je na prijenosu tehnoloških, tehničkih i financijskih rizika s klijenta, naručitelja energetske usluge na ESCO tvrtku, pružatelja energetske usluge koja daje činidbena jamstva, a ugovorena naknada temeljena je na dokazanoj izvedbi, odnosno postignutom i verificiranom poboljšanju energetske učinkovitosti.

Održiva provedba ESCO modela zahtjeva multidisciplinarni pristup i stručnost svih uključenih u pripremu kvalitetnog Ugovora o energetskom učinku, odnosno realizaciju projekta energetske učinkovitosti provođenjem mjera energetske učinkovitosti.

2.2 Pružatelj energetske usluge Veritas ESCO d.o.o.

Veritas ESCOd.o.o. prva je privatna tvrtka u Republici Hrvatskoj iz područja modernizacije odnosno rekonstrukcije javne rasvjete. Tvrtka je osnovana 2013. g. prepoznavanjem tržišne niše u potrebi modernizacije preko 80 % javne rasvjete u Hrvatskoj. Osnivanju ove tvrtke koja posluje po ESCO modelu prethodilo je više od pet godina razvoja koncepta u tri paralelna smjera: pravnom, tehnološkom i ekonomskom.

Najzahtjevniji i najdugotrajniji posao bio je uspostava pravnog okvira za djelovanje utjecanjem na donošenje propisa iz područja energetske učinkovitosti i energetskih usluga prenošenjem i usklađivanjem EU direktiva u hrvatsko zakonodavstvo, a ovaj posao još uvijek traje. U stalno promjenjivom poslovnom okruženju koje zahtijeva kontinuirani proces učenja, Veritas ESCO razvija svoje kapacitete u suradnji sa znanosti pa zapošljava mlade visokoobrazovane inženjere, redom studente Fakulteta elektrotehnike, strojarstva i brodogradnje (FESB) Splitskog sveučilišta. Počevši s troje zaposlenih u 2013. g., tvrtka Veritas ESCO danas broji osamnaest zaposlenih, od čega dvanaest inženjera FESB-a.

Snažnim opredjeljenjem ulaganju u razvoj, tvrtka Veritas ESCO razvila je vlastitu LED uličnu svjetiljku pod nazivom Veritas ST-M, globalno konkurentan proizvod koji ima sve pripadajuće certifikate potrebne za plasman i korištenje ove svjetiljke na tržištu EU.

Kako ESCO model u pravilu ne pretpostavlja tvrtku proizvođača, specifičnost tvrtke Veritas ESCO jest upravo u činjenici što uličnu svjetiljku Veritas ST-M tvrtka proizvodi u vlastitom proizvodnom pogonu u Splitu. Brojne jedinice lokalne samouprave prepoznale su potencijal ESCO modela te stručnost i najmoderniju LED tehnologiju ugrađenu u ovaj proizvod pa je broj projekata rekonstrukcije javne rasvjete koje provodi Veritas ESCO u stalnom porastu.

2.3 Fond za zaštitu okoliša i energetska učinkovitost

Sustav upravljanja i kontrole operativnog programa Konkurentnost i kohezija 2014. – 2020. u Republici Hrvatskoj uspostavilo je strukturu na način da je glavno upravljačko tijelo Ministarstvo regionalnog razvoja i fondova Europske unije, a u kontekstu projekata

energetske učinkovitosti, posredničko tijelo razine 1 jest Ministarstvo zaštite okoliša i prirode, dok je posredničko tijelo razine 2 Fond za zaštitu okoliša i energetske učinkovitost (FZOEU). Djelatnost FZOEU-a, između ostalog, obuhvaća poslove vezane za financiranje pripreme, provedbe i razvoja programa i projekata u području energetske učinkovitosti (Zakon o Fondu za zaštitu okoliša i energetske učinkovitost NN 107/03).

Projekt *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina* odgovor je na Javni natječaj za sufinanciranje projekata energetske učinkovitosti u industriji Fonda za zaštitu okoliša i energetske učinkovitost, otvorenog u listopadu 2014. g. (NN 122/14) u skladu s *Programom rada Fonda*, a temeljem *Trećeg nacionalnog akcijskog plana energetske učinkovitosti RH-a za razdoblje od 2014. do 2016.*

U skladu s uvjetima Javnog natječaja i preporukama FZOEU za izradu ponude te specifičnostima financiranja modelom energetske usluge, u nastavku opisan je postupak prijave projekta na Javni natječaj za sufinanciranje projekata energetske učinkovitosti u industriji kao i sama provedba projekta.

3. Projekt energetske učinkovitosti “Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d. Omiš”

Projekt ugradnje energetski učinkovite LED rasvjete i kompresorskog postrojenja u tvrtki Galeb d.d. provodio se u razdoblju nešto duljem od godinu dana, od studenoga 2014. godine do prosinca 2015. godine, a sastojao se od pripremnih radnji, izrade projektne dokumentacije, ugovaranja financijskog modela sve do ugradnje energetski učinkovite opreme.

3.1 Korisnik Galeb d.d.

Galeb dalmatinska trikotaža d.d. osnovana je 1951. g., sa sjedištem u Omišu. Osnovna djelatnost tvrtke Galeb d.d. je proizvodnja donjeg rublja i odjeće, a kompletan proizvodni proces od pređe do gotovog proizvoda odvija se unutar vlastitog proizvodnog pogona kroz sljedeće tehnološke faze: pletenje, dorada pletiva (bojenje, bijeljenje, pranje, sušenje), krojenje, šivanje, pregled i pakiranje. Tvrtka ima oko 400 zaposlenih od čega je više od pola zaposleno u proizvodnji.

Tvrtka je u sustave upravljanja implementirala međunarodne norme: ISO 9001 za upravljanje kvalitetom, ISO 14001 za upravljanje zaštitom okoliša, OHSAS 18001 za upravljanje sigurnošću i ISO 50001 za upravljanje energijom. U politici upravljanja, s naglaskom na zahtjeve uspostavljene norme ISO 50001, tvrtka Galeb d.d. u svojim aktivnostima i procesima analizira sve aspekte okoliša, sigurnosti i potrošnje energije te ocjenjuje i mjeri njihov utjecaj i značaj na organizaciju. U provedbi procesa rada i kompletnog poslovanja tvrtke opredjeljuje se za ispunjavanje zahtjeva i trajno poboljšanje sustava kvalitete, okoliša i sigurnosti te sustava energije i performansi energije. Također, poduzima adekvatne preventivne radnje u svrhu sprječavanja nesukladnog rada, pojave onečišćenja okoliša, nesigurnog rada i neadekvatnog odnosa prema energiji.

3.2 Analiza stanja i kontekst

Tvrtka Galeb d.d. smještena je u Omišu na dvije lokacije, a pogon proizvodnje pletiva na lokaciji Priko Lisičina mjesto je provedbe projekta energetske učinkovitosti. U skladu s uvjetima Javnog natječaja za sufinanciranje projekata energetske učinkovitosti u industriji od strane Fonda za zaštitu okoliša i energetske učinkovitost (FZOEU) Galeb d.d. poduzeo je sve potrebne predradnje kako bi prijavio projekt za sufinanciranje. Uz mogućnost visokog udjela sufinanciranja FZOEU-a upravo zbog činjenice da se proizvodni pogon Priko Lisičina nalazi u zaštićenom području prirode odnosno značajnom krajobrazu kanjona rijeke Cetine (Zakon o

zaštiti prirode NN 80/13), Galeb d.d koristi i dodatnu mogućnost da ovu investiciju realizira putem financijskog modela energetske usluge.

U studenom 2014. godine započinje suradnja s tvrtkom Veritas ESCO d.o.o. iz Splita čiji tim iskusnih stručnjaka savjetuje i planira daljnje korake koji će uslijediti kroz provedbu. Galeb d.d. voditeljem projekta imenuje inženjera Marka Juričića, stručnog suradnika za energetiku i automatiku.

Zbog specifičnosti izvora financiranja, u slučaju modela energetske usluge, a prije dostave ponude Fondu za zaštitu okoliša i energetske učinkovitost, potrebno je izvršiti određene predradnje, odnosno pripremiti potrebnu dokumentaciju snimanjem postojećeg stanja.

3.3 Studija izvodljivosti

Studija izvodljivosti prvi je dokument koji treba dokazati opravdanost i nužnost provedbe namjeravanog zahvata rekonstrukcije i zamjene energetske neučinkovite rasvjete i kompresora u proizvodnom pogonu i preduvjet je za potpis Ugovora o energetskom učinku između naručitelja energetske usluge, tvrtke Galeb d.d. i pružatelja energetske usluge, tvrtke Veritas ESCO d.o.o.

U studenom 2014. g. Galeb d.d. i Veritas ESCO d.o.o. pristupaju izradi Studije izvodljivosti projekta *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d. Omiš*. Studija izvodljivosti daje opis postojećeg stanja s tehničkim podacima kao i opis planiranog tehničkog rješenja te izračun ušteda u odnosu na postojeće stanje. Provedena Studija nedvojbeno ukazuje na nužnost i opravdanost planiranog zahvata. Postojeće stanje unutrašnje i vanjske rasvjete kao i kompresorskog postrojenja iskazano u bilancama referentnog stanja i to angažirane snage u kW, potrošnje električne energije u kW/god, referentnu emisiju tCO₂/god i referentni trošak za električnu energiju u kn/god, sumarno je prikazano u tablici 1.

Tabela 1 Sumarna bilanca Referentnog stanja proizvodnog pogona pletionice

SUMARNO REFERENTNO STANJE	
SNAGA:	111, 58 (kW)
POTROŠNJA:	431.665,50 (kWh/god)
EMISIJA CO ₂ :	162,31 (tCO ₂ /god)
TROŠAK:	323.749,13 (kn/god)

Izvor: Studija izvodljivosti projekta energetske učinkovitosti *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d. Omiš* (prilagodio autor).

U tabeli 2 prikazana je sumarna bilanca novoprojektiranog/novoinstaliranog stanja pogona nakon rekonstrukcije.

Tabela 2 Sumarna bilanca novoprojektiranog stanja proizvodnog pogona pletionice

SUMARNO NOVOPROJEKTIRANO STANJE	
SNAGA:	61,70 (kW)
POTROŠNJA:	182.040,64 (kWh/god)
EMISIJA CO ₂ :	68,45 (tCO ₂ /god)
TROŠAK:	136.530,48 (kn/god)

Izvor: Studija izvodljivosti projekta energetske učinkovitosti *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d. Omiš* (prilagodio autor).

Ukupni troškovi planiranog zahvata rekonstrukcije opreme koji uključuje ugradnju 1500 komada novih LED cijevi u proizvodni pogon, 30 komada novih LED svjetiljki za vanjsku

rasvjetu te jedan novi visokoučinkoviti vijčani kompresor, uz troškove demontaže, zbrinjavanja i montaže iznose 911.730,00 kn bez PDV-a.

Prema ukupnom trošku planiranog zahvata i bilanci novoprojektiranog stanja jasno su vidljivi indikatori kvalitete ulaganja i to smanjenje emisije 93,86 tCO₂/god u odnosu na referentno stanje te specifični trošak od 9.713,83 kn/tCO₂ god za postizanje tog smanjenja što je prikazano u tablici 3.

Tabela 3 Indikatori kvalitete ulaganja

INDIKATORI KVALITETE ULAGANJA
Godišnje smanjenje emisije CO ₂ prema referentnom stanju:
162, 31 (tCO ₂ /god) referentno - 68,45 (tCO ₂ /god) novo = 93,86 (tCO₂/god)
Indikator kvalitete ulaganja za novoprojektiranu tehnologiju:
911.730,00 (kn) / 93,86 (tCO ₂ /god) = 9.713,83 (kn/tCO₂ god)

Izvor: Studija izvodljivosti projekta energetske učinkovitosti *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d. Omiš* (prilagodio autor).

U tabeli 4 prikazani su indikatori energetske učinkovitosti u odnosu na referentno stanje i to uštede električne energije od 249.624,86 kWh/god, godišnje postotno smanjenje potrošnje električne energije od 57,83 % i godišnji novčani iznos uštede električne energije od 187.218,65 kn.

Tabela 4 Indikatori energetske učinkovitosti

INDIKATORI ENERGETSKE UČINKOVITOSTI
Godišnja ušteda električne energije novoprojektiranog stanja u odnosu na Referentno stanje:
431.665,50 (kWh/god) referentno - 182.040,64 (kWh/god) novo = 249.624,86 (kWh/god)
Energetska učinkovitost (smanjenje godišnje potrošnje) u odnosu na Referentno stanje:
249.624,86 (kWh/god) / 431.665,50 (kWh/god) = 57,83 (%)
Novčani iznos godišnje uštede električne energije u odnosu na Referentno stanje:
323.749,13 (kn/god) referentno - 136.530,48 (kn/god) novo = 187.218,65 (kn/god)

Izvor: Studija izvodljivosti projekta energetske učinkovitosti *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d. Omiš* (prilagodio autor).

3.4 Ponuda za sufinanciranje projekata energetske učinkovitosti u industriji

Nakon provedene Studije izvodljivosti koja je potvrdila nužnost i opravdanost ulaganja, u prosincu 2014. g. potpisan je Ugovor o energetsom učinku između naručitelja energetske usluge (NEU), tvrtke Galeb d.d. i pružatelja energetske usluge (PEU), tvrtke Veritas ESCO d.o.o., Ugovorom se pružatelj energetske usluge obvezao provesti mjere energetske učinkovitosti te se obvezao postići Ugovorom zajamčene uštede provedbom mjera. PEU u cijelosti snosi financijski, tehnički, komercijalni i gospodarski rizik provedbe ovog Ugovora. NEU se Ugovorom obvezao podnijeti svoju ponudu na Javni natječaj FZOEU-a te se obvezao

plaćati PEU mjesečnu cijenu/naknadu za izvršenu energetska uslugu nakon provedbe mjera u trajanju od tri godine. Cijena ugovorene energetske usluge (Cn) jednaka je troškovima planiranog zahvata na što se obračunava PDV što čini ukupnu cijenu usluge (Cuk). Financiranje predmeta Ugovora definirano je na način da FZOEU sufinancira 80 % iznosa Cn prema odgovarajućem ugovoru o zajedničkom financiranju s NEU-om, NEU iz ostvarenih ušteda financira 20 % iznosa Cn te financira ukupan iznos PDV-a. PEU se obvezao izraditi glavni projekt o vlastitom trošku, a NEU imenovati nadzornog inženjera sukladno Zakonu o građenju (NN 153/13). Projekt *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina* je pravovremeno prijavljen upućivanjem Ponude za sufinanciranje projekata energetske učinkovitosti u industriji Fondu za zaštitu okoliša i energetska učinkovitost.

U skladu s uvjetima Javnog natječaja za sufinanciranje projekata energetske učinkovitosti u industriji, prijavitelj je dužan dostaviti Ponudu za sufinanciranje koja sadrži propisanu natječajnu dokumentaciju. U tablici 5 naveden je sadržaj predmetne ponude projekta energetske učinkovitosti.

Tabela 5 Natječajna dokumentacija (sadržaj ponude)

SADRŽAJ PONUDE
1. Prijavni obrazac FZOEU
2. Opis projekta s ciljevima projekta
3. Indikatori projekta prema Ugovoru o energetska učinku
4. Terminski plan provedbe i financijskog tijeka
5. Izjava o zatvaranju financijske konstrukcije – energetska usluga
6. Studija izvodljivosti
7. Projektni zadatak
8. Troškovnik opreme i radova
9. Ugovor o energetska učinku
10. Indikatori kvalitete ulaganja i energetske učinkovitosti
11. Ugovoreni terminski plan
12. Potvrda porezne uprave o podmirenju obveza javnih davanja
13. Zemljišno-knjižni izvadak
14. BONPLUS obrazac
15. SOL 2 obrasci
16. Izjava o korištenim potporama male vrijednosti
17. Izjava o korištenim potporama male vrijednosti povezanih društava
18. Izjava poduzetnika da nije u teškoćama
19. Izvadak iz sudskog registra
20. Izvadak iz katastra
21. Preslika katastra s GEO portala
22. CD s Prijavnim obrascem i Troškovnikom

Izvor: Ponuda projekta energetske učinkovitosti *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina* tvrtke *Galeb d.d. Omiš* (prilagodio autor).

U Prijavnom obrascu za projekte energetske učinkovitosti u industriji FZOEU, uz sve podatke o ciljevima, mjerama, utjecaju mjera i očekivanim uštedama, iskazana je vrijednost ukupne investicije i iznos tražene subvencije Fonda kako je prikazano u tabeli 6.

Tabela 6 Odjeljak Očekivana sredstva fonda Prijavnog obrasca

OČEKIVANA SREDSTVA FONDA	
Status ponuditelja (t.III Natječaja):	Zaštićeni dijelovi prirode
Vrijednost ukupne investicije:	1.139.622,50 kn (s PDV-om)
Vrijednost opravdanih troškova (sukladno t. IV Natječaja):	911.730,00 kn (bez PDV-a)
Učešće Fonda u opravdanim troškovima (t.III Natječaja):	80,00%
Iznos tražene subvencije Fonda:	729.384,00 kn (bez PDV-a)

Izvor: Prijavni obrazac za projekte energetske učinkovitosti u industriji Fonda za zaštitu okoliša i energetske učinkovitosti projekta energetske učinkovitosti *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d. Omiš* (prilagodio autor).

3.5 Odluka o odabiru korisnika i dodjeli sredstava Fonda

Po podnošenju Ponude potrebno je čekati odluku Fonda koja će biti donesena nakon obrade svih prijava podnesenih na natječaj, a u roku od 60 dana od dana isteka roka za dostavu ponuda. Za projekte za koje iznos sufinanciranja ne prelazi 2.000.000,00 kn, odluku o odabiru korisnika i dodjeli sredstava Fonda za zaštitu okoliša i energetske učinkovitost donosi direktor Fonda, a za one koje prelaze ovaj iznos odluku donosi Upravni odbor Fonda.

U ožujku 2015. g. korisnik Galeb d.d. primio je pisanu obavijest o prihvaćanju ponude za projekt *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d. Omiš* Odlukom o odabiru korisnika i dodjeli sredstava Fonda za zaštitu okoliša i energetske učinkovitost i za koju se odobrava subvencija u visini od 80 % opravdanih troškova, a najviše u iznosu do 641.640,00 kuna. Prije sklapanja Ugovora s Fondom, a najkasnije u roku od tri mjeseca od dana zaprimanja ove obavijesti, korisnik Galeb d.d. dužan je Fondu dostaviti odgovarajuću dopunu dokumentacije potrebnu za sklapanje ugovora.

3.6 Dopuna dokumentacije

Odlukom o odabiru korisnika Galeb d.d. i dodjeli sredstava Fonda, a u skladu s Ugovorom o energetske učinkovitosti, pružatelj energetske usluge Veritas ESCO d.o.o. u suradnji s ovlaštenim inženjerima trećih tvrtki kreće s izradom glavnog projekta koji se sastoji od dvije cjeline, elektrotehničkog i strojarskog projekta. Imajući u vidu točku IV. Odluke i točku IX. Natječaja, ugovoren je ponuditelj opreme, specifikacija opreme s pripadajućim troškovnikom i rekapitulacijom troškovnika te je izmijenjen terminski plan provedbe projekta.

Nadalje, ocjenom podnesene Prijave za sufinanciranje Fond je utvrdio da dio troškova nije opravdan jer se ne odnosi direktno na industrijski pogon, a to je dio rasvjete u proizvodnom pogonu koji se nalazi u uredskim prostorima, isto tako i kompletna vanjska rasvjeta u vanjskom krugu industrijskog pogona. Odlukom Fonda svakako je prihvaćeno subvencioniranje 80 % opravdanih troškova, međutim za ostvarenje ciljeva projekta potrebno je provesti čitav zahvat rekonstrukcije odnosno dio koji se odnosi na neopravdane troškove također realizirati u skladu s provedbenim planom. U skladu s navedenim, dodatkom Ugovoru o energetske učinkovitosti mijenja se dio o financiranju kako je prikazano u tablici 7.

Tabela 7 Vrijednost opravdanih troškova i iznos najvišeg iznosa subvencije

ODLUKOM ODOBRENA SREDSTVA FONDA	
Vrijednost ukupne investicije:	1.139.622,50 kn (s PDV-om)
Vrijednost opravdanih troškova (sukladno t. IV Natječaja):	802.050,00 kn (bez PDV-a)
Učešće Fonda u opravdanim troškovima (t.III Natječaja):	80,00%
Iznos odobrene subvencije Fonda najviše do:	641.640,00 kn (bez PDV-a)

Izvor: Odluka o odabiru korisnika i dodjeli sredstava Fonda za zaštitu okoliša i energetske učinkovitost radi sufinanciranja projekata energetske učinkovitosti u industriji KLASA 310-34/14-03/123 (prilagodio autor).

Prihvatanjem Odluke mijenja se, odnosno povećava učešće naručitelja energetske usluge pa sada naručitelj Galeb d.d. iz ostvarenih ušteda financira 29,6 % iznosa cijene energetske usluge (Cn) Ugovora o energetskom učinku za razliku od ranije „idealnih“ 20 %. Proporcionalno je tako ugovoren i povećani iznos mjesečne cijene/naknade za izvršenu energetske uslugu.

3.7 Potpis Ugovora o sufinanciranju i provedba projekta rekonstrukcije

U lipnju 2015. g. Fondu je pravovremeno predana sva odgovarajuća dopuna dokumentacije potrebna za sklapanje Ugovora, a u rujnu 2015. g. Galeb d.d. je s Fondom sklopio Ugovor o zajedničkom financiranju projekta energetske učinkovitosti *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d.* davanjem sredstva subvencije Fonda. Ugovorena su sredstva upravo u visini odobrene subvencije iz Odluke o odabiru korisnika, a rok za realizaciju Projekta i dostavu Završnog izvješća o realizaciji jest najkasnije do kraja 2015. godine.

Pružatelj energetske usluge, Veritas ESCO d.o.o. nabavio je svu potrebnu opremu, imenovani nadzorni inženjer provjerio je sukladnost opreme s Glavnim projektom, a do prosinca 2015. g. pod stručnim nadzorom su provedeni svi radovi primjene mjera energetske učinkovitosti.

3.8 Dostava Završnog izvješća o realizaciji projekta

Nakon provedenih svih mjera ugradnje, nadzora, ispitivanja i mjerenja učinkovitosti ugrađene opreme odnosno privremene situacije izvršenja energetske usluge, pristupilo se izradi Završnog izvješća.

Završno izvješće o realizaciji projekta energetske učinkovitosti *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d.* dostavljeno je Fondu za zaštitu okoliša i energetske učinkovitost 17. 12. 2015. g., a sukladno odredbama Ugovora o zajedničkom financiranju projekta energetske učinkovitosti. U tabeli 8 naveden je sadržaj Završnog izvješća predmetnog Projekta.

Tabela 8 Sadržaj Završnog izvješća

SADRŽAJ ZAVRŠNOG IZVJEŠĆA
1. Obrazac Završnog izvješća o ostvarenim učincima projekta FZOEU
2. Račun Privremene situacije za pružanje energetske usluge, a za dio provođenja mjera energetske učinkovitosti (oprema i radovi)
3. Završno izvješće nadzornog inženjera o obavljenom stručnom nadzoru nad izvođenjem elektrotehničkih instalacija
4. Završno izvješće nadzornog inženjera o obavljenom stručnom nadzoru nad izvođenjem strojarских instalacija

5. Zapisnik o puštanju u rad
6. Zapisnik o primopredaji građevine
7. Prateći list za otpad kao dokaz o propisnom zbrinjavanju demontiranih izvora svjetlosti na bazi žive
8. Specifikacija ugrađene opreme i izvedenih radova i pripadajućim količinama
9. Izjava poduzetnika da nije u teškoćama
10. Izjava o korištenim potporama male vrijednosti
11. Izjava o korištenim potporama male vrijednosti povezanih društava
12. Jedna bjanko zadužnica na iznos od 1.000.000,00 kuna, ovjerena i potvrđena kod javnog bilježnika

Izvor: Završno izvješće projekta energetske učinkovitosti *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d. Omiš* (prilagodio autor).

3.9 Uplata subvencije Fonda

Dostavljeno Završno izvješće Projekta prihvaćeno je od strane Fonda jer je u potpunosti sukladno Pravilniku o načinu praćenja namjenskog korištenja sredstava Fonda za zaštitu okoliša i energetske učinkovitost i ugovoreni prava i obveza (NN 183/04 i 29/14) i općim aktima Fonda. Uplata sredstava subvencije FZOEU-a korisniku Galeb d.d. realizirana je u siječnju 2016. g. te je Galeb d.d., u svojstvu naručitelja energetske usluge (NEU) doznačena sredstva subvencije uplatio na račun pružatelja energetske usluge (PEU), Veritas ESCO d.o.o., u roku od osam dana, sukladno Ugovoru o energetske učinku.

Specifičnost Ugovora o energetske učinku jest privremena situacija okončanja provedenih mjera energetske učinkovitosti odnosno izvršenja radova i ugradnje opreme čime je ispunjen dio ugovornih obveza. Nakon toga teče ugovoreni otplatni rok za pružanje energetske usluge gdje NEU plaća ugovorenu mjesečnu naknadu u jednakim iznosima kroz ugovoreno vremensko razdoblje za pruženu energetske uslugu na temelju privremenih situacija za izvršenu uslugu i radove PEU-a. Nakon isteka Ugovora, ovlašteni predstavnici NEU-a i PEU-a će sastaviti i potpisati okončani obračun i utvrditi stvarne moguće obveze i nepodmirena plaćanja. Obračun okončane situacije sastavit će se i potpisati najkasnije u roku od dvadeset dana nakon završetka Ugovora o energetske učinku.

4. Zaključak

Energetska učinkovitost skup je isplaniranih i provedenih mjera čiji je cilj korištenje najmanje moguće količine energije na način da razina udobnosti i stopa proizvodnje ostanu sačuvane ili pojednostavljeno, energetska učinkovitost znači uporabu manje količine energije za obavljanje istog posla. Za razliku od štednje energije koja uvijek podrazumijeva odricanja određene razine koristi, energetska učinkovitost podrazumijeva zadržavanje jednake razine tih koristi, ali uz manju potrošnju energije.

Za pokretanje aktivnosti energetske učinkovitosti nužno je prije svega podizanje svijesti i volje poduzetnika i njihovih zaposlenika za promjenom ustaljenih navika prema energetske učinkovitim rješenjima, a za provedbu projekata energetske učinkovitosti ključna je financijska podrška.

Potencijal za smanjenje potrošnje energije odnosno postizanje energetske ušteda u gospodarskom sektoru jasno je vidljiv iz provedenog projekta energetske učinkovitosti *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d.* gdje je provedbom mjera energetske učinkovitosti postignuto godišnje smanjenje potrošnje električne energije od gotovo 60 % i godišnji novčani iznos uštede električne energije od gotovo 200.000,00 kn, uz napomenu da je Natječajem za

sufinanciranje uvjetovano ostvarivanje ušteda od 20 %. Neupitna isplativost i opravdanost Projekta jasno je vidljiva iz visokih vrijednosti indikatora energetske učinkovitosti i indikatora kvalitete ulaganja.

Izdašnom subvencijom Fonda za zaštitu okoliša i energetske učinkovitost, uz ESCO model ugovaranja energetske usluge, projekt rekonstrukcije realiziran je bez inicijalnog vlastitog ulaganja i troška, ESCO tvrtka preuzela je u potpunosti financijski, tehnološki i komercijalni rizik, a naplaćuje se isključivo iz ostvarenih ušteda.

REFERENCE

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Uredba o ugovaranju i provedbi energetske usluge u javnom sektoru (NN 11/15).

Javni natječaj za sufinanciranje projekata energetske učinkovitosti u industriji Fonda za zaštitu okoliša i energetske učinkovitost (NN 122/14).

Treći nacionalni akcijski plan energetske učinkovitosti RH za razdoblje od 2014. do 2016.

Ponuda projekta energetske učinkovitosti *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d. Omiš.*

Zakon o zaštiti prirode (NN 80/13).

Zakon o građenju (NN 153/13).

Pravilnik o načinu praćenja namjenskog korištenja sredstava Fonda za zaštitu okoliša i energetske učinkovitost i ugovorenih prava i obveza (NN 183/04 i 29/14).

Odluka o odabiru korisnika i dodjeli sredstava Fonda za zaštitu okoliša i energetske učinkovitost radi sufinanciranja projekata energetske učinkovitosti u industriji KLASA 310-34/14-03/123.

Završno izvješće projekta energetske učinkovitosti *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d. Omiš.*

Financing with ESCO model- example of company Galeb

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Abstract. Energy efficiency is the backbone of the unique energy policy of the European Union and is one of the five major objectives of the Europe 2020 strategy - reducing energy consumption by 20% by 2020. Increasing energy efficiency is an effective way of achieving the goals of sustainable development, since energy efficiency directly contributes to the reduction of emissions into the environment, thus strengthening the competitiveness of the industry, creating new jobs and increasing the security of energy supply. In the context of the

EU Cohesion Policy, the Republic of Croatia has significant funds of financial support at its disposal, intended for the implementation of energy efficiency projects from EU funds in various sectors through programs for financing and co-financing Croatian Environmental Protection and Energy Efficiency Fund (FZOEU). A clear and measurable impact the attempts to reduce energy consumption have on the competitiveness of business, in addition to the possibility of subsidies of energy efficiency projects from public sources, has resulted in the emergence of innovative models of financing projects of this kind in the domestic market. ESCO (Energy Service Company) is the generic name of the concept of market services in the energy sector. ESCO model includes development, implementation and financing of energy efficiency to reduce energy costs and maintenance by installing energy-efficient equipment and optimizing energy systems while ensuring the repayment of the investment through savings achieved in a given period. This paper presents a case study on the project investment in energy-efficient lighting and compressor plant in the production plant textile company Galeb. Also, preparatory activities, applications, contracting, implementation and reporting on the project, which is financed by ESCO contract model energy services with subsidy of FZOEU through the de minimis aid and relations between all parties involved in the project, are presented.

Keywords: *ESCO model, energy services, subsidies, investments in energy measures*

Novine u financijskom poslovanju i računovodstvu neprofitnih organizacija

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Sažetak. Razlozi donošenja novih zakona i pravilnika po pitanju neprofitnih organizacija su nedovoljno razrađeni uvjeti dodjele financijskih podrški udrugama, ali i povratna informacija o sredstvima danim na raspolaganje u sklopu različitih projekata. Kako bi se spriječila mogućnost zloupotreba u korištenju sredstava namijenjenih udrugama za provođenje programa i projekata te u konačnici mogla prezentirati transparentnost rada udruga ovakav pravilnik bio je jedina opcija. Neprofitne organizacije, tj. udruge koje vode dvojno knjigovodstvo, dočekale su još jednu izmjenu Pravilnika propisanog Zakonom o financijskom poslovanju i računovodstvu neprofitnih organizacija. Udruge, koje su se po tko zna koji put našle u nedoumici što i kako dalje, moraju ovim Pravilnikom utvrditi način provođenja samoprocjene funkcioniranja sustava financijskog upravljanja i kontrole neprofitne organizacije te primijeniti metodologiju izrade financijskog plana, kao i uvjete i način izvršavanja financijskog plana. Novi Pravilnik sastoji se od nekoliko cjelina koje ćemo prezentirati u nastavku. Zakon je u tom pogledu predvidio i popunjavanje upitnika s ciljem potvrde da se sredstva udruge koriste zakonito, namjenski i svrhovito, ali i da se dobije povratna informacija o uložnim sredstvima po raznim projektima. Prvi financijski plan koji neprofitna organizacija mora temeljiti na odredbama ovog Pravilnika izrađuje se tek u 2016. godini za 2017. godinu pa bismo ovo kašnjenje donošenja Pravilnika mogli nazvati srećom u nesreći jer nam pruža duži period prilagodbe nametnutim uvjetima planiranja, kao i još jednu godinu u kojoj nećemo saznati da li su sredstva pametno uložena.

Ključne riječi: neprofitna organizacija, pravilnik, upitnik, sredstva

1. Uvod

Financijsko poslovanje udruga propisano je s nekoliko zakona i pravilnika. Jedan od njih je Zakon o financijskom poslovanju i računovodstvu neprofitnih organizacija te su sve neprofitne organizacije (udruge) dužne sukladno Zakonu voditi uredno financijsko poslovanje.

U svojoj primjeni oslanja se na tri pravilnika:

1. Pravilnik o sustavu financijskog upravljanja i kontrola, izradi i izvršavanju financijskih planova neprofitnih organizacija.

2. Pravilnik o izvještavanju u neprofitnom računovodstvu i Registru neprofitnih organizacija.

3. Pravilnik o neprofitnom računovodstvu i računskom planu neprofitnih organizacija.

Obveznici su domaće i strane udruge te njihovi savezi, zaklade, fundacije, ustanove, umjetničke organizacije, komore, sindikati, udruge poslodavaca i sve druge pravne osobe kojima temeljni cilj osnivanja i djelovanja nije stjecanje dobiti te za koje, iz posebnih propisa, proizlazi da su neprofitnog karaktera. Sustav financijskog poslovanja obuhvaća načela sustava financijskog poslovanja, izradu i izvršavanje financijskih planova i izvještaj o potrošnji proračunskih sredstava.

Financijsko poslovanje udruga temelji se na dva osnovna načela: načelu javnosti i transparentnosti te načelu dobrog financijskog upravljanja i kontrole. Načelo javnosti i transparentnosti podrazumijeva javnu objavu financijskih izvještaja i to putem Registra neprofitnih organizacija i Registra udruga. Za udruge s ukupnim prihodom iznad 3 milijuna kuna ono, također, podrazumijeva uvid u financijske izvještaje protekle godine putem ovlaštenog revizora, a za udruge s prihodom iznad 10 milijuna kuna i javnu objavu revizorskog izvještaja o obavljenoj reviziji.

Načelo dobrog financijskog upravljanja i kontrole podrazumijeva odgovornost tijela uprave glede planiranja, izrade i realizacije financijskog plana, zatim odgovornost po pitanju računovodstva i izrade izvještaja, a sve to sa svrhom postizanja postavljenih ciljeva i zaštite resursa udruge od gubitaka bilo neadekvatnim korištenjem i/ili prijevarama.

2. Financiranje udruga i drugih neprofitnih organizacija iz javnih sredstava

Sve neprofitne organizacije moraju se prilagoditi novom sustavu financiranja iz javnih sredstava. S obzirom na brojnost kriterija, mjerila, normiranost postupaka financiranja i ugovaranja programa i projekata od interesa za opće dobro, očekuje se primjereni angažman kako bi svi proveli novodoneseni propis koji zahtijeva stroga pravila ponašanja.

Financiranje projekata i programa od interesa za opće dobro koje provode udruge jedan je od najčešćih oblika suradnje državnih tijela i udruga te ostalih organizacija civilnog društva u provedbi javnih politika, odnosno rješavanju prioritarnih društvenih problema.

Prema podacima za 2014. godinu, iz Državnog proračuna se za financiranje programa i projekata udruga godišnje izdvaja više od 600 milijuna kuna, a iz proračuna jedinica lokalne i područne (regionalne) samouprave više od 1,044 milijarde kuna.

Osim toga, zadnji prikupljeni podatci o donacijama i sponzorstvima trgovačkih društava u vlasništvu Republike Hrvatske upućuju na skoro 145 milijuna kuna rashoda po osnovi donacija i sponzorstva. Unatoč tako visokim izdvajanjima, dosad još uvijek nisu bili dovoljno precizno razrađeni kriteriji i mjerila dodjele financijskih potpora udrugama iz javnih izvora, a postojali su i različiti standardi u postupanju kako na državnoj tako i na lokalnoj razini, a s time i mogućnosti različitih zlouporaba u korištenju sredstava iz javnih izvora namijenjenih za provedbu programa i projekata od interesa za opće dobro.

Udruge koje pokazuju interes za korištenje sredstava iz javnih izvora moraju biti spremne na ispunjavanje dodatnih zahtjeva koje ova Uredba postavlja sa svrhom osiguranja što kvalitetnijeg nadzora nad trošenjem sredstava poreznih obveznika. Temeljna mjerila koja moraju ispunjavati udruge vezana su, s jedne strane uz obveze koje udruga ima prema državi, a s druge strane, uz unutarnji ustroj i organizacijske kapacitete same udruge. Ponajprije, udruge se mogu koristiti financijskim odnosno nefinancijskim potporama iz javnih izvora jedino ako su upisane u Registar udruga, odnosno u Registar neprofitnih organizacija te ako su se svojim statutom opredijelile za obavljanje djelatnosti i aktivnosti koje su predmet financiranja i kojima promiče uvjerenja i ciljeve koji nisu u suprotnosti s Ustavom i zakonom.

Nadalje, udruge moraju uredno ispunjavati obveze iz svih prethodno sklopljenih ugovora o financiranju iz javnih izvora, a u suprotnom će im svaka prijava novog programa ili projekta na javni natječaj bilo kojeg davatelja financijskih sredstava biti odbijena. Konačno, udruge moraju uredno ispunjavati obveze plaćanja doprinosa za mirovinsko i zdravstveno osiguranje i plaćanja poreza te drugih davanja prema državnom proračunu i proračunima jedinica lokalne uprave i samouprave.

Sukladno članku 14. stavku 1. Pravilnika o izvještavanju u neprofitnom računovodstvu i Registru neprofitnih organizacija („Narodne novine“, broj 31/15) neprofitne organizacije koje ostvaruju sredstva iz javnih izvora, uključujući sredstva iz proračuna jedinice lokalne samouprave obvezno sastavljaju izvještaj o potrošnji proračunskih sredstava za poslovnu godinu i dostavljaju ga davatelju sredstava u roku od 60 dana od isteka poslovne godine.

Ovim se omogućuje odgovornije i racionalnije financiranje programa i projekata udruga iz javnih izvora jer se očekuje da će veća transparentnost i otvorenost postupaka dodjele financijskih sredstava za projekte i programe udruga i ostalih organizacija civilnog društva iz javnih izvora pridonijeti osnaživanju povjerenja građana u rad tijela javne vlasti, kao i u rad udruga te ostalih organizacija civilnog društva. Primjenom se očekuje postupna transformacija pristupa financiranju programa i projekata udruga kao instrumentu provedbe javnih politika, odnosno jednom od načina rješavanja društvenih problema, a ne instrumentu za pridobivanje potpore pojedinih interesnih skupina.

Izvještaj o potrošnji proračunskih sredstava sastavlja se na obrascu PROR-POT. Obrazac je dan u prilogu Pravilnika. Međutim, ako je drugim propisima ili aktima utvrđen detaljniji sadržaj i izgled obrasca izvještaja o potrošnji proračunskih sredstava, nije obvezno korištenje obrasca PROR-POT. Izvještaj se obvezno sastavlja za poslovnu godinu, ali se može sastavljati i za razdoblja tijekom poslovne godine, ali ako to zatraži davatelj sredstava.

Međutim, Pravilnikom je dopušteno da se Izvještaj može dostaviti davatelju sredstava i u roku različitom od propisanog ako je rok utvrđen u drugim propisima ili aktima.

Obrazac PROR-POT, koji se nalazi u prilogu Pravilnika, sadržava najmanje sljedeće podatke:

1. primatelj sredstava
2. davatelj sredstava
3. naziv projekta / programa / ostalo
4. razdoblje izvještavanja

Obrazac PROR-POT uzima u obzir i činjenicu da pojedini davatelji sredstava, posebice za doznake neprofitnim organizacijama u zadnjem tromjesečju poslovne godine, omogućavaju prijenos nepotrošenih sredstava i potrošnju istih u sljedećoj poslovnoj godini.

U ovom dijelu obrasca PROR-POT navode se isključivo oni javni davatelji sredstava koji financiraju isti projekt, program ili slično te davatelj kojemu se podnosi Izvještaj o potrošnji proračunskih sredstava na ovom obrascu. Dakle, ako se Izvještaj podnosi jedinici lokalne i područne (regionalne) samouprave za primljenu donaciju vezanu za nabavu nogometnih dresova, a druga jedinica lokalne i područne (regionalne) samouprave je, primjerice, istoj neprofitnoj organizaciji donirala sredstva za organizaciju nekog susreta, u III. dijelu obrasca PROR-POT nije potrebno navoditi ovu drugu jedinicu i njezinu donaciju. Ali, ako je jedinica lokalne i područne (regionalne) samouprave doznala sredstva neprofitnoj organizaciji za redovito poslovanje, kao primjerice i neka druga jedinica, onda je to potrebno navesti u obrascima koji se dostavljaju objema jedinicama. U prethodnim su dijelovima obrasca PROR-POT neprofitne organizacije navodile na koje su troškove odnosno rashode alocirale novac doznačen iz javnih izvora. U IV. dijelu obrasca navode se aktivnosti koje su provedene te se opisuju postignuti rezultati. Prethodno je opisan sadržaj obrasca PROR-POT.

Međutim, s obzirom na „šarolikost“ neprofitnog sustava kada je riječ o djelatnosti, ustrojstveni oblik i izvore financiranja, Pravilnikom je dana mogućnost davateljima sredstava

dopune obrasca izvještaja o potrošnji proračunskih sredstava i drugim podacima prilikom donošenja odluke ili drugog akta o odobrenju sredstava neprofitnoj organizaciji. Neprofitna organizacija koja je primatelj javnih sredstava obvezna je, na zahtjev davatelja sredstava, dostaviti i kopiju vjerodostojne dokumentacije na temelju koje je rashod / izdatak, iskazan u obrascu PROR-POT.

3. Novi pravilnik o sustavu financijskog upravljanja i kontrola, izradi i izvršavanju financijskih planova neprofitne organizacije

Neprofitne organizacije, osim dosadašnjih izmjena zakona o poslovanju, uvođenjem obrasca PROR-POT kako bismo saznali o potrošnji javnih sredstava, dočekale su još jednu izmjenu Pravilnika propisanog Zakonom o financijskom poslovanju i računovodstvu neprofitnih organizacija.

U Narodnim novinama broj 119/15 Ministarstvo financija objavilo je Pravilnik o sustavu financijskog poslovanja i kontrola te izradu i izvršavanje financijskih planova neprofitnih organizacija koji je stupio na snagu 09. studenog 2015. godine

Udruge, koje su se po tko zna koji put našle u nedoumici što i kako dalje, moraju ovim pravilnikom utvrditi način provođenja samoprocjene funkcioniranja sustava financijskog upravljanja i kontrole neprofitne organizacije, te primijeniti metodologiju izrade financijskog plana, kao i uvjete i način izvršavanja financijskog plana.

Novi Pravilnik sastoji se od nekoliko cjelina koje ćemo prezentirati u nastavku..

3.1 Financijsko upravljanje i kontrola

Ova cjelina odnosi se na upravljačku odgovornost u upravljanju poslovanjem udruge vezano za planiranje poslovnih aktivnosti udruge, kao i izradu financijskih planova te njihovu realizaciju. Odnosi se na ispravno vođenje računovodstva te računovodstveno izvješćivanje (npr. ovlaštena osoba mora kontrolirati sve vrste knjigovodstvenih dokumenata koje u udugu ulaze ili iz nje izlaze kao što su ispravni ulazni računi i izlazni računi, zakonski propisan način priznavanja i knjiženja prihoda i rashoda, obračuna amortizacije i sl.).

Ovaj dio, također, podrazumijeva i osobni i profesionalni integritet zakonskih zastupnika i zaposlenika, rukovođenje i stil upravljanja kao i definiranje vizije i ciljeva neprofitne organizacije.

Na žalost, vrlo je nejasno kako će se porezni nadzor postaviti vezano za kontrolu navedene odredbe budući da ni zakonski predstavnik ni zaposlenici često nisu u mogućnosti uvjetovati da određeni knjigovodstveni dokumenti koji ulaze u udugu, od kojih su najbitniji ulazni računi, budu kreirani na način da zadovolje prethodno navedene stavke. Što zapravo znači da vam na računu za vođenje knjigovodstvenih usluga više nije dovoljno da piše knjigovodstvene usluge za listopad 2015. godine temeljem ugovora br. 10., nego moraju biti specificirane sve usluge izvršene za taj mjesec, a svi znamo da je vrlo teško, a u većini slučajeva i nemoguće dobavljaču uvjetovati stavke na računu koji vam ispostavlja.

3.2 Praćenje sustava financijskog upravljanja i kontrola

Ovaj dio predstavlja temelj za ispunjavanje Upitnika o funkcioniranju sustava financijskog upravljanja i kontrola budući da je zakonski zastupnik neprofitne organizacije obavezan za svaku poslovnu godinu provesti samoprocjenu učinkovitosti i djelotvornosti funkcioniranja navedenog sustava. Samoprocjena provodi se popunjavanjem propisanog upitnika s ciljem potvrde da se sredstva udruge koriste zakonito, namjenski i svrhovito te da je sustav financijskog upravljanja udruge djelotvoran i učinkovit.

To znači da je ovaj upitnik vlastita kontrola, pri čemu odgovaranjem na pitanja koja se tiču pojedine udruge, tj. koja su primjenjiva na poslovanje pojedine udruge izvrše neku vrstu

kontrole poslovanja udruge te imaju mogućnost regulacije i poboljšanja poslovanja ako utvrde da je to potrebno. Naravno da mnoga od ovih pitanja na većinu malih i srednjih udruga nisu primjenjiva te smatramo da se njima nije potrebno opterećivati i razmišljati da moraju imati odgovore na sva pitanja i zato je jedna od danih opcija odgovora N/P (nije primjenjivo).

Ako udruga nema potrebu za skladištem, jer se bavi isključivo uslužnom djelatnošću, na dio upitnika koji se tiče opreme i dokumentacije, vezano za opremu, odgovorit će N/P.

Kao i uvijek, prvo što smo se zapitali nakon objave ovog upitnika bilo je da što bi se dogodilo ako na neko od ovih pitanja odgovore da se ne primjenjuje ili odgovore pogrešno. Nažalost, ne bi se dogodilo ništa jer Pravilnikom nisu propisane kaznene odredbe za neispravno ispunjavanje ili ako zbog nesigurnosti na određena sporna pitanja odgovore da nisu primjenjiva na određenu organizaciju.

Međutim, i ovdje treba biti na oprezu jer su kaznene odredbe sadržane u drugim zakonskim i podzakonskim aktima. Tako, na primjer, na pitanje „Na zaprimljenim računima navedeni su svi elementi računa u skladu sa zakonskim i podzakonskim aktima“ ni u kojem slučaju ne može se odgovoriti ne ili nije primjenjivo jer su stavke na ulaznim računima propisane nizom drugih zakona temeljem kojih su propisane i kazne koje ćete platiti ako vam je račun neispravan.

Tako država nastoji pomoći udrugama da prepoznaju probleme u financijskom i pravnom funkcioniranju te ih na vrijeme isprave i izbjegnu nepotrebno plaćanje kazni. Samoprocjena, odnosno popunjavanje upitnika provodi se najkasnije u roku od 30 dana od roka predviđenog za predaju financijskih izvještaja za prethodnu poslovnu godinu, što znači da za 2015. upitnik morate popuniti najkasnije do 30. ožujka 2016. godine. Rok čuvanja, tj. arhiviranja ispunjenih upitnika je sedam godina od završetka godine na koju se upitnik odnosi.

3.3 Izrada financijskog plana

Neprofitna organizacija koja je obveznik primjene ovog Pravilnika obvezna je izrađivati financijski plan za provedbu godišnjeg programa rada. Prijedlog financijskog plana neprofitne organizacije za sljedeću godinu priprema zakonski zastupnik i dostavlja ga najvišem tijelu neprofitne organizacije, odnosno tijelu koje je temeljem statuta neprofitne organizacije ovlašteno za njegovo donošenje.

Financijski plan za sljedeću godinu donosi najviše tijelo neprofitne organizacije, odnosno tijelo koje je temeljem statuta neprofitne organizacije za to ovlašteno, najkasnije do 31. prosinca tekuće godine.

Financijski plan neprofitne organizacije sastoji se od:

1. plana prihoda i rashoda
2. plana zaduživanja i otplata
3. obrazloženja financijskog plana (tzv. bilješke uz financijski plan).

Uz sastavne dijelove financijskog plana, financijski plan može sadržavati i plan novčanih tokova.

Budući da u dijelu pravilnika nije precizno definirana metodologija, naišli smo na preporuke da se prihodi i rashodi planiraju na minimalno drugoj razini računa računskog plana. To znači, kao prvo i osnovno da, htjeli ili ne, potrebno je na izradi financijskog plana surađivati s računovođom jer gotovo sve ove podatke moguće je dobiti od računovodstva, tj. računovođa mora objasniti kako ove podatke iščitava iz prethodnih financijskih izvještaja temeljem kojih će se raditi procjena prihoda i rashoda za određenu godinu. Smatramo da je nepotrebno i naivno da se u ovu avanturu upuštaju sami predsjednici udruga jer zasigurno neće dobro završiti.

Što se tiče plana zaduživanja i otplata neophodno je donijeti odluke (nije potrebno mijenjati statut) kojima će se definirati najviši iznos do kojeg se neprofitna organizacija može jednokratno kratkoročno zadužiti (odnosi se na kredite na rok otplate do godine dana), kao i najviši iznos do kojeg neprofitna organizacija može jednokratno dati kratkoročne zajmove.

Čak, i ako se za planiranu godinu ne planira zadužiti, bitno je da odlukama definira limite jer se tako, ako zaista dođe do potrebe za zaduživanjem, organizacija ipak može zadužiti bez obzira što to nije definirano financijskim planom.

Uz navedene odluke plan zaduživanja i otplata sadrži visinu planiranih primitaka od dugoročnog zaduživanja temeljem primljenih kredita i zajmova, primitaka od prodaje vrijednosnih papira, dionica i udjela u glavnici, primitaka od povrata glavnice danih zajmova te izdataka od danih dugoročnih zajmova, ulaganja u vrijednosne papire, dionice i udjele u glavnici te otplata glavnice primljenih dugoročnih kredita i zajmova.

Bitno je napomenuti da u financijskom planu neprofitne organizacije mora biti vidljiv planirani rezultat poslovanja za koji se očekuje da će ga neprofitna organizacija ostvariti na dan 31. prosinca godine koja prethodi godini za koju se donosi financijski plan.

Rezultat poslovanja sastoji se od prenesenog manjka odnosno viška iz prethodnih godina i očekivanog manjka odnosno viška za godinu koja prethodi godini za koju se donosi financijski plan. Preneseni manjkovi, odnosno viškovi iz prethodnih godina ne moraju biti nužno pokriveni, odnosno iskorišteni (utrošeni) u godini za koju se sastavlja financijski plan.

3.4 Izmjene i dopune financijskog plana (rebalans)

Pravilnikom je propisano da se izmjene i dopune financijskog plana provode tijekom godine po postupku za donošenje financijskog plana te je preporučljivo rebalans raditi najmanje jednom godišnje ili u slučaju značajnih odstupanja nastalih prihoda i rashoda u odnosu na planirane, kao i u slučaju nastanka novih obveza za čije podmirenje sredstva nisu osigurana te u slučaju smanjenja prihoda uz čije je ostvarenje vezano podmirenje već nastalih obveza.

Bitno je da se prilikom izrade plana donese odluka temeljem koje se određuje postotak odstupanja stvarno nastalih prihoda i rashoda od planiranih. U trenutku kada odstupanja premaše definirani postotak neophodno je raditi rebalans financijskog plana.

4. Zaključak

Zašto je pitanje udruga važno državi, ali i javnosti, govori podatak da je proračunom svake godine predviđeno oko 600 milijuna kuna za financiranje nevladinih udruga. Tome treba pridodati i nemale iznose koji se za rad udruga izdvajaju iz lokalnih proračuna pa interes javnosti, na što se troši i kako se raspodjeljuje taj silni novac, nije za čuditi. Sve ove izmjene zakona (uvođenje Izvještaja o potrošnji proračunskih sredstava, financijski plan, upitnik itd.) donesene su kako bismo rasvijetlili na što se troše milijuni kuna iz javnog proračuna, unijeli transparentnost i na koncu riješili pitanje brojke od oko 50 000 udruga u Hrvatskoj.

Već smo počeli s prvim korakom ove godine te je predan Izvještaj o potrošnji proračunskih sredstava. Obrazac PROR-POT jedan je od sistema kontrole uloženih sredstava te njegovom primjenom dobit ćemo novu i bolju sliku o potrošnji sredstava iz javnih izvora. Sada javnost očekuje prve povratne informacije.

I za kraj da razjasnimo rokove donošenja financijskog plana. Financijski plan za 2016. godinu ne sastavlja se temeljem ovog Pravilnika već je zbog njegova kasnog donošenja dana mogućnost obveznicima da navedeni plan izrađuju temeljem Zakona o financijskom poslovanju i računovodstvu neprofitnih organizacija koji propisuje da financijski plan neprofitne organizacije mora sadržavati plan prihoda i rashoda, plan zaduživanja i otplata te obrazloženje financijskog plana i usvaja se do 31. prosinca 2015.

Prvi financijski plan koji neprofitna organizacija mora temeljiti na odredbama ovog Pravilnika izrađuje se tek u 2016. godini za 2017. godinu pa bismo ovo kašnjenje donošenja Pravilnika mogli nazvati srećom u nesreći jer nam pruža duži period prilagodbe nametnutim uvjetima planiranja, koje je kod mnogih neprofitnih organizacija gotovo nemoguća misija.

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Changes in financial operations and accounting of non-profit organizations

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Abstract: The reasons for the adoption of new laws and regulations with regard to non-profit organizations are under-developed conditions of providing financial support to associations, but also the feedback of the funds given to the disposal within different projects. This Ordinance was the only option for associations in order to prevent the possibility of abuse in the use of funds for implementing programs and projects, and ultimately presenting the transparency of an association. Non-profit organizations, i.e. associations of double-entry bookkeeping, once again met with the modification of the Ordinance prescribed by the law of financial operations and accounting of non-profit organizations. Associations, finding themselves in a dilemma as to what their next step should be, have to determine a way of conducting the self-assessment function of financial management and control of non – profit organizations. They also have to apply methodology for making the way and terms for the execution of their financial plan. New Ordinance consists of several sections which we will present in continuation. This law predicted the need of filling in the questionnaires in order to verify that the Associations use their funds legally, in a dedicated and purposeful manner, but also to get feedback on the funds invested in various projects. The first financial plan that non-profit organizations have to base on the provisions of this Ordinance shall be drawn up in 2016 for 2017, and we could call this delay a blessing in disguise because it gives us longer period of adjustment to imposed conditions of planning, as well as another year in which we will not find out whether the funds are invested wisely.

Keywords: *Non-profit organization, Ordinance, questionnaire, resources*

Financial ratios of commercial banks in the Republic of Croatia

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Abstract. Banks are an important part of the financial system and they have an important role in contributing to the economic development of the country. They play a vital role in the distribution of a country's economic resources. Banks are intermediaries between savings and investors. If banks have poor indicators, it can have repercussions for the country's economy which leads to the conclusion that a safe and profitable banking system is of utmost importance to a country. The financial crisis has also affected the business operations of banks in Croatia. This paper examines the performance of commercial banks in the Republic of Croatia in the period from 2009. to 2014. Profitability, liquidity, capitalization and credit quality are shown through financial ratios analysis. The database used for the analysis was created from the annual reports of banks, the newsletters published periodically by the Croatian National Bank, and other publicly available information.

Key words: banks, financial ratios, financial crisis, Republic of Croatia

1. Profitability Ratios

In the banking literature two measures are used to assess the profitability of a certain bank. First one is Return on Assets (ROA) and the second one is Return of Equity (ROE). ROA is a measure of bank's profitability which shows the quality of bank's assets management. It also measures the managerial efficiency (Hasan and Bashir, 2003). ROA is calculated as a ratio between profit after taxation and average total assets and it shows how much money bank earned on each monetary unit of assets. Desirable ROA value depends on the intensity of company's assets. Success of a bank is perceived if ROA is higher than 1 percent. ROE is calculated as a ratio between profit after taxation and average or total equity. Value of ROE required for successful business activities of a bank amounts 8 – 10 percent.

Table 1. Average bank profitability in Republic of Croatia measured by average return on bank's assets and capital

Year	ROAA	ROAE
2014	0,50%	2,80%
2013	0,20%	0,80%
2012	0,80%	4,80%
2011	1,20%	6,90%
2010	1,10%	6,50%
2009	1,10%	6,40%
2008	1,60%	9,90%
2007	1,60%	10,90%

Source: HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

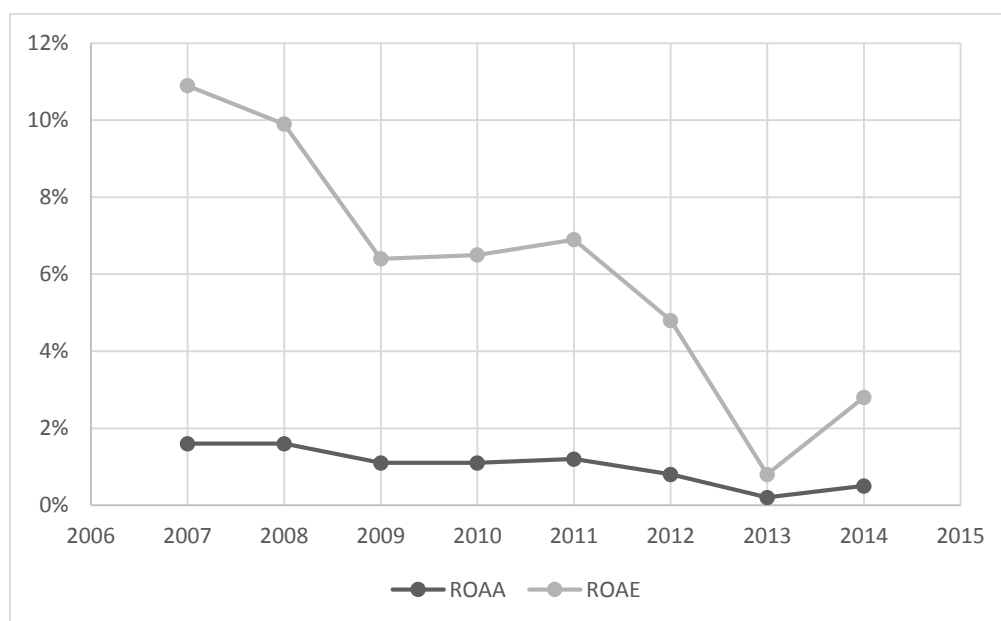


Figure 1. Average bank profitability in Republic of Croatia measured by average return on bank's assets and capital

Source: Author's creation according to HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

2. Management Efficiency Ratios

Management efficiency is reflected in operating costs management. Operating costs consist of employee costs, material costs and amortization. They are the result of the successful bank management. Salaries and bonuses can represent a significant percentage in the structure of bank costs. Similarly, large banks have high values of capital, especially IT equipment that are amortized relatively quickly and must be frequently replaced. The profit of a bank is directly related to the cost. Operating costs are measured by CIR (Cost to Income Ratio), which is calculated as ratio between operating costs and total revenue. This ratio reflects the bank's ability to cover operating costs. High CIR value in financial institutions is equivalent to low productivity in the real sector. CIR shows how many monetary units are needed in certain period of time to generate one monetary unit of revenue. If the ratio increases, it means that costs are growing at a higher rate than revenue. Control of noninterest costs is the most important in the process of reducing CIR, since the costs of interest are, however, mainly influenced by exogenous (market) factors (Trip, 1998). High CIR directly reflects on quality and price of loans. CIR is generally regarded as a benchmark in comparison among banks (Cochea, 2000, Asher, 1994). Little (2008) identifies five key performance indicators of European banks: culture of cost rationing, high degree of automation and investment in IT equipment, clear decision – making hierarchy, high degree of decentralization and focus on costs that are directly related to generating income. Higher ratio implies less efficient management (Kosmidou, 2008). Operating costs have a negative effect on the bank profitability (Abreu and Mendes, 2001, Sufian, 2011). It is expected that banks with high costs charge higher margins to cover their costs (Maudos and de Guevara, 2004). Also, greater operational efficiency enables banks to lower interest margins through lower loan rates or higher deposit rates (Claeys and Vander Venne, 2008).

Table 2.: Operating costs management ratio

Year	Cost to income ratio (CIR)
2014	51%
2013	52%
2012	52%
2011	48%
2010	48%
2009	50%
2008	52%
2007	52%

Source: HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

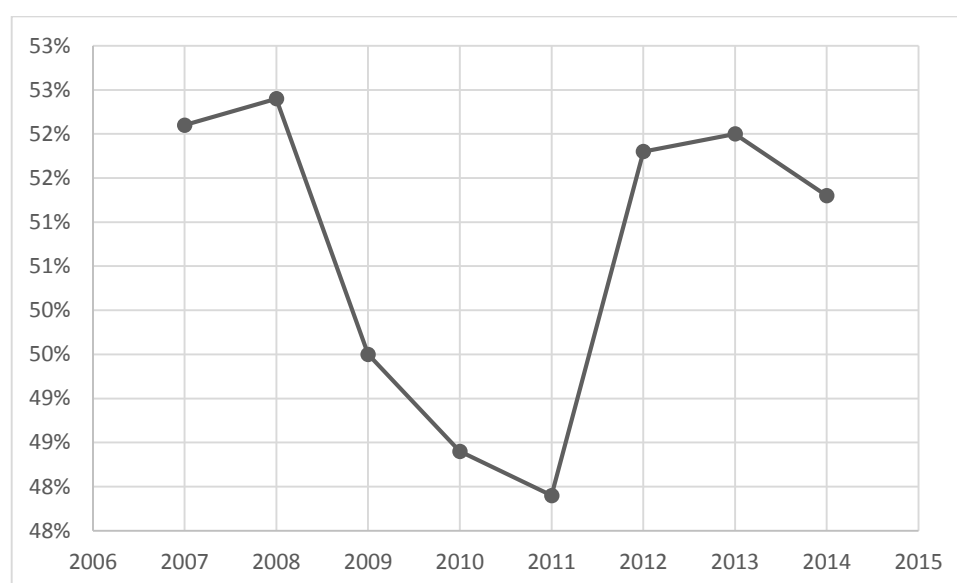


Figure 2. Operating costs management ratio

Source: Author's creation according to HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

3. Capitalization Ratios

In general, the banks are expected to absorb losses generated by particular bad loans from their operating income. But, the problems emerge with unexpected, extraordinary losses that cannot be absorbed from regular income. Bank's capital is the "first line of defense" against these unexpected shocks. The capital adequacy ratio, as a measure of a bank's capitalization is calculated as the ratio between capital and risk-weighted assets. In order to ensure that banks can absorb a reasonable level of losses before they become insolvent, a minimal capital adequacy ratio is defined by international standards. Minimal capital adequacy ratio is intended for protection of depositors and promoting the stability and efficiency of the banking system. Regulators demand that banks maintain capital adequacy ratio above the required minimum level as a corrective for excessively risky loans and investments. In the analysis of bank profitability, unavoidable variable is the capital adequacy ratio. Better capitalized banks should achieve higher profitability. That is confirmed by Berger (1995), Abreu and Mendes (2001), Staikouras and Wood (2003), Athanasoglu, Brissimis and Delis (2005), Kosmidou (2008), Gul, Irshad and Zaman (2011) and Olalekan and Adeyinka (2013). Some studies have shown that banks which have high capital adequacy ratio operate cautiously and ignore potentially profitable investments (Goddard, Molyneux and Wilson, 2004). At the same time,

better capitalized banks typically have less need for external financing, what results in greater profitability (Pasiouras and Kosmidou, 2007).

Table 3. Capital Adequacy Ratio

Year	Capital Adequacy Ratio (CAR)
2014	22%
2013	21%
2012	21%
2011	20%
2010	19%
2009	16%
2008	15%
2007	16%

Source: HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

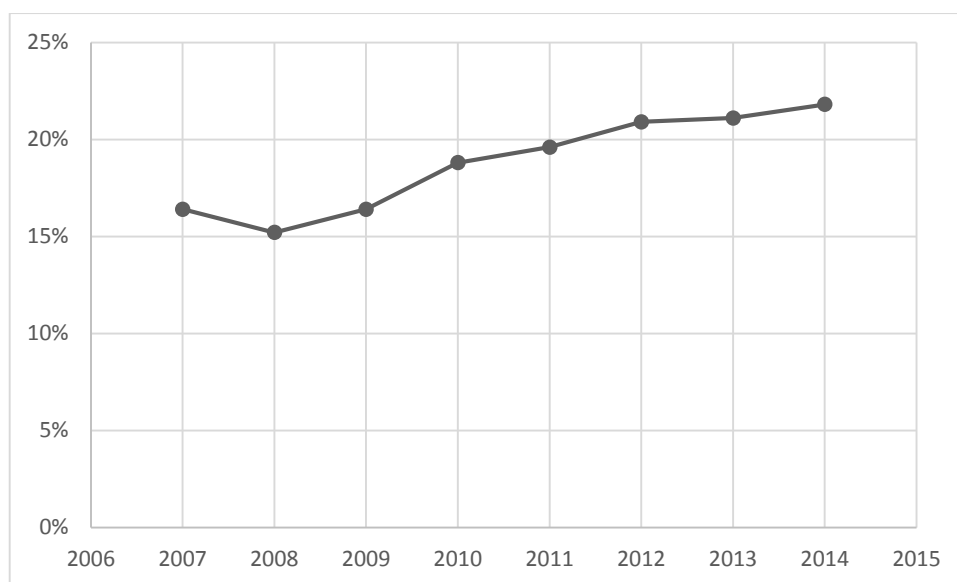


Figure 3. Capital Adequacy Ratio

Source: Author's creation according to HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

4. Liquidity Ratios

Liquidity is defined as the ability of a bank to settle their obligations within maturity. It is determined by comparing maturity of the loans on the asset side of balance sheet and asset funding sources on the liability side of balance sheet. Although the liquidity is crucial for bank's operations, high liquidity reduces income and negatively influences returns (Atahnasoglou, Delis, Staikouras, 2006). High liquidity can also result in lower interest rates which usually lead to increased demand for loans. In this way, high liquidity in banks stimulates economic growth. The liquidity of banks can be measured using three indicators:

1. liquid assets to total assets ratio,
2. liquid assets to total deposits ratio, and
3. total loans and total assets ratio.

In this research, third indicator will be presented. Loans are less liquid than other components of a bank's assets. The higher value of this ratio indicates lower liquidity of the bank.

Table 4.Total Loans to Total Assets Ratio

Year	Total Loans to Total Assets Ratio
2014	64%
2013	66%
2012	67%
2011	68%
2010	68%
2009	67%
2008	67%
2007	63%

Source: HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

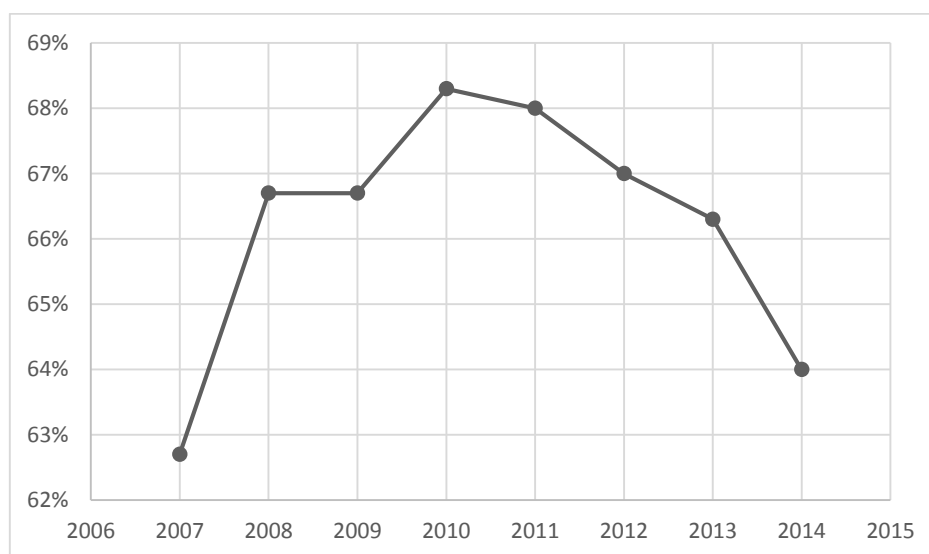


Figure 4.Total Loans to Total Assets Ratio

Source: Author's creation according to HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

5. Funding Sources Ratios

Deposit ratio is the ratio between deposits held by banks and total assets and it shows attracted deposits contribute to the financing of bank's assets. Deposits are the main source of bank's assets and represent a cheap financing source for the bank (Roman, Tomuleasa, 2013). Financing costs are calculated as the ratio between costs of deposit interests and total deposits.

Table 5. Share of Deposits in Total Assets

Year	Share of Deposits in Total Assets
2014	72%
2013	71%
2012	69%
2011	69%
2010	69%
2009	68%
2008	67%
2007	68%

Source: HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

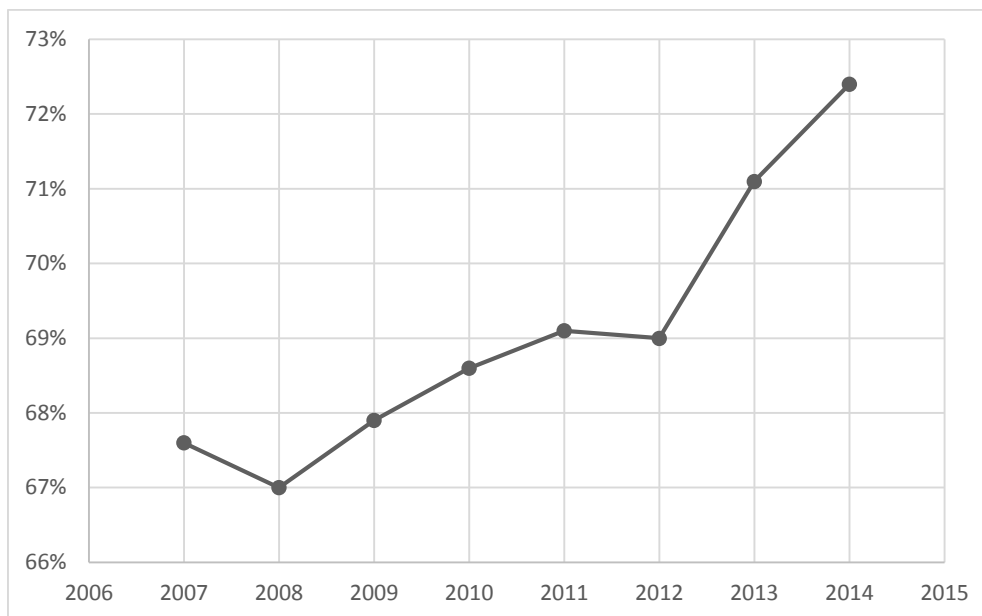


Figure 5. Share of Deposits in Total Assets

Source: Author's creation according to HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

6. Income Diversification Indicators

Deregulation and increased competition forced banks to expand their activities and to develop new lines of business alongside their traditional activities. Banks diversify their income by engaging in new activities such as the issuing and trading securities, investment banking brokerage and other activities that generate noninterest income. Cross – country bank analysis in eleven developing countries (Sanya and Wolfe, 2011) has showed that diversified income positively affects profitability and reduces insolvency of banks. NIIR variable is equal to the proportion of noninterest income in total income where noninterest income comprises different types of charges. Gross values of charges are usually used, since it is difficult to determine the cost of certain charge because it is often independent of noninterest income. High noninterest costs carry certain risks. Namely, there is a possibility of losing clients if charges are constantly increasing. Also, the growth of noninterest income may be related to a stronger credit activity, which increases the volatility risk of income. Noninterest income can be divided into those generated by traditional banking activities and those generated by untraditional banking activities (such as investments in financial innovations, derivatives etc.).

Table 6. Share of Noninterest Income in Total Income

Year	Share of Noninterest Income in Total Income
2014	29,0%
2013	29,4%
2012	30,9%
2011	27,7%
2010	29,9%
2009	37,5%
2008	30,1%
2007	32,5%

Source: HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

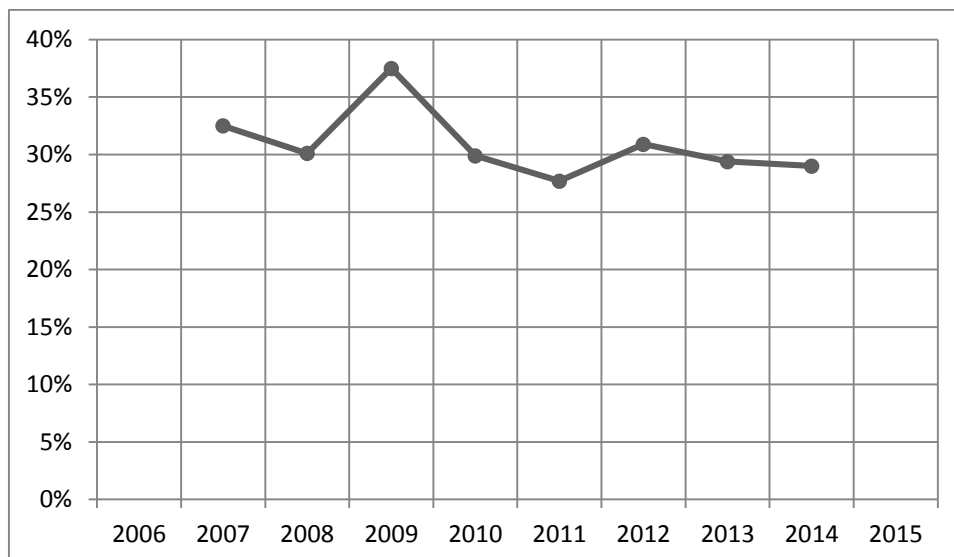


Figure 6. Share of Noninterest Income in Total Income

Source: HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

7. Market Concentration Measures

Concentration is a measure of market power. Market power can be defined as the ability of companies to increase the price above their marginal costs without reducing their total sales. A higher level of concentration implies a market in which larger banks that can effectively benefit from economies of scale are present. On the banking market with a higher concentration, customers have less choice and market power of some banks is higher. Under this approach, a higher concentration will be positively correlated with the profitability of banks. Concentration Ratio and Herfindahl – Hirschman Index are most frequently used as a measure of concentration. In this study, the concentration index CR5 which measures asset proportion of five largest banks in banking sector will be used as a measure of market structure.

Table 7. Total Assets Share of Five Largest Croatian Banks in Total Assets of Croatian Banking System

Year	CR5
2014	72%
2013	73%
2012	74%
2011	76%
2010	75%
2009	75%
2008	72%
2007	72%

Source: HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

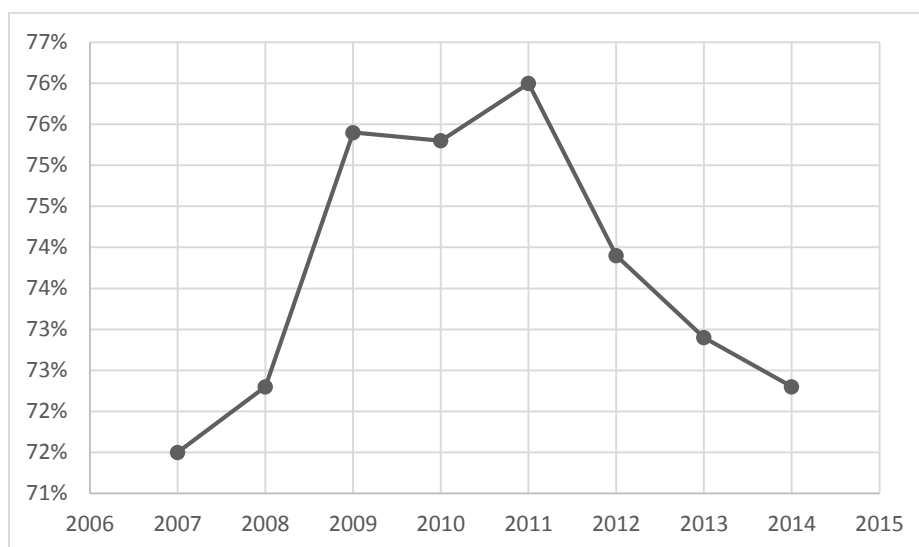


Figure 7.Total Assets Share of Five Largest Croatian Banks in Total Assets of Croatian Banking System

Source: Author's creation according to HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

8. Conclusion

This paper presents business performance of banks in the Republic of Croatia through series of indicators. Profitability indicators (ROAA and ROAE), despite the good operational costs management, have a downward trend. It is the consequence of financial crisis, particularly because of the decreasing economic activity in some sectors (such as construction) and reduced demand for house and car loans, traditionally the most abundant income of banks. Capitalization of the Croatian banking system is very good, capital adequacy ratios are well above the legal minimum, indicating the safety of the Croatian banking system. It is also supported by liquidity, sources of financing and revenue structure. In the traditional banking system, such as Croatian, loans constitute the most significant component of bank's assets, deposits are the most important source of financing, while interest income is most significant part of income structure. Croatian banks have avoided the challenge of greater presence in the financial markets, the so-called casino banking, which has (bearing in mind the financial crisis) positively affected the stability of the Croatian banking system. As far as the market concentration measures are concerned, Croatian banking system is highly concentrated, significantly higher than the banking systems of Germany and Italy, but on the other side significantly less than the banking systems of Estonia, Lithuania, Finland and Netherlands.

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Prijevare u financijskim izvještajima – odgovornosti za sprječavanje i otkrivanje

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Sažetak. Pogrešno prikazivanje, odnosno nepravilnosti u financijskim izvještajima mogu biti uzrokovane prijevarama i pogreškama. Za razliku od pogreške, koja predstavlja nenamjeran propust, najčešće računovodstvenog osoblja klijenta, prijevara predstavlja namjernu radnju koja je najčešće motivirana stjecanjem nepripadne materijalne koristi i oblikovanjem zavaravajućih financijskih izvještaja. U okviru ovog članka naglasak je na prijevarnom prikazivanju u financijskim izvještajima jer se prijevare događaju u svim segmentima gospodarstva. Naime, svako društvo je izloženo riziku prijevarnog prikazivanja u financijskim izvještajima neovisno o obliku, vlasništvu, veličini i ostalim značajkama poslovanja. Pogrešno, odnosno prijevarno prikazivanje u financijskim izvještajima može biti uzrokovano prijevornim financijskim izvještavanjem ili protupravnim prisvajanjem imovine. Kako bi se minimalizirao rizik prijevara u financijskim izvještajima potrebno je aktivno sudjelovanje svih sudionika lanca financijskog izvještavanja: od uprave koja je odgovorna za sastavljanje i prezentiranje financijskih izvještaja do eksternih revizora koji utvrđuju vjerodostojnost tih izvještaja. U okviru ovog rada autori obrađuju čimbenike rizika prijevare, tj. faktore koji uvjetuju prijevare, kao i odgovornosti za njihovo sprječavanje i otkrivanje. U kontekstu odgovornosti za sprječavanje i otkrivanje prijevara u financijskim izvještajima razmatraju se uloge pojedinih sudionika u lancu financijskog izvještavanja s naglaskom na razgraničenje odgovornosti uprave, interne i eksterne revizije.

Ključne riječi: *prijevare, trokut prijevare, eksterna revizija, interna revizija*

1. Uvod

Veliki korporativni skandali koji su se dogodili u posljednjih 20-ak godina bili su uzrokovani prijevarama i doveli su do gubitka radnih mjesta, propadanja korporacija, propadanja mirovinskih fondova te narušavanja povjerenja u procese financijskog izvještavanja i revizije. Prijevare se mogu klasificirati na nekoliko vrsta. Tako primjerice, sukladno Međunarodnom revizijskom standardu 240 „Revizorove odgovornosti u vezi s prijevarama u reviziji financijskih izvještaja“ (dalje MRevS 240) razlikuju se dvije vrste prijevarnog prikazivanja: pogrešno prikazivanje nastalo zbog prijevarnog financijskog izvještavanja i pogrešno prikazivanje nastalo zbog protupravnog prisvajanja imovine (MRevS 240, 2010.). Prema Udruženju ovlaštenih istražitelja prijevare (eng. *Association of Certified Fraud Examiners – ACFE*) prijevare se klasificiraju u tri kategorije (ACFE, 2014.): zloupotreba imovine, korupcija i prijevare u financijskim izvještajima. Zloupotreba imovine najčešći je oblik prijevara i događa se u čak 85 % slučajeva, međutim, ovaj oblik prijevara uzrokuje najniže gubitke. Tako primjerice, prema rezultatima istraživanja za 2014. godinu zloupotreba imovine uzrokovala je prosječan gubitak od 130.000 \$. S druge pak strane, prijevare u financijskim izvještajima događaju se u tek 9 % slučajeva, međutim, uzrokuju najveće gubitke, a prosječan

gubitak od ovih prijevarena iznosi milijun dolara (ACFE, 2014.). Prijevarno financijsko izvještavanje dovelo je do nekih od najvećih korporativnih skandala kao što su Enron, WorldCom, Parmalat itd. Korupcija kao oblik prijevarnog ponašanja javlja se u 37 % slučajeva i uzrokuje prosječan gubitak od 200.000 \$. Procjenjuje se da prosječna korporacija godišnje gubi oko 5 % prihoda zbog prijevara, međutim, bitno je naglasiti da se štete od prijevara i zloupotreba ne mogu točno utvrditi jer mnoge nisu otkrivene te se može govoriti samo o procijenjenim gubicima. Iz prethodno navedenog može se uočiti kako su svi poslovni subjekti u većoj ili manjoj mjeri izloženi riziku prijevara te bi poduzeća, neovisno o svojoj veličini, strukturi vlasništva ili vrsti djelatnosti trebala identificirati i procijeniti rizike nastanka prijevara te u svoje poslovanje implementirati mjere za sprječavanje prijevara.

2. Prijevare u financijskim izvještajima

2.1. Pojam prijevara

Pogrešno prikazivanje, odnosno nepravilnosti u financijskim izvještajima mogu biti uzrokovane prijevarama i pogreškama. Za razliku od pogreške, koja predstavlja nenamjerno propust, najčešće računovodstvenog osoblja klijenta, prijevara predstavlja namjernu radnju u kojoj mogu sudjelovati svi zaposleni kod klijenta, uključujući i one koji su zaduženi za upravljanje, koja je najčešće motivirana stjecanjem nepripadne materijalne koristi i oblikovanjem zavaravajućih financijskih izvještaja. Prema MRevS-u 240 prijevara se definira kao namjerna radnja jedne ili više osoba unutar menadžmenta, onih koji su zaduženi za upravljanje, zaposlenika ili trećih stranaka, koja uključuje varanje kako bi se stekla nepravdna ili nezakonita prednost. Udruženje ovlaštenih istražitelja prijevara definira prijevaru kao namjerno čin ili propust kreiran s ciljem obmane koji rezultira gubicima žrtve i/ili postizanjem cilja izvršitelja. Ovisno o akterima koji su uključeni u prijevaru razlikuju se prijevara od strane menadžmenta i prijevara od strane zaposlenika.

Sukladno MRevS-u 240 dvije su vrste namjernog pogrešnog (prijevarnog) prikazivanja (MRevS 240, 2010.):

- ✓ pogrešno prikazivanje nastalo zbog prijevarnog financijskog izvještavanja (i)
- ✓ pogrešno prikazivanje nastalo zbog protupravnog prisvajanja imovine.

Dok prijevarno financijsko izvještavanje uključuje namjerni pogrešni prikaz te izostavljanje iznosa ili neobjavljivanje podataka s ciljem zavaravanja korisnika financijskih izvještaja, dotle protupravno prisvajanje imovine uključuje krađu imovine poslovnog subjekta. Prema odredbama MRevS-a 240 prijevarno financijsko izvještavanje može uključivati (MRevS 240, 2010.):

- ✓ manipulaciju, falsificiranje (uključujući krivotvorenje) ili izmjenu računovodstvenih evidencija ili potkrjepljujuće dokumentacije iz koje su financijski izvještaji pripremljeni
- ✓ pogrešno prikazivanje ili namjerne propuste u financijskim izvještajima o događajima, transakcijama ili ostalim značajnim informacijama (te)
- ✓ namjernu krivu primjenu računovodstvenih principa vezanih uz iznose, klasifikaciju, način prezentiranja ili objave.

Protupravno prisvajanje imovine odnosno zlouporaba imovine uključuje krađu imovine poduzeća i može biti provedeno na razne načine (uključujući preusmjeravanje priljeva, krađu materijalne i nematerijalne imovine, navođenje poslovnog subjekta na plaćanje robe i usluga koje nisu primljene te korištenje imovine subjekta za osobne potrebe). Zlouporaba imovine je često popraćena krivotvorenim ili neprimjerenim spisima i evidencijama kako bi se prikrio nedostatak imovine.

Prijevare u financijskim izvještajima mogu biti provedene na različite načine, a u tablici 1 navedeni su najčešći oblici internih i eksternih prijevare

Tablica 1: Najčešći oblici internih i eksternih prijevare

INTERNE PRIJEVARE		EKSTERNE PRIJEVARE
ZAPOSLENICI	MENADŽERI	
Krađa zaliha	Pogrešno prikazivanje rezultata poslovanja	Krivotvoreni računi primljeni od vanjskih stranki
Zloupotreba gotovine	Lažni računi za prihode i troškove	Prezentiranje lažnih informacija
Krađa novca primljenog od kupaca	Isisavanje novca pomoću prijateljskih tvrtki	Krađa intelektualnog vlasništva
Krivotvorenje financijskih isprava	Krivotvorenje isprava	Lažni računi od dobavljača
Lažni računi za troškove	Primanje i davanje mita	Obmana kupaca i investitora
Novac za plaćanje na crno	Novac za plaćanje na crno	Podmićivanje/tajne provizije
Mito	Nepoštene kupoprodaje na štetu tvrtke	Nepoštene ponude cijena
Posudbe koje se ne vraćaju	Insajderska trgovina	Prijevarni ugovori
Lažno prikazivanje radnih sati i učinaka	Neplaćanje računa	Neplaćanje računa od strane kupaca
Korištenje službenih automobila u privatne svrhe	Neisporuka naplaćene robe	Neisporučivanje naplaćene robe od strane dobavljača
Korištenje usluga poduzeća u privatne svrhe	Obmana kupaca	Obmana dobavljača
Rad za vlastite potrebe u toku radnog vremena	Varanje na kvaliteti i količini isporučene robe	Varanje na kvaliteti i količini isporučene robe

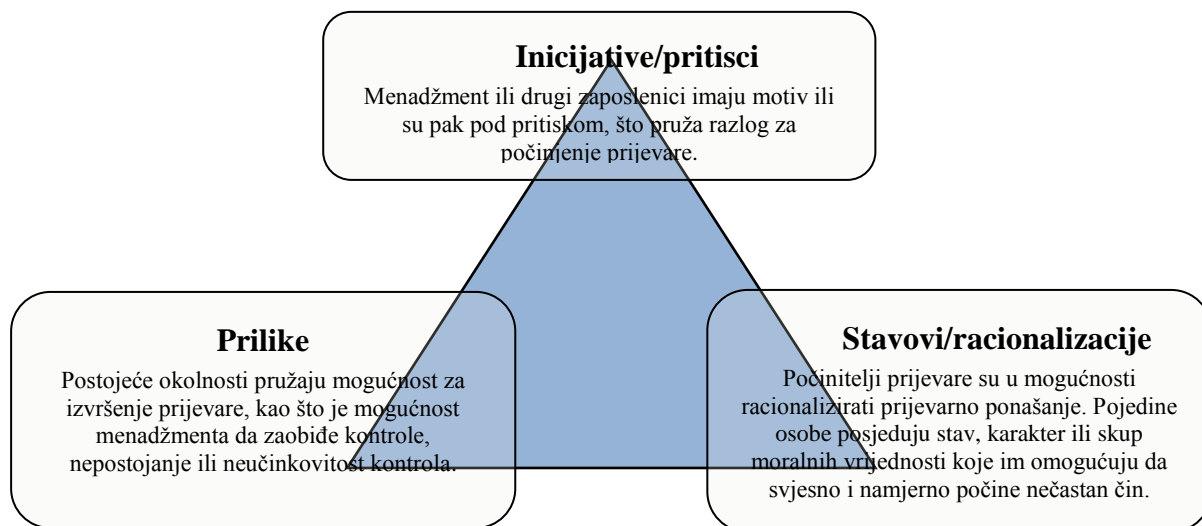
Izvor: KPMG, Fraud Awareness Survey, Citirano prema: Belak, V., Poslovna forenzika i forenzično računovodstvo, Borba protiv prijevare, Belak Excellens d.o.o., Zagreb, 2011., str. 120.

Kao motivi za prijevarno financijsko izvještavanje u Republici Hrvatskoj se obično javljaju tri osnovna motiva za prijevaru (Bešvir, 2007.):

- ◊ podcjenjivanje rezultata financijske godine u računu dobiti i gubitka, precjenjivanje obveza u pasivi bilance te podcjenjivanje stanja aktive u bilanci (npr. zbog smanjenja osnovice poreza na dobit, zadržavanja isplata dividendi i sl.)
- ◊ precjenjivanje rezultata financijske godine u računu dobiti i gubitka podcjenjivanjem obveza u pasivi bilance te precjenjivanjem stanja aktive bilance (primjerice zbog stvaranja slike uspješnosti, kredibiliteta, isplata dividendi i sl.) (te)
- ◊ pronevjera – protupravno prisvajanje imovine.

2.2. Faktori koji uzrokuju prijevaru

Čimbenici rizika prijevare mogu se definirati kao događaji ili uvjeti koji indiciraju da se prijevara dogodila, odnosno kao faktori koji su obično prisutni kada se prijevara dogodi. Bitno je napomenuti da čimbenici rizika prijevare ne upućuju nužno na postojanje prijevare u određenom poslovnom subjektu, međutim, oni su uglavnom prisutni pri počinjenju prijevare. U cilju procjene rizika prijevare, čimbenici rizika prijevare klasificiraju se na temelju tri uvjeta koji se pojavljuju kod prijevare. Ta se tri uvjeta nazivaju „trokut prijevare“, a sastoje se od inicijativa, tj. pritisaka, prilika te stavova i racionalizacija. „Trokut prijevare“ prikazuje slika 1 (Ramos, 2016.).



Slika 1: Trokut prijevare

Bitno je naglasiti da su ova tri uvjeta u međusobnoj interakciji. Tako pojedinci, koji su inače poštteni, mogu počiniti prijevaru i namjerno pogrešno iskazati financijske informacije ako djeluju u okruženju koje im nameće određene pritiske. Posljednjih godina uz „trokut prijevare“ razmatra se i tzv. „dijamant prijevare“ koji uz inicijativu, prilike i racionalizaciju uključuje i sposobnost počinitelja prijevare. Naime, brojni su korporativni skandali pokazali da neće doći do prijevare ako nije prisutna i četvrta komponenta, odnosno ako počinitelj nema sposobnost da osmisli, provede i u konačnici prikrije prijevaru.

U „Dodatku 1“ MRevS-a 240 navedeni su primjeri čimbenika rizika prijevare s kojima se revizori mogu susresti u različitim situacijama, a klasificirani su na čimbenike rizika povezane s prijevarnim financijskim izvještavanjem te čimbenike rizika povezane s protupravnim prisvajanjem imovine. Za svaku od navedene dvije vrste prijevara čimbenici rizika su razvrstani na osnovi tri uvjeta koji su obično prisutni kada se prijevara dogodi: poticaji/pritisci, prilike te stavovi/opravljanja.

Kao primjeri čimbenika rizika prijevare povezani s pogrešnim prikazivanjem nastalim prijevarnim financijskim izvještavanjem uobičajeno se navode (MRevS 240, 2010.):

Poticaji/pritisci

- ◇ financijsku stabilnost ili profitabilnost ugrožavaju ekonomski uvjeti, industrijski ili poslovni uvjeti subjekta
- ◇ postoji pretjerani pritisak na menadžment da ispuni zahtjeve ili očekivanja trećih stranaka
- ◇ dostupne informacije koje ukazuju da je osobna financijska situacija menadžmenta ili onih koji su zaduženi za upravljanje ugrožena financijskim poslovanjem subjekta
- ◇ postoji pretjerani pritisak na menadžment ili operativne djelatnike da ispune financijske ciljeve određenih od strane onih koji su zaduženi za upravljanje, uključujući poticajne ciljeve prodaje ili profitabilnosti.

Prilike

- ◇ priroda industrije ili poslovanja subjekta pruža prilike za prijevarno izvještavanje
- ◇ nadgledanje menadžmenta nije efikasno
- ◇ postoje kompleksne ili nestabilne organizacijske strukture
- ◇ komponente sustava internih kontrola su nedostatne.

Stavovi/opravljanja

- ◇ menadžment neučinkovito priopćava, uvodi, podržava ili nameće vrijednosti ili etičke standarde subjekta ili priopćava neprimjerene vrijednosti ili etičke standarde,

- ◊ nefinancijski menadžment pretjerano sudjeluje u odabiru računovodstvenih načela i provedbi značajnih procjena
- ◊ praksa kršenja zakona o vrijednosnim papirima ili drugih zakona i regulative ili sudski sporovi protiv subjekta, njegovog višeg menadžmenta ili onih koji su zaduženi za upravljanje zbog prijevара ili prekršaja zakona i regulative
- ◊ pretjeran interes menadžmenta za zadržavanje ili povećavanje vrijednosti subjektivih cijena dionica ili trenda zarada
- ◊ praksa menadžmentovog obvezivanja analitičarima, kreditorima i ostalim trećim strankama na ostvarivanje agresivnih ili nerealističnih prognoza
- ◊ menadžment propušta pravodobno ispraviti značajne nedostatke u internim kontrolama
- ◊ interes menadžmenta za poduzimanje neprimjerenih načina minimaliziranja zarada zbog oporezivanja
- ◊ slab moral među višim menadžmentom
- ◊ vlasnici-menadžeri ne prave razliku između osobnih i poslovnih transakcija
- ◊ neslaganje između dioničara u subjektima pod snažnom kontrolom
- ◊ ponavljajući pokušaji menadžmenta da opravda marginalno ili neprimjereno računovodstvo temeljem značajnosti
- ◊ zategnuti odnosi između menadžmenta i postojećeg ili prethodnog revizora.

I u slučaju zloupotrebe imovine čimbenici rizika su podijeljeni na osnovi tri uvjeta koji su obično prisutni kada nastane pogrešno prikazivanje zbog prijevара. Kao primjeri čimbenika rizika povezani s pogrešnim prikazivanjima nastalim zbog zloupotrebe imovine navode se (MRevS 240, 2010.):

Poticaji/pritisци

- ◊ osobne financijske obveze mogu stvoriti pritisak na menadžment ili djelatnike s pristupom novcu ili drugoj imovini podložnoj krađi ili zloupotrebi
- ◊ negativan odnos između subjekta i djelatnika s pristupom gotovini ili drugoj imovini podložnoj krađi može motivirati te djelatnike na zloupotrebu imovine.

Prilike

- ◊ određene karakteristike ili okolnosti mogu povećati podložnost imovine zloupotrebi (i)
- ◊ neprimjerene interne kontrole nad imovinom mogu povećati podložnost te imovine zloupotrebi.

Stavovi/oprаvdanja

- ✓ zanemarivanje potrebe nadgledanja ili smanjivanja rizika povezanog sa zloupotrebom imovine
- ✓ zanemarivanje internih kontrola nad zloupotrebom imovine zaobilaznjem postojećih kontrola ili propuštanjem ispravljanja poznatih nedostataka u internim kontrolama
- ✓ ponašanje kojim se pokazuje nezadovoljstvo subjektom ili njegovim tretmanom djelatnika
- ✓ promjene u ponašanju ili stilu života koje mogu ukazivati da je došlo do protupravnog prisvajanja imovine (te)
- ✓ toleriranje sitnih krađa.

U „Dodatku 1“ MRevS-a 240 navedeni su primjeri čimbenika rizika prijevара relevantni za revizorovo razmatranje, međutim revizori ili druge osobe koje istražuju mogućnost nastanka prijevара u poduzeću mogu definirati dodatne čimbenike rizika specifične za određeno poduzeće (ovisno o veličini subjekta, vlasničkoj strukturi, uvjetima djelatnosti, ...).

3. Odgovornosti za sprječavanje i otkrivanje prijevара u financijskim izvještajima

Sprječavanje i otkrivanje prijevара u financijskim izvještajima zadatak je svih sudionika korporativnog upravljanja. Naime, iako je menadžment primarno odgovoran za sastavljanje i prezentiranje financijskih izvještaja te za oblikovanje efikasnog sustava internih kontrola ne mogu se zaobići ni uloge ostalih sudionika u lancu korporativnog izvještavanja u sprječavanju i otkrivanju prijevара. U tom smislu, u okviru ovog poglavlja se definiraju uloge i odgovornosti menadžmenta te internih i eksternih revizora u sprječavanju i otkrivanju prijevара.

3.1. Odgovornost menadžmenta

Menadžment je primarno odgovoran za sastavljanje i prezentiranje financijskih izvještaja te za oblikovanje sustava internih kontrola. Odgovornost menadžmenta i onih koji su zaduženi za upravljanje je uspostaviti efikasan sustav internih kontrola te održavati politike i postupke koji će osigurati da financijski izvještaji budu pripremljeni, u svim značajnim odrednicama, u skladu s primjenjivim okvirom financijskog izvještavanja. Sukladno t. 13. MRevS-a 240 osnovna odgovornost za sprječavanje i otkrivanje prijevара je na onima koji su zaduženi za upravljanje i menadžmentu subjekta.

Kako bi učinkovito izvršavao svoje dužnosti financijskog izvještavanja, menadžment bi trebao provoditi sljedeće aktivnosti (Rezaee, Riley, 2010.):

- identificirati i ocijeniti okolnosti, uvjete i čimbenike koji mogu voditi prijevarama u financijskim izvještajima
- ocijeniti i upravljati rizikom prijevarama u financijskim izvještajima koji je povezan s identificiranim okolnostima, uvjetima i čimbenicima te
- oblikovati i uvesti odgovarajući i učinkovit proces internih kontrola za sprječavanje i otkrivanje prijevarama u financijskim izvještajima.

Menadžment je, uz nadzor onih koji su zaduženi za upravljanje, osim uspostavljanja odgovarajućeg sustava internih kontrola, zadužen za stvaranje klime čestitosti i etičnog ponašanja te za stvaranje pozitivnog radnog okruženja u kojem će djelovati odgovorni i savjesni zaposlenici koji će poduzeti odgovarajuće aktivnosti kao reakciju na prijevarama koje su se dogodile ili postoji izvjesna sumnja da će se dogoditi. Menadžment je, dakle, odgovoran za postavljanje odgovarajućeg „tona s vrha“ i organizacijske kulture u kojoj će biti jasno definirano da se ne tolerira prijevarama ponašanje.

3.2. Odgovornost interne revizije

Interna revizija se može promatrati kao prva linija obrane protiv prijevarama zbog statusa i uloge interne revizije u sustavu korporativnog upravljanja. Interni revizori trebaju imati proaktivnu ulogu u prevenciji i otkrivanju prijevarama u financijskim izvještajima jer za razliku od eksternih revizora njihova uloga nije ograničena ni vremenskim ni prostornim resursima. S obzirom na svoj organizacijski status interni revizori su u najboljem položaju da kontinuirano nadziru sustav internih kontrola, procjenjuju rizike prijevarama, identificiraju moguće crvene zastavice odnosno znakove upozorenja te sprječavaju i otkrivaju prijevarama u organizaciji.

Funkcija interne revizije treba najprije provjeravati (Tušek, Žager, 2008.):

- Odnos prema riziku na najvišoj organizacijskoj razini – npr. jesu li članovi uprave skloni rizičnom ponašanju, boje li se rizika ili su između tih dviju krajnosti te kako se njihov stav odražava na organizaciju u cjelini.
- Strategije upravljanja rizicima – tretiraju li se ključni rizici u različitim područjima organizacije na odgovarajući način, odnosno je li se ignoriraju, prihvaćaju, minimiziraju, eliminiraju i tome slično.

- Opći sustav upravljanja rizicima – jesu li ugrađeni unutar organizacije, odražavaju li i predstavljaju strategiju spram specifičnih rizika na određenom području organizacije.

Sukladno standardima interne revizije, interni revizori trebaju imati odgovarajuća znanja potrebna za identifikaciju crvenih zastavica i pokazatelja koji ukazuju na moguću prijevare. Također, interni revizori moraju djelovati s dužnom pažnjom i odgovarajućom razinom profesionalnog skepticizma kako bi uočili nepravilnosti koje mogu ukazivati na moguće prijevorno ponašanje. Interna revizija je nadzorna funkcija i savjetodavna aktivnost menadžmenta te se interni revizori trebaju uključiti u borbu protiv prijevare na svim razinama. Oni mogu značajno doprinijeti sprječavanju pogrešaka i prijevara ako ispunjavaju svoju glavnu zadaću, a to je da opskrbljuju menadžment mišljenjem o efikasnosti interne kontrole, daju prijedloge za poboljšanje interne kontrole te informiraju o najnovijim tehnikama i metodologijama za otkrivanje prijevara (Tušek, Žager, 2008.).

U procesu istraživanja prijevare interni revizori trebaju procijeniti jesu li primjerene i učinkovite interne kontrole na mjestu za otkrivanje prijevare, oblikovati odgovarajuće procedure za otkrivanje prijevara, identificirati simptome i znakove upozorenja te obavijestiti primjerene razine menadžmenta o mogućim prijevarama. Interni revizori su u mogućnosti da otkriju i spriječe sve vrste prijevara u organizaciji – od prijevare zaposlenika do prijevara menadžmenta – međutim njihova učinkovitost u otkrivanju prijevara ovisi i o njihovoj poziciji u hijerarhijskoj strukturi poduzeća. Naime, na učinkovitost internih revizora u otkrivanju prijevara značajno utječe njihova neovisnost te potencijalni sukob interesa kojem mogu biti izloženi. Funkcija interne revizije može zaštititi poduzeće od prijevare u financijskim izvještajima ako su interni revizori učinkoviti u tri područja (Rezaee, Riley, 2010.):

- sprječavanju prijevare u financijskim izvještajima kroz adekvatne i učinkovite sustave internih kontrola
- otkrivanju prijevare u financijskim izvještajima provođenjem funkcije interne revizije te
- izvještavanjem otkrivene prijevare u financijskim izvještajima timu vrhovnog menadžmenta i revizorskom odboru.

3.3. Odgovornost eksterne revizije

MRevS 240 „Revizorove odgovornosti u vezi s prijevarama u reviziji financijskih izvještaja“ definira odgovornosti i ulogu eksternih revizora u otkrivanju prijevara i pogrešaka u financijskim izvještajima. Iako korisnici financijskih izvještaja očekuju da će revizori provodeći reviziju financijskih izvještaja otkriti prijevare i pogreške ako one postoje u financijskim izvještajima, bitno je naglasiti da, zbog karakteristika revizije i ograničenja u njenom provođenju, postoji rizik neotkrivanja značajnih pogrešnih prikazivanja u financijskim izvještajima nastalih zbog prijevara i pogrešaka, odnosno revizori ne moraju otkriti prijevare i pogreške u financijskim izvještajima unatoč provođenju revizije u skladu s MRevS-ima. U prilog tome idu i rezultati istraživanja koje je 2014. godine provelo Udruženje ovlaštenih istražitelja prijevare. Prema tom istraživanju eksterni revizori su tek na sedmom mjestu u otkrivanju prijevara, a otkrili su prijevare u samo 3 % promatranih slučajeva (ACFE, 2014.). Nešto učinkovitiji u otkrivanju prijevara su interni revizori koji su otkrili oko 14 % prijevara, a najveći broj prijevara otkriven je putem anonimne dojave (oko 42 % slučajeva) – bilo od strane zaposlenika, kupaca ili dobavljača ili pak slučajno (7 % slučajeva).

Revizija financijskih izvještaja rezultira razumnim uvjerenjem da financijski izvještaji kao cjelina ne sadrže značajna pogrešna prikazivanja nastala uslijed prijevara ili pogrešaka. Revizorova je odgovornost primjereno isplanirati i provesti reviziju u skladu s Međunarodnim revizijskim standardima kako bi mogao izraziti mišljenje o realnosti i objektivnosti financijskih izvještaja. Pri tome treba imati u vidu činjenicu da, bez obzira što je revizija

obavljena sukladno MRevS-ima, revizor ne može steći bezrezervno, odnosno apsolutno uvjerenje da će svojim postupcima otkriti značajna pogrešna prikazivanja u financijskim izvještajima zbog, prije svega, ograničenja u obavljanju revizije. Naime, zbog čimbenika kao što su korištenje prosudbi, primjena testiranja, postojanje inherentnih ograničenja internih kontrola i činjenice da su revizijski dokazi više indikativni nego što pružaju zaključke, postoji neizbježan rizik da će neka značajna pogrešna prikazivanja u financijskim izvještajima ostati neotkrivena, iako je revizija ispravno planirana i provedena u skladu s MRevS-ima.

U postupku revizije financijskih izvještaja revizoru je teže otkriti prijevare nego pogrešku, budući da je prijevarena namjerna radnja smišljena i počinjena s ciljem prijevare i zavaravanja ne samo revizora, nego i ostalih korisnika financijskih izvještaja. Rizik neotkrivanja značajnih pogrešnih prikaza nastalih zbog prijevare veći je od rizika neotkrivanja značajnih pogrešnih prikaza zbog pogrešaka jer prijevarena obično obuhvaća radnje kojima se ona pokušava prikriti, kao što je krivotvorenje, namjerno ispuštanje knjiženja transakcije ili namjerni pogrešni prikazi dostavljeni revizoru. Navedene pokušaje prikrivanja prijevare revizor će još teže otkriti ako su prisutni i zlonamjerni sporazumi kojima je cilj navesti revizora da povjeruje u vjerodostojnost nekih dokaza, premda su oni zapravo lažni. Također, rizik neotkrivanja značajnih pogrešnih prikazivanja veći je kod prijevare od strane menadžmenta, nego kod prijevare od strane zaposlenika budući da menadžment, s obzirom na svoju upravljačku poziciju, može zaobići kontrolne postupke i narediti podređenima pogrešno evidentiranje određenih poslovnih događaja (MRevS 240, 2010.).

Ako se nakon obavljene revizije financijskih izvještaja utvrdi pogrešno prikazivanje financijskih izvještaja nastalo uslijed prijevare to ne mora nužno značiti da je došlo do propusta u primjeni MRevS-a pri provođenju revizije jer revizijski postupci mogu biti nedjelotvorni za utvrđivanje namjernih pogrešaka, tj. prijevarena zbog postojanja prikrivenih zlonamjernih sporazuma između menadžmenta, onih koji su zaduženi za upravljanje, zaposlenika ili trećih osoba.

4. Zaključak

U okviru ovog rada autori su obradili pojam prijevare, čimbenike rizika prijevare te odgovornosti pojedinih sudionika u lancu financijskog izvještavanja u sprječavanju i otkrivanju prijevarena. U cilju sprječavanja i otkrivanja prijevarena iznimno su bitni različiti oblici nadzora, kako internog tako i eksternog. U ovom radu naglasak je na razgraničavanju uloge menadžmenta, internih i eksternih revizora u kontekstu sprječavanja i otkrivanja prijevarena u financijskim izvještajima.

Menadžment i oni koji su zaduženi za upravljanje imaju primarnu odgovornost za sprječavanje i otkrivanje prijevarena u poduzeću. Naime, menadžment je odgovoran za procjenu rizika te oblikovanje odgovarajućeg sustava internih kontrola koji će minimizirati prijevareno ponašanje. Menadžeri su ti koji šalju „signal s vrha“ i definiraju cjelokupno kontrolno okruženje u poduzeću te i u tom smislu najviše mogu doprinijeti sprječavanju i otkrivanju prijevarena. Interni revizori, u okviru internog nadzora poduzeća, imaju sve aktivniju ulogu u sprječavanju prijevarena i preventivnom djelovanju. Naime, s obzirom na svoj položaj i prisutnost u poduzeću, oni su u boljem položaju za otkrivanje prijevarena od eksternih revizora. Interni revizori su zaduženi za procjenu rizika te ocjenu sustava internih kontrola te u tom smislu trebaju imati i proaktivnu ulogu u sprječavanju i otkrivanju prijevarena u poduzeću. Iako otkrivanje prijevarena nije primarna dužnost internih revizora, oni ipak trebaju imati odgovarajuća znanja o vrstama prijevarena, načinima njihova sprječavanja i otkrivanja. Također, interni revizori moraju djelovati s dužnom pažnjom i odgovarajućom razinom profesionalnog

skepticizma kako bi uočili nepravilnosti koje mogu ukazivati na moguće prijevorno ponašanje. Interna revizija je nadzorna funkcija i savjetodavna aktivnost menadžmenta te se interni revizori trebaju uključiti u borbu protiv prijevare na svim razinama.

Eksterna revizija predstavlja naknadno pregledavanje i utvrđivanje realnosti i objektivnosti financijskih izvještaja te „mjeru vjerodostojnosti financijskih izvještaja“. Svrha je eksterne revizije povećati vjerodostojnost financijskih izvještaja. Međutim, eksterni revizori nisu, niti mogu biti odgovorni za sprječavanje i otkrivanje prijevare u financijskim izvještajima. Odgovornost eksternih revizora provesti je reviziju sukladno revizijskim standardima te utvrditi jesu li financijski izvještaji pripremljeni u skladu s primjenjivim okvirom financijskog izvještavanja. Iako revizija doprinosi, već samom činjenicom što predstavlja dodatni i naknadni stupanj nadzora, sprječavanju i otkrivanju prijevare u financijskim izvještajima bitno je naglasiti da, zbog karakteristika revizije i ograničenja u njenom provođenju, postoji rizik neotkrivanja značajnih pogrešnih prikazivanja u financijskim izvještajima nastalih zbog prijevare i pogrešaka, odnosno revizori ne moraju otkriti prijevare i pogreške u financijskim izvještajima unatoč provođenju revizije u skladu s MRevS-ima. Neovisno o jasno definiranim odgovornostima eksternih revizora potrebno je spomenuti i nerealna očekivanja korisnika financijskih izvještaja koji očekuju da će revizori provodeći reviziju financijskih izvještaja otkriti prijevare i pogreške ako one postoje u financijskim izvještajima. Dakle, u praksi postoje prevelika očekivanja korisnika financijskih izvještaja, odnosno tzv. jaz u očekivanjima (eng. *expectation gap*) i nepotpuno razumijevanje uloge i odgovornosti revizora u sprječavanju i otkrivanju prijevare iako je ta problematika jasno definirana kroz MRevS 240.

Temeljem svega prethodno navedenog razvidno je kako različiti sudionici sustava korporativnog izvještavanja imaju različite uloge i odgovornosti u kontekstu sprječavanja i otkrivanja prijevare, međutim, potrebna je suradnja i odgovarajuće djelovanje svih kako bi se minimalizirao rizik prijevornog prikazivanja u financijskim izvještajima.

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Frauds in financial statements - prevention and detection responsibilities

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Abstract. Misstatements or irregularities in financial statements may be caused by frauds and errors. Unlike an error, which represents unintentional failure, usually made by the client's accounting staff, fraud represents an intentional act that is usually motivated by acquiring unjust material benefits and creating deceptive financial statements. In this article, the emphasis is on fraudulent presentations in financial statements (since frauds occur in all segments of the economy). Namely, every company is exposed to risk of fraudulent presentations in financial statements, regardless of the form, ownership, size, and other features of a business. Misstatements, or fraudulent presentations in financial statements, may be caused by fraudulent financial reporting and misappropriation of assets. In order to minimize the risk of frauds in financial statements, active participation of all participants in the financial reporting chain is required: from the management - who are responsible for the preparation and presentation of financial statements - to external auditors, who determine the credibility of such reports. In the context of this paper, authors deal with fraud risk factors or factors that indicate a fraud as well as responsibilities for their prevention and detection. In the context of the responsibility for preventing and detecting frauds in financial statements, roles of different participants in the chain of financial reporting are considered, with a focus on distinguishing responsibilities of management, internal, and external audit.

Key words: *frauds, fraud triangle, external audit, internal audit*

Komunalna naknada i komunalni doprinos

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Sažetak. Komunalna naknada i komunalni doprinos su jedni od najvećih prihoda proračuna jedinica lokalne samouprave u Republici Hrvatskoj. Komunalna naknada prihod je proračuna lokalne jedinice namijenjen za financiranje komunalnih djelatnosti: odvodnje atmosferskih voda, održavanja čistoće u dijelu koji se odnosi na čišćenje javnih površina, održavanja javnih površina, održavanja nerazvrstanih cesta, održavanja groblja i krematorija, javne rasvjete. Komunalni doprinos prihod je proračuna lokalne jedinice koji se koristi za financiranje gradnje i korištenja objekata i uređaja komunalne infrastrukture: javnih površina, nerazvrstanih cesta, groblja i krematorija te javne rasvjete. U ovom radu prikazano je na temelju zadataka kako se obračunava komunalna naknada, a kako komunalni doprinos. Komunalna naknada plaća se po koeficijentima, s tim da se pomnoži s kvadratnim metrom prostora. Detaljnije informacije nalaze se u Odluci o komunalnoj naknadi jedinice lokalne samouprave. Komunalni doprinos plaća se kod gradnje množenjem koeficijenta namjene i kubnog metra korisne površine objekta koji se gradi. Informacije o iznosima, zavisno od zone i namjene objekta, treba potražiti u Odluci o komunalnom doprinosu jedinice lokalne samouprave (grad, općina) u kojoj će se graditi. U ovom radu prikazat ćemo primjer obračuna komunalnih obveza i njihovog udjela u ukupnom prihodu na primjeru grada Šibenika.

Ključne riječi: *komunalna naknada, komunalni doprinos, lokalni prihodi*

1. Uvod

Navedena tema izabrana je iz razloga jer komunalna naknada i komunalni doprinos predstavljaju bitan instrument prikupljanja javnih prihoda općina i gradova kao jedinica lokalne samouprave u Republici Hrvatskoj te se prihodi od komunalne naknade i komunalnog doprinosa ubrajaju u fiskalno najizdašnije prihode općina i gradova.

Lokalnim i regionalnim jedinicama vlasti potrebni su prihodi kako bi podmirile zakonima definirane javne potrebe, uspješno obavile samoupravne funkcije te pružile lokalnom stanovništvu u skladu s njihovim sklonostima potrebnu razinu javnih dobara i usluga.

Vlastiti i vanjski izvori prihoda su osnovni izvori financiranja lokalnih jedinica vlasti. Vlastiti izvori prihoda su lokalni porezi i korisničke naknade, a vanjski izvori prihoda su izvori pomoći iz državnog ili županijskog proračuna, udjeli u zajedničkim poreznim i neporeznim prihodima te primicima od zaduživanja. Lokalne jedinice vlasti ostvaruju porezne prihode iz dva osnovna izvora: županijskih, općinskih i gradskih poreza s jedne strane te zajedničkih poreza s druge strane. Neporezni prihodi (tzv. prihodi po posebnim propisima) i kapitalni prihodi su prihodi koje lokalne jedinice samostalno utvrđuju i naplaćuju.

2. Komunalni doprinos

Nakon poreznih prihoda, drugi najznačajniji izvori prihoda lokalnih jedinica su neporezni prihodi. Neporezni prihodi su u skladu s načelom porezne korisnosti, a to znači da korisnici za pružene javne usluge plaćaju naknade. Neporezni prihodi su poželjan izvor financiranja lokalnih jedinica vlasti jer povećavaju autonomiju lokalnih jedinica vlasti i promoviraju njihovu vlastitu odgovornost u pružanju javnih usluga i dobara. U Hrvatskoj se neporezni prihodi uglavnom temelje na komunalnim naknadama i doprinosima koje naplaćuju lokalne jedinice i komunalna poduzeća. Visinu stope neporeznih prihoda utvrđuju samostalno lokalne jedinice te samostalno obavljaju njihovu naplatu.

Komunalni doprinos novčano je javno davanje koje se plaća za građenje i korištenje objekata komunalne infrastrukture. Prihod je jedinice lokalne samouprave, a plaća ga vlasnik građevne čestice na kojoj se gradi građevina, odnosno investitor.¹ Sredstva koja se prikupe od komunalnog doprinosa služe za građenje objekata i uređaja komunalne infrastrukture za:

- javne površine
- nerazvrstane ceste
- groblja i krematorija
- javnu rasvjetu.

Osim iz sredstava komunalnog doprinosa navedeni objekti financiraju se i iz proračuna lokalne samouprave, naknade za koncesiju i drugih izvora utvrđenih posebnim zakonom. Sredstvima komunalnog doprinosa financira se i pribavljanje zemljišta na kojem se grade objekti i uređaji komunalne infrastrukture (javne površine, nerazvrstane ceste, groblja i krematoriji, javna rasvjeta), rušenje postojećih objekata i uređaja, premještanje postojećih nadzemnih i podzemnih instalacija te radovi na sanaciji toga zemljišta.²

2.1 Obveznik plaćanja komunalnog doprinosa

Komunalni doprinos plaća vlasnik građevne čestice na kojoj se gradi građevina, odnosno investitor. Vlasnik građevne čestice, odnosno investitor plaćanjem komunalnog doprinosa sudjeluje u podmirenju troškova izgradnje objekata i uređaja komunalne infrastrukture utvrđenih Programom. Investitor je pravna ili fizička osoba na čije se ime gradi građevina.³ Obveznik plaćanja komunalnog doprinosa, tj. investitor dužan je uplatiti komunalni doprinos prije početka građenja, ali ostaje mogućnost da mu jedinica lokalne uprave i samouprave ostavi mogućnost obročnog plaćanja komunalnog doprinosa.

2.2 Način obračuna komunalnog doprinosa

Komunalni doprinos obračunava se u skladu s obujmom, odnosno po metru kubnom građevine koja se gradi na građevnoj čestici, a kod građevine koja se uklanja zbog građenja nove građevine ili kada se postojeća građevina dograđuje ili nadograđuje, komunalni se doprinos obračunava na razliku u obujmu u odnosu na prijašnju građevinu.⁴

Ono što u obračunu komunalnog doprinosa pojedinim investitorima predstavlja potencijalni problem je nepoznavanje načina obračuna, tj. da se komunalni doprinos obračunava po kubnom metru za razliku od komunalne naknade koja se obračunava po kvadratnom metru i to se vezuje uz trošak gradnje u tom razdoblju. Isto tako, ostavljena je mogućnost lokalnim

¹ <http://www.mgipu.hr/default.aspx?id=27827>

² Zakon o komunalnom gospodarstvu, članak 31. stavka 5; dostupno na : <http://www.zakon.hr/z/319/Zakon-o-komunalnom-gospodarstvu>

³ Zakon o gradnji, članka 49. stavka 1; dostupno na: <http://www.zakon.hr/z/690/Zakon-o-gradnji>

⁴ Zakon o komunalnom gospodarstvu, članak 31. stavka 8; dostupno na : <http://www.zakon.hr/z/319/Zakon-o-komunalnom-gospodarstvu>

jedinicama da sami utvrđuju raspored zona na svom području i koeficijente obračuna u tim zonama.

Jedinična vrijednost komunalnog doprinosa za obračun po metru kubnom građevine koja se gradi određuje se za pojedinu zonu u gradu, odnosno općini. Ta je vrijednost najviša za prvu zonu i ne može biti viša od 10 % prosječnih troškova gradnje prema kubnom metru etalonske građevine u Republici Hrvatskoj. Prosječni troškovi gradnje m^3 etalonske građevine u Republici Hrvatskoj iznose 1.382,86 kuna po kubnom metru, objavljuje se u Narodnim novinama.

2.3 Primjer obračuna komunalnog doprinosa po zonama u gradu Šibeniku

Primjer obračuna na poslovno-stambenoj zgradi u gradu Šibeniku od 114 stanova, 27 poslovnih prostora, 5 etaža garaže:

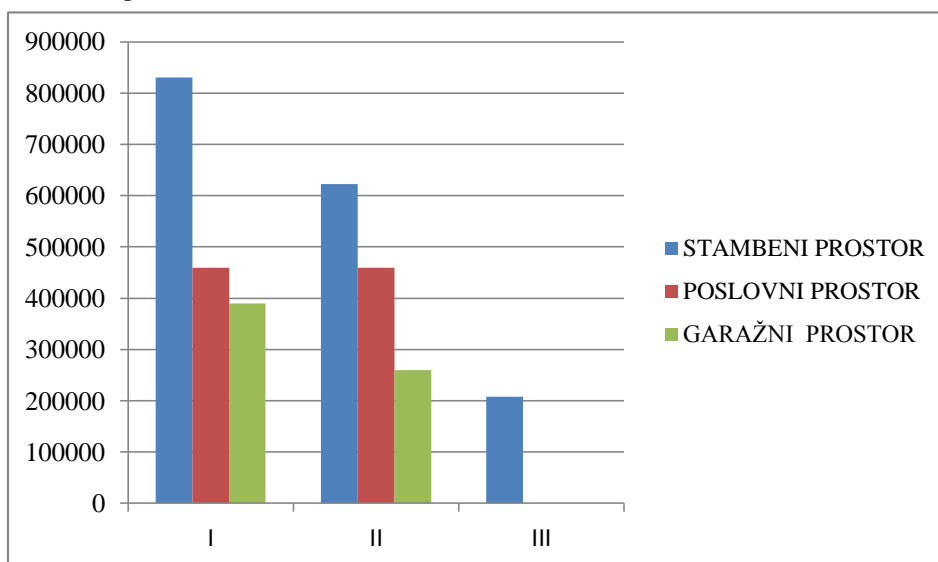
- 27 poslovnih prostora prosječne veličine 45 m^2 (visina poslovnog prostora 2,8 m),
- prosječni troškovi gradnje m^3 etalonske građevine u Republici Hrvatskoj iznose 1.382,86 kn po metru kubičnom
- 27 poslovnih objekata
- 114 stanova prosječne veličine 65 m^2 (visina stambenog prostora 2,8 m)
- 5000 m^2 garažnog prostora (visina garažnog prostora 2,6 m).

U tablici i pripadajućem grafu prikazan je iznos komunalnog doprinosa koji bi trebalo platiti za pripadajući stambeni, poslovni i garažni prostor iz gore navedenog primjera po zonama koje vrijede na području grada Šibenika.

Tablica 1: Prikaz komunalnog doprinosa po namjeni prostora za grad Šibenik

ZONE	STAMBENI PROSTOR	POSLOVNI PROSTOR	GARAŽNI PROSTOR
I	829.920	459.270	390.000
II	622.440	459.270	260.000
III	207.480		

Izvor: Izrada autora prema navedenom zadatku



Grafikon 1: Prikaz komunalnog doprinosa po namjeni prostora u gradu Šibeniku

3. Komunalna naknada

Komunalna naknada je prihod proračuna jedinice lokalne samouprave, a sredstva komunalne naknade namijenjena su financiranju obavljanja sljedećih djelatnosti:⁵

- odvodnja atmosferskih voda
- održavanje čistoće u dijelu koji se odnosi na čišćenje javnih površina
- održavanje javnih površina
- održavanje nerazvrstanih cesta
- održavanje groblja i krematorija
- javna rasvjeta.

Kao što je iz gore navedenih zakonskih akata vezanih za komunalnu naknadu vidljivo da se sredstvima komunalne naknade mora financirati održavanje raznih područja infrastrukture što iziskuje razna sredstva za lokalne jedinice, koja se ne mogu uvijek namaknuti komunalnom naknadom.

Predstavničko tijelo jedinice lokalne samouprave donosi odluku o komunalnoj naknadi kojom se obavezno utvrđuju:⁶

- naselja u kojima se naplaćuje komunalna naknada
- područja zona u gradu, odnosno općini
- koeficijent zona
- koeficijent namjene za poslovni prostor i za građevno zemljište koje služi u svrhu obavljanja poslovne djelatnosti
- rok plaćanja komunalne naknade
- nekretnine važne za jedinicu lokalne samouprave koje se u potpunosti ili djelomično oslobađaju od plaćanja komunalne naknade
- opći uvjeti i razlozi zbog kojih se u pojedinim slučajevima može odobriti potpuno ili djelomično oslobađanje od plaćanja komunalne naknade i izvore sredstava iz kojih će se namiriti iznos za slučaj potpunog ili djelomičnog oslobađanja od plaćanja komunalne naknade.

Predstavničko tijelo jedinice lokalne samouprave donosi i odluku o vrijednosti obračunske jedinice – boda.

Jedinica lokalne jedinice, tj. njeno predstavničko tijelo ima razne mogućnosti kroz gore navedene faktore omogućiti vlasnicima građevinskih objekata različite mogućnosti otplate komunalne naknade kroz različite socijalne kriterije ili omogućavanje razvoja pojedinih dijelova lokalne jedinice.

Komunalnu naknadu moguće je obuhvatiti jednako i zakonskim pojmom „poreza“, kao i pojmom „drugog javnog davanja“ jer komunalna naknada odgovara svim obilježjima koji su u skladu s potrebama da bi se određeni instrument smatrao porezom.⁷ Komunalna naknada ipak predstavlja javno davanje jer, za razliku od poreza, ipak ima određenu direktnu protučinidbu. Iz perspektive obveznika komunalne naknade, komunalna naknada je davanje u novcu koje su oni temeljem zakona obvezni platiti jedinicama javne vlasti, a iz perspektive lokalne jedinice ona predstavlja njihov proračunski prihod koji se koristi za podmirivanje proračunom utvrđenih javnih izdataka.

⁵ Zakon o komunalnom gospodarstvu, članak 22., dostupno na: <http://www.zakon.hr/z/319/Zakon-o-komunalnom-gospodarstvu>

⁶ <http://www.mgipu.hr/default.aspx?id=14118>

⁷ N. Žunić Kovačević, S. GADŽO, Komunalna naknada u RH i njezino pozicioniranje...Zb. Prav. fak. Sveuč. Rij. (1991) v. 35, br. 1, 245-270 (2014)

3.1 Obveznik plaćanja komunalne naknade

Komunalnu naknadu plaćaju vlasnici odnosno korisnici:⁸

- stambenog prostora
- poslovnog prostora
- garažnog prostora
- građevinskog zemljišta koje služi za obavljanje poslovne djelatnosti
- neizgrađenog građevinskog zemljišta.

Za nekretnine (stambeni prostor, poslovni prostor, garažni prostor, građevinsko zemljište koje služi za obavljanje poslovne djelatnosti i neizgrađeno građevinsko zemljište) koje se nalaze unutar građevinskog područja naselja plaća se komunalna naknada te za stambeni i poslovni prostor izvan građevinskog područja naselja u kojem se obavljaju komunalne djelatnosti (održavanje javnih površina, održavanje nerazvrstanih cesta i javna rasvjeta) i nekretnine koje su opremljene pristupnom cestom, objektima za opskrbu električnom energijom i vodom prema mjesnim prilikama te su sastavni dio infrastrukture lokalne samouprave.

Ono što predstavlja problem kod naplate komunalne naknade je problem utvrđivanja vlasništva nad pojedinim građevinskim objektima. Nesređene zemljišne knjige su velika prepreka u boljoj naplati komunalne naknade i potencijalnim ovrhama kod naplate komunalne naknade. Isto tako, ono što je prednost ovog načina obračuna je mogućnost koju lokalna jedinica ima da odredi iznose za različite vrste građevinskog prostora i na taj način potiče izgradnju građevina za određenu namjenu.

3.2 Način obračuna komunalne naknade

Visina komunalne naknade određuje se ovisno o:⁹

- lokaciji nekretnine, odnosno zoni u kojoj se nalazi nekretnina
- vrsti nekretnine.

Komunalnu naknadu obračunavamo po metru kvadratnom površine za stambeni, poslovni i garažni prostor po jedinici korisne površine koja se utvrđuje na način propisan Uredbom o uvjetima i mjerilima za utvrđivanje zaštićene najamnine, a za građevinsko zemljište po jedinici stvarne površine.

Za razliku od komunalnog doprinosa kod obračuna komunalne naknade kao obračunska jedinica koristi se kvadratni metar što sa gledišta vlasnika građevinskog objekta je puno transparentnije i jednostavnije za obračun.

3.3 Primjer obračuna komunalne naknade po zonama u gradu Šibeniku

Grad Šibenik podijeljen je na pet zona, a koeficijenti obračuna po zonama prikazani su u tablici 2:

Tablica 2: Iznosi komunalne naknade po u gradu Šibeniku

GRAD ŠIBENIK ZONE	STAMBENI kn/m ²	POSLOVNI kn/m ²
I	0,24	1,58
II	0,23	1,50
III	0,14	0,95
IV	0,10	0,63
V	0,05	0,32

Izvor: www.sibenik.hr

⁸ Zakon o komunalnom gospodarstvu, članak 22. stavka 3; dostupno na : <http://www.zakon.hr/z/319/Zakon-o-komunalnom-gospodarstvu>

⁹ Zakon o komunalnom gospodarstvu, članak 24. stavka 1, dostupno na: <http://www.zakon.hr/z/319/Zakon-o-komunalnom-gospodarstvu>

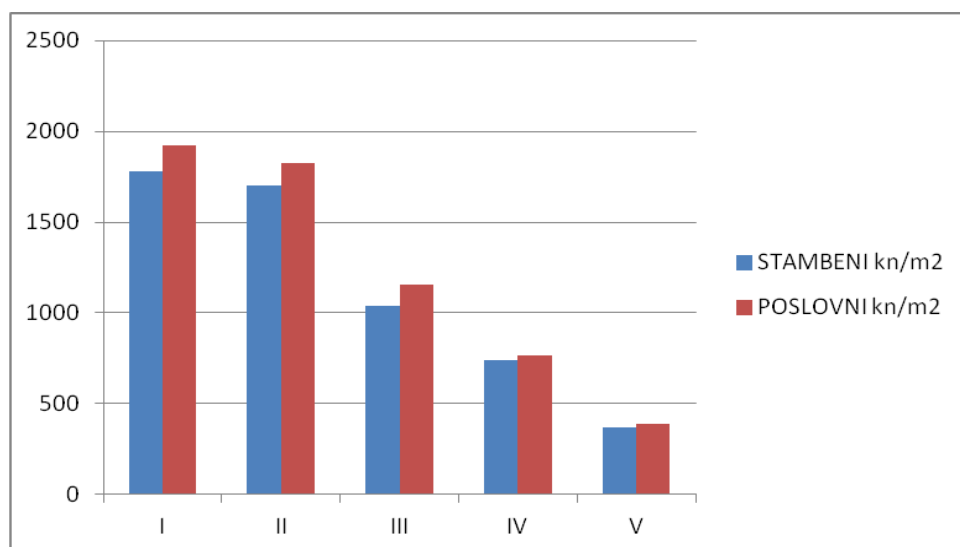
U tablici i pripadajućem grafu prikazan je iznos komunalne naknade koju bi trebalo platiti za pripadajući stambeni, poslovni i garažni prostor iz gore navedenog primjera po zonama koje vrijede na području grada Šibenika.

Obračun komunalne naknade za poslovni i stambeni prostor izrađen je na istom primjeru koji je naveden kod komunalnog doprinosa:

Tablica 3: Prikaz komunalne naknade grada Šibenika po namjeni prostora za sve zone

GRAD ŠIBENIK ZONE	STAMBENI kn/m ²	POSLOVNI kn/m ²
I	1778,40	1919,70
II	1704,30	1822,50
III	1037,40	1154,25
IV	741,00	765,45
V	370,50	388,80

Izvor: izrada autora prema zadatku navedenom kod komunalnog doprinosa



Grafikon 2: Prikaz komunalne naknade grada Šibenika po namjeni prostora za sve zone

4. Prihodi od komunalnog doprinosa i naknade

Prihodi od komunalnih doprinosa i naknada Grada Šibenika u 2014. godini iznosili su 33.008.042,00 kuna što je porast od 56,7 posto u odnosu na prethodnu godinu. Rast prihoda od komunalnih doprinosa oštro je varirao u razdoblju od 2011. do 2014. godine, dok su prihodi od komunalne naknade konstantno rasli.

Tablica 4: Prikaz koliko je potrebno metara kvadratnih da bi se ostvarili ukupni prihodi poslovanja Grada Šibenika

GRAD ŠIBENIK ZONE	STAMBENI kn/m ²	Izračun metara kvadratnih potrebnih da se ostvare ukupni prihodi proračuna Grada Šibenika				
		2010.	2011.	2012.	2013.	2014.
I	0,24	743.609.963	620.458.146	773.113.821	681.058.267	756.114.179
II	0,23	775.940.830	647.434.587	806.727.465	710.669.496	788.988.709
III	0,14	1.274.759.936	1.063.642.536	1.325.337.979	1.167.528.457	1.296.195.736
IV	0,1	1.784.663.910	1.489.099.550	1.855.473.170	1.634.539.840	1.814.674.030
V	0,05	3.569.327.820	2.978.199.100	3.710.946.340	3.269.079.680	3.629.348.060

GRAD ŠIBENIK ZONE	POSLOVNI kn/m ²	Izračun metara kvadratnih potrebnih da se ostvare ukupni prihodi proračuna Grada Šibenika				
		2010.	2011.	2012.	2013.	2014.
I	1,58	112.953.412	94.246.807	117.435.011	103.451.889	114.852.787
II	1,5	118.977.594	99.273.303	123.698.211	108.969.323	120.978.269
III	0,95	187.859.359	156.747.321	195.312.965	172.056.825	191.018.319
IV	0,63	283.279.986	236.365.008	294.519.551	259.450.768	288.043.497
V	0,32	557.707.472	465.343.609	579.835.366	510.793.700	567.085.634

Izvor: izrada autora prema podacima Ministarstva financija, *Proračun Grada Šibenika*, dostupno na: <http://www.mfin.hr/hr/ostvarenje-proracuna-jlprs-za-period-2010-2014>

U tablici 4 napravljen je izračun koliko je potrebno metara kvadratnih stambenog ili poslovnog prostora da bi se ostvarili ukupni prihodi poslovanja. Razvidno je da je komunalna naknada za poslovne prostore veća pa je stoga potrebno mnogo manje metara kvadratnih nego za stambene prostore.

5. Zaključak

Zbog svega navedenog, uzimajući u obzir komunalnu naknadu i komunalni doprinos, može se zaključiti da se komunalna naknada i komunalni doprinos ubrajaju među najizdašnije prihode jedinica lokalne samouprave, odnosno jedne od najvažnijih instrumenata financiranja jedinica lokalne samouprave u Republici Hrvatskoj.

Zajednička karakteristika komunalne naknade i komunalnog doprinosa je ta da se radi o javnim davanjima koja plaćaju fizičke i pravne osobe i od druge strane očekuju se određene protučinidbe. To nas dovodi do pitanja je li ispravnije komunalnu naknadu i komunalni doprinos definirati kao porez ili korisničku naknadu, pri tome se misli na postupak utvrđivanja obveze plaćanja komunalne naknade i komunalnog doprinosa te uvjete i postupak djelomičnog ili potpunog oslobođanja od obveze plaćanja komunalne naknade ili komunalnog doprinosa. Isto tako, često se za komunalnu naknadu veže i pojam drugog javnog davanja koji su građani temeljem zakona obvezni platiti jedinicama javne vlasti.

Komunalni doprinos je parafiskalni namet koji se plaća u trenutku dobivanja lokacijske dozvole. Za razliku od njega, komunalna naknada je parafiskalni namet koji se plaća višekratno bilo mjesečno ili tromjesečno ovisno o tome kako je definirano u pojedinom gradu ili općini. Iz toga i proizlazi temeljna razlika jer se komunalna naknada plaća na izgrađene građevine dok se komunalni doprinos plaća za građevine koje će se tek sagrađiti. Sukladno tome, novčana sredstva koja grad prikupi od komunalne naknade namijenjena su održavanju komunalne infrastrukture, a novčana sredstva koja grad prikupi od komunalnog doprinosa za izgradnju nove komunalne infrastrukture.

Komunalni doprinos i komunalna naknada mehanizam su u rukama jedinice lokalne samouprave kroz koji može omogućiti razvoj socijalne politike same lokalne jedinice, ali i ono što je još važnije, omogućiti razvitak same lokalne jedinice ili barem nekog dijela iste.

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Revenues from utility fees and utility contributions

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Abstract. Utility fees and utility contributions are one of the biggest budget revenues of local government units in Croatia. Communal fee income in the budget of the local unit is intended for financing the utilities: storm water drainage, cleanliness maintenance in the part relating to the cleaning of public areas, the maintenance of public areas, the maintenance of unclassified roads, and the maintenance of cemeteries, crematoria, and public lighting. The municipal contribution to the revenue of the local unit budget is used to finance the construction and use of facilities and equipment of communal infrastructure: public areas, unclassified roads, cemeteries and crematoria, and public lighting. In this paper, the emphasis is on the tasks concerning the calculation of utility compensations as a municipal contribution. The communal fee is paid by the coefficients provided, multiplied by m² - space. Municipal contributions are paid in the construction purposes and multiplying the quotient m³ - the usable area of the building being built. Information about the amounts depending on the zone and the use of the building should refer to the decision concerning utility contributions of the local government (city, municipality) where the building is to be built. In this paper, we show an example of calculating utility charges and contributions and their share in total revenues, using the town of Šibenik as the example.

Key words: *Utility fee, utility contributions, local revenues*

Smanjenje vrijednosti dugotrajne materijalne imovine

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Sažetak. U ovom članku prikazat će se računovodstveni i porezni postupci i knjiženja vezana uz smanjenje vrijednosti dugotrajne materijalne imovine i revalorizaciju. Revalorizacija dugotrajne materijalne imovine predstavlja svođenje knjigovodstvene vrijednosti imovine na tržišnu vrijednost, koja može biti veća ili manja. Međutim, u praksi se pojam revalorizacije najčešće koristi u slučaju povećanja vrijednosti imovine, dok se za revalorizaciju na nižu vrijednost koriste pojmovi „smanjenje vrijednosti“ i „vrijednosno usklađenje“. U današnje vrijeme kada se još osjete posljedice ekonomske krize, često dolazi do smanjenja tržišne vrijednosti imovine, odnosno dolazi do pada njihovih fer vrijednosti. U 2014. godini u Republici Hrvatskoj donesene su izmjene i dopune Zakona o porezu na dobit koje imaju za posljedicu promjene u poreznom priznavanju rashoda od smanjenja vrijednosti imovine. S obzirom na navedene izmjene, u članku će se prikazati obračun poreza na dobitak i modeli knjiženja vezani uz porezno nepriznate rashode od usklađenja vrijednosti dugotrajne materijalne imovine koji dovode do privremenih razlika i odgođene porezne imovine. Nadalje, prikazat će se postupci i knjiženja vezana uz smanjenje vrijednosti revalorizirane dugotrajne materijalne imovine.

Ključne riječi: smanjenje vrijednosti, metoda troška, revalorizacija, odgođena porezna imovina, odgođene porezne obveze

1. Uvod

Dugotrajna materijalna imovina je oblik imovine bez kojeg najčešće nije moguće obavljati neku djelatnost. Trošak nabave nekog predmeta dugotrajne materijalne imovine treba priznati kao imovinu ako je vjerojatno da će buduće ekonomske koristi povezane s imovinom pritijecati poduzetniku i ako se trošak imovine može pouzdano izmjeriti. Prema Hrvatskom standardu financijskog izvještavanja (dalje: HSFI) 6 - *Dugotrajna materijalna imovina* i Međunarodnom računovodstvenom standardu (dalje: MRS) 16 – *Nekretnine, postrojenja i oprema*, dugotrajna materijalna imovina je ona imovina koja je namijenjena za korištenje u proizvodnji proizvoda ili isporuci roba ili usluga, za iznajmljivanje drugima ili u administrativne svrhe, koja se očekuje koristiti duže od jednog razdoblja i ona imovina koja je namijenjena za korištenje na neprekidnoj osnovi u svrhu aktivnosti poduzetnika.

Nakon početnog priznanja dugotrajne materijalne imovine klasificirane prema zahtjevima MRS-a 16, odnosno HSFI-a 6 po trošku nabave, poslovni subjekt ima mogućnost odabira računovodstvene politike za naknadno vrednovanje dugotrajne materijalne imovine. Sukladno MRS-u 16 i HSFI-u 6 za naknadno vrednovanje dugotrajne materijalne imovine koristi se ili metoda troška ili metoda revalorizacije. Odabrana računovodstvena politika za naknadno vrednovanje dugotrajne materijalne imovine ima direktan utjecaj na pozicije financijskih izvještaja, odnosno na računovodstvene informacije sadržane u financijskim izvještajima. U vremenu prije ekonomske krize na tržištima je vladala optimistička atmosfera, odnosno dolazilo je do povećanja tržišnih vrijednosti dugotrajne materijalne imovine. Stoga su poduzetnici u velikoj mjeri koristili metodu revalorizacije kao računovodstvenu politiku za naknadno vrednovanje dugotrajne materijalne imovine kako bi u financijskim izvještajima

poboljšali imovinski i financijski položaj poduzeća uslijed povećanja ukupne imovine i ukupnog kapitala.

U današnje vrijeme kada se još osjete posljedice ekonomske krize, često dolazi do smanjenja tržišne vrijednosti imovine, odnosno dolazi do pada njihovih fer vrijednosti. Umanjenje vrijednosti imovine regulirano je i MRS-om 36 – *Umanjenje imovine* koji propisuje obvezu provjere s ciljem utvrđivanja postoji li dokaz da vrijednost neke imovine može biti smanjena na datum bilance. MRS-u 36 raste važnost od početka ekonomske krize. Revalorizacija dugotrajne materijalne imovine predstavlja svođenje knjigovodstvene vrijednosti imovine na tržišnu vrijednost, koja može biti veća ili manja. Međutim, u praksi se pojam revalorizacije najčešće koristi u slučaju povećanja vrijednosti imovine, dok se za revalorizaciju na nižu vrijednost koriste pojmovi „smanjenje vrijednosti“ i „vrijednosno usklađenje“. Navedeni pojmovi koristit će se i u nastavku prilikom provođenja knjiženja i objašnjenja računovodstvenih postupaka vezanih uz smanjenje vrijednosti nerevalorizirane i revalorizirane dugotrajne materijalne imovine. Vrijednosno usklađenje dugotrajne materijalne imovine podrazumijeva usklađenje njezine vrijednosti na realnu (fer) vrijednost, što ima za posljedicu nastanak troškova s osnove vrijednosnog usklađenja. S obzirom na izmjene Zakona o porezu na dobit prikazat će se obračun poreza na dobit i modeli knjiženja vezani uz porezno nepriznate rashode od usklađenja vrijednosti dugotrajne materijalne imovine.

Za potrebe računovodstvenog evidentiranja smanjenja vrijednosti dugotrajne materijalne imovine potrebno je prvo utvrditi koju računovodstvenu politiku poduzetnik koristi za naknadno vrednovanje te imovine, odnosno je li koristi metodu troška ili pak metodu revalorizacije. Poduzetnik treba odabrati ili metodu troška ili metodu revalorizacije kao računovodstvenu politiku i primijeniti tu politiku na cjelokupnu skupinu dugotrajne materijalne imovine. Obveznici primjene HSFI-a pridržavat će se odredbi HSFI-a 6 prilikom računovodstvenog evidentiranja smanjenja vrijednosti dugotrajne materijalne imovine, dok je za obveznike primjene MSFI-a mjerodavan MRS 36. Bitno je naglasiti da u ovom slučaju nema razlika između odredbi MRS-a 36 i HSFI-a 6 koje uređuju smanjenje vrijednosti imovine. U nastavku će se posebno prikazati računovodstveni postupci smanjenja vrijednosti dugotrajne materijalne imovine koja se naknadno vrednuje po metodi troška, odnosno po metodi revalorizacije.

2. Smanjenje vrijednosti dugotrajne materijalne imovine koja se naknadno vrednuje po metodi troška

Prema metodi troška, nakon početnog priznanja dugotrajnu materijalnu imovinu treba iskazati prema njezinom trošku nabave umanjenoj za akumuliranu amortizaciju i gubitke od umanjenja vrijednosti (Belak, 2009.). Prema ovoj metodi, dugotrajna materijalna imovina evidentira se prema nabavnim vrijednostima na jednom računu, a na odgovarajućem korektivnom računu ispravak vrijednosti koji se obračunava amortizacijom. Zemljište se iskazuje prema nabavnoj vrijednosti umanjenoj za moguće gubitke od smanjenja, s obzirom na to da zemljište ne podliježe obračunu amortizacije. Ako se vrijednost dugotrajne materijalne imovine iskazuje po metodi troška, tada se gubitak koji je proizašao iz smanjenja vrijednosti evidentira kao rashod razdoblja.

HSFI 6 u t. 51. navodi: „Na svaki datum izvještavanja poduzetnik treba ocijeniti postoji li pokazatelj da neka dugotrajna materijalna imovina može biti umanjena. Ako takav pokazatelj postoji, poduzetnik treba procijeniti nadoknadivi iznos imovine“. Sukladno t. 52. HSFI-a 6 nadoknadivi iznos je viši iznos pri usporedbi fer neto prodajne vrijednosti jedinice koja stvara novac i vrijednosti u upotrebi. Ako bilo koji od ovih iznosa premašuje knjigovodstvenu vrijednost imovine, imovina se ne umanjuje i nije nužno procijeniti drugi iznos. Po metodi troška vrijednost imovine neće se ni povećati neovisno o tome što jedan od ovih iznosa (fer

neto prodajna vrijednost ili vrijednost u upotrebi) premašuje knjigovodstvenu vrijednost. Ako je nadoknativa vrijednost imovine manja od njezine knjigovodstvene vrijednosti, knjigovodstvena vrijednost imovine se smanjuje na njezinu nadoknadivu vrijednost (MRS 36, t. 59.). To je smanjenje gubitka od umanjenja vrijednosti.

U 2014. godini u Republici Hrvatskoj donesene su izmjene i dopune Zakona o porezu na dobit koje imaju za posljedicu promjene u poreznom priznavanju rashoda od smanjenja vrijednosti imovine. Zakon o porezu na dobit u čl. 12. st. 22. navodi: „Ako porezni obveznik u poslovnim knjigama iskazuje vrijednosno usklađenje dugotrajne imovine navedene u ovom članku, u porezno priznate rashode poreznog razdoblja može se uključiti samo iznos koji bi bio utvrđen primjenom godišnjih amortizacijskih stopa iz stavka 5. ovoga članka“. U stavku 5. članka 12. Zakona o porezu na dobit propisane su godišnje amortizacijske stope (bez povećanja) za pojedine grupe dugotrajne imovine, što prikazuje i tablica 1.

Tablica 1 Godišnje amortizacijske stope prema članku 12. st. 5. Zakona o porezu na dobit

Red. br.	Naziv imovine	Vijek trajanja u godinama	Godišnja (redovna) stopa amortizacije
1.	Građevinski objekti i brodovi veći od 1000 BRT	20	5%
2.	Osnovno stado, osobni automobili	5	20%
3.	Nematerijalna imovina, oprema (strojevi, postrojenja i dr.), vozila (teretna) i mehanizacija	4	25%
4.	Računala, računalna oprema i programi, mobilni telefoni i oprema za računalne mreže	2	50%
5.	Ostala (nespomenuta) imovina	10	10%

Izvor: Zakon o porez na dobit, dostupno na: <http://www.zakon.hr/z/99/Zakon-o-porezu-na-dobit>

Porezno priznato vrijednosno usklađenje može se izračunati pomoću linearne metode amortizacije prema kojoj se godišnja svota amortizacije izračuna tako da se osnovica za amortizaciju sredstva (trošak nabave) pomnoži s godišnjom (redovnom) stopom amortizacije. Ako vrijednosno usklađenje prelazi taj iznos, višak iznad porezno priznatog iznosa bit će privremeno porezno nepriznat, pritom nastaju privremene računovodstvene razlike te će se u računovodstvu evidentirati odgođena porezna imovina. Odgođena porezna imovina je svota poreza na dobit koja će biti nadoknativa u budućim razdobljima, kada se ova odbitna stavka može koristiti kao umanjenje osnovice poreza na dobit (Kopun, 2009.).

Primjer 2.1. Smanjenje vrijednosti dugotrajne materijalne imovine (koja se naknadno vrednuje po metodi troška) do visine porezno dopuštenog iznosa

Nabavna je vrijednost tvorničke zgrade 5.000.000,00 kn, a amortizirana vrijednost iznosi 2.600.000,00 kn. Vijek trajanja zgrade procijenjen je na 25 godina pa je stopa amortizacije 4 %. Prema Zakonu o porezu na dobit (čl. 12. st. 5.) redovna amortizacijska stopa za građevinske objekte je 5 %, što znači da je porezno priznato vrijednosno usklađenje 250.000,00 kn.

1. Obračunata je amortizacija zgrade za tekuću poslovnu godinu po stopi od 4 % te je godišnji iznos amortizacije 200.000,00 kn ($5.000.000,00 \times 0,04$).

2. Procjenom je utvrđeno da je nadoknativa vrijednost tvorničke zgrade 2.100.000,00 kn. Neto knjigovodstvena vrijednost zgrade nakon obračuna amortizacije iznosi 2.200.000,00 kn (5.000.000,00 – 2.600.000,00 – 200.000,00). S obzirom na to da je nadoknativa vrijednost niža od neto knjigovodstvene vrijednosti, potrebno je provesti vrijednosno usklađenje, odnosno smanjenje vrijednosti tvorničke zgrade za 100.000,00 kn (2.200.000,00 – 2.100.000,00). Vrijednosno usklađenje u iznosu od 100.000,00 kn niže je od porezno priznatog vrijednosnog usklađenja koje iznosi 250.000,00 kn, stoga je cjelokupno smanjenje porezno priznato.

Knjiženje u glavnoj knjizi:

0231 Tvornička zgrada		0290 Akumulirana amortizacija tvorničke zgrade	
S° 5.000.000,00			2.600.000,00 S°
			200.000,00 (1
0281 Vrijednosno usklađenje građevina		4410 Troškovi vrijednosnog usklađenja	
	100.000,00 (2	2) 100.000,00	
4310 Amortizacija građevina			
1) 200.000,00			

Primjer 2.2. Smanjenje vrijednosti dugotrajne materijalne imovine (koja se naknadno vrednuje po metodi troška) iznad visine porezno dopuštenog iznosa

Nabavna je vrijednost tvorničke zgrade 5.000.000,00 kn, a amortizirana vrijednost iznosi 2.600.000,00 kn. Vijek trajanja zgrade procijenjen je na 25 godina pa je stopa amortizacije 4 %. Prema Zakonu o porezu na dobit (čl. 12. st. 5.) redovna je amortizacijska stopa za građevinske objekte 5 %, što znači da je porezno priznato vrijednosno usklađenje 250.000,00 kn.

1. Obračunata je amortizacija zgrade za tekuću poslovnu godinu po stopi od 4 % te je godišnji iznos amortizacije 200.000,00 kn (5.000.000,00 x 0,04).
2. Procjenom je utvrđeno da je nadoknativa vrijednost tvorničke zgrade 1.500.000,00 kn. Neto knjigovodstvena vrijednost zgrade nakon obračuna amortizacije iznosi 2.200.000,00 kn (5.000.000,00 – 2.600.000,00 – 200.000,00). S obzirom na to da je nadoknativa vrijednost niža od neto knjigovodstvene vrijednosti, potrebno je provesti vrijednosno usklađenje, odnosno smanjenje vrijednosti tvorničke zgrade za 700.000,00 kn (2.200.000,00 – 1.500.000,00). Vrijednosno usklađenje u iznosu od 250.000,00 kn porezno je priznato, a razlika iznad toga u iznosu od 450.000,00 kn porezno je nepriznata.
3. Dobit prije oporezivanja iznosi 700.000,00 kn. Obračunan je porez na dobit. Poreznu osnovicu potrebno je uvećati za porezno nepriznato vrijednosno usklađenje u iznosu od 450.000,00 kn.
4. Priznata je odgođena porezna imovina.
5. Utvrđena je neto dobit.

Tablica 2 Porezna bilanca

Porezna bilanca (pomoćna)	
Dobit prije poreza	700.000,00
Porez na dobit (20 %)	140.000,00
Neto dobit	560.000,00
Uvećanje porezne osnovice za nepriznate troškove	450.000,00

Uvećanje poreza (20 %)	90.000,00
Porez za plaćanje	230.000,00

Knjiženje u glavnoj knjizi:

0231 Tvornička zgrada	
S° 5.000.000,00	

0290 Akumulirana amortizacija tvorničke zgrade	
2.600.000,00 S°	
200.000,00 (1)	

0281 Vrijednosno usklađenje građevina	
700.000,00 (2)	

4410 Troškovi vrijednosnog usklađenja	
2) 250.000,00	

4310 Amortizacija građevina	
1) 200.000,00	

4415 Vrijednosno usklađenje nepriznato	
2) 450.000,00	

803 Porez na dobit	
3) 230.000,00	140.000,00 (5)
4) 90.000,00	

2430 Obveze za porez na dobit	
	230.000,00 (3)

0802 Odgođena porezna imovina	
4) 90.000,00	

800 Dobit prije poreza	
5) 700.000,00	700.000,00 S°

8040 Dobit razdoblja	
	560.000,00 (5)

Nakon priznanja gubitka od umanjenja imovine, amortizaciju te imovine treba uskladiti u budućim razdobljima na način da se sustavno rasporedi knjigovodstvena vrijednost imovine, umanjena za ostatak vrijednosti (ako postoji), za razdoblje njezinog preostalog korisnog vijeka upotrebe (Horvat Jurjec, 2009.). U idućoj godini poduzetnik ima pravo na vrijednosno usklađenje obračunano prema redovnoj stopi amortizacije. Ako u toj godini više nema vrijednosnih usklađenja, onda je smanjenje imovine jednako obračunanoj amortizaciji. U tom slučaju poduzetnik će moći ukinuti dio ili cjelokupnu privremenu razliku i vratiti (smanjiti) porez na dobit plaćen za porezno nepriznate rashode od vrijednosnih usklađenja (Belak, 2015.).

Primjer 2.3. Ukidanje privremenih razlika nakon porezno nepriznatog vrijednosnog usklađenja i korištenje odgođenom poreznom imovinom

Nabavna je vrijednost tvorničke zgrade 5.000.000,00 kn, a amortizirana vrijednost iznosi 2.800.000,00 kn. Prethodne je godine obavljeno vrijednosno usklađenje u iznosu od 700.000,00 kn. Odgođena porezna imovina iznosi 90.000,00 kn.

Neto knjigovodstvena vrijednost zgrade prije vrijednosnog usklađenja iznosi 2.200.000,00 kn (5.000.000,00 – 2.800.000,00).

Neto knjigovodstvena vrijednost zgrade nakon vrijednosnog usklađenja iznosi 1.500.000,00 kn (5.000.000,00 - 2.800.000,00 - 700.000,00).

Vijek trajanja zgrade procijenjen je na 25 godina pa je stopa amortizacije 4 %. Amortizacija je obračunana u iznosu od 200.000,00 kn godišnje. Kad se neto knjigovodstvena vrijednost

zgrade prije vrijednosnog usklađenja, koja je 2.200.000,00 kn podijeli sa 200.000,00 kn, vidi se da je preostalo još 11 godina amortizacije.

Iznos koji se amortizira smanjen je na 1.500.000,00 kn te ga je potrebno rasporediti na preostalih 11 godina.

Godišnji iznos amortizacije = $1.500.000,00 / 11 \text{ godina} = 136.363,64 \text{ kn / godišnje}$

Godišnja stopa amortizacije = $136.363,64 / 5.000.000,00 = 2,7272728 \%$

1. Obračunata je amortizacija zgrade za tekuću poslovnu godinu po stopi od 2,7272728 % te je godišnji iznos amortizacije 136.363,64 kn ($5.000.000,00 \times 2,7272728 \%$).
2. Porezno priznato je vrijednosno usklađenje u iznosu od 250.000,00 kn, što znači da se za taj iznos može smanjiti porezna osnovica. Dobit prije oporezivanja iznosi 1.000.000,00 kn. Obračunan je porez na dobit. Poreznu osnovicu potrebno je smanjiti za ukinutu privremenu razliku u iznosu od 250.000,00 kn.
3. Iskorištena je odgođena porezna imovina u iznosu od 50.000,00 kn.
4. Utvrđena je neto dobit.

Tablica 3 Porezna bilanca

Porezna bilanca (pomoćna)	
Dobit prije poreza	1.000.000,00
Porez na dobit (20 %)	200.000,00
Neto dobit	800.000,00
Smanjenje porezne osnovice za ukidanje privremene razlike	- 250.000,00
Smanjenje poreza (20 %)	-50.000,00
Porez za plaćanje	150.000,00

Knjiženje u glavnoj knjizi:

0231	Tvornička zgrada
S° 5.000.000,00	

0290	Akumulirana amortizacija tvorničke zgrade
	2.800.000,00 S°
	136.363,64 (1)

0281	Vrijednosno usklađenje građevina
	700.000,00 S°

4310	Amortizacija građevina
1)	136.363,64

803	Porez na dobit
2)	150.000,00 200.000,00 (4)
3)	50.000,00

2430	Obveze za porez na dobit
	150.000,00 (2)

0802	Odgođena porezna imovina
S° 90.000,00	50.000,00 (3)

800	Dobit prije poreza
4)	1.000.000,00 1.000.000,00 S°

8040	Dobit razdoblja
	800.000,00 (4)

3. Smanjenje vrijednosti dugotrajne materijalne imovine koja se naknadno vrednuje po metodi revalorizacije

Kada poslovni subjekt koristi metodu revalorizacije kao računovodstvenu politiku za naknadno vrednovanje dugotrajne materijalne imovine tada se dugotrajna materijalna imovina iskazuje prema revaloriziranom iznosu, koji čini fer vrijednost te imovine na datum revalorizacije, umanjena za kasniji ispravak vrijednosti i kasnije akumulirane gubitke od umanjenja (t. 31. MRS-a 16 i t. 32. HSFI-a 6). Fer vrijednost predstavlja tržišnu cijenu na točno određeni datum i nije procjena buduće vrijednosti već odražava uvjete na tržištu na dan sastavljanja financijskih izvještaja. Definirano je da se ta vrijednost utvrđuje u skladu sa zahtjevima MSFI-a 13 - *Mjerenje fer vrijednosti* prema kojem je fer vrijednost mjera vrijednosti temeljena na tržištu i označava cijenu koja bi bila ostvarena prodajom neke stavke imovine ili plaćena za prijenos neke obveze u urednoj transakciji između tržišnih sudionika na datum utvrđivanja vrijednosti (Cirkveni, 2013.). HSFI 6 u točki 7. navodi sljedeće: „fer vrijednost je iznos koji bi trebalo primiti za prodanu imovinu ili platiti za podmirenje obveze u uobičajenoj transakciji između sudionika na tržištu na dan mjerenja vrijednosti“.

Revalorizacija se treba provoditi dovoljno redovito kako se knjigovodstvena vrijednost ne bi značajno razlikovala od one do koje bi se došlo utvrđivanjem fer vrijednosti na datum bilance (t. 31. MRS 16 i t. 32. HSFI 6). Ako je poduzeće za naknadno vrednovanje dugotrajne materijalne imovine izabralo metodu revalorizacije, tada su moguća dva računovodstvena postupka evidentiranja smanjenja vrijednosti dugotrajne materijalne imovine ovisno o tome je li imovina bila revalorizirana jer se taj dio vrijednosti najprije ispravlja.

Kad se knjigovodstvena vrijednost imovine smanji zbog revalorizacije, to smanjenje treba priznati kao rashod od vrijednosnog usklađenja ako ne postoji revalorizacijska rezerva za tu istu imovinu. Ako postoji revalorizacijska rezerva za imovinu (imovina je ranije bila revalorizirana na višu vrijednost) tada revalorizacijsko smanjenje vrijednosti imovine umjesto na rashode izravno tereti revalorizacijsku rezervu do visine te rezerve (t. 40 MRS-a 16 i t. 38. HSFI-a 6).

Primjer 3.1. Revalorizacija poslovne zgrade

Poduzeće XY provelo je revalorizaciju vrijednosti poslovne zgrade 1. siječnja 2014. čija je nabavna vrijednost 1.000.000,00 kn, a akumulirana amortizacija 200.000,00 kn. Knjigovodstvena vrijednost zgrade iznosi 800.000,00 kn.

1. Procjenom vrijednosti nekretnine utvrđeno je da fer vrijednost poslovne zgrade iznosi 1.400.000,00 kn. Revalorizirana je nabavna vrijednost i akumulirana amortizacija te su priznate revalorizacijske rezerve koje su umanjene za iznos poreza na dobit koji će biti uključen u poreznu osnovicu u nekom sljedećem razdoblju.
2. Na kraju poslovne godine poduzeće XY obračunava amortizaciju zgrade po godišnjoj stopi od 2,5 %.
3. Dobit prije poreza iznosi 1.500.000,00 kn. Porezna osnovica povećana je za svotu amortizacije revalorizacije koja se prenosi s revalorizacijskih rezervi na zadržani dobitak. Proknjižena je obveza za porez na dobit.
4. Revalorizacijom su uvećani troškovi amortizacije u iznosu od 18.750,00 kn (za 15.000,00 kn smanjuje se revalorizacijska rezerva u korist zadržanog dobitka, a pripadajući porez na amortizaciju revalorizacije u iznosu od 3.750,00 kn prenosi se s odgođenih poreznih obveza na konto 803 radi umanjenja poreza na dobit koji tereti rezultat tekućeg razdoblja).
5. Utvrđena je dobit razdoblja (neto dobit).

Revalorizacija poslovne zgrade:

- Knjigovodstvena vrijednost zgrade = 1.000.000,00 - 200.000,00 = 800.000,00 kn
- Indeks revalorizacije = (Fer vrijednost / Knjigovodstvena vrijednost) - 1
- Indeks revalorizacije = (1.400.000,00 / 800.000,00) - 1 = 1,75 - 1 = 0,75 ili 75 %
- Istodobno se revalorizira nabavna vrijednost i akumulirana amortizacija naviše za 75 %:
 - Revalorizacija nabavne vrijednosti = 1.000.000,00 x 0,75 = 750.000,00 kn
 - Revalorizacija akumulirane amortizacije = 200.000,00 x 0,75 = 150.000,00 kn
 - Rezultat revalorizacije iznosi 600.000,00 kn i unosi se u revalorizacijske rezerve
 - Odgođena porezna obveza = 600.000,00 x 20 % = 120.000,00 kn

Obračun godišnje amortizacije:

- Amortizacija nabavne vrijednosti = 1.000.000,00 x 2,5 % = 25.000,00 kn
- Amortizacija revalorizacije = 750.000,00 x 2,5 % = 18.750,00 kn

Tablica 4 Porezna bilanca

Porezna bilanca (pomoćna)	
Dobit prije poreza	1.500.000,00
Porez na dobit (20 %)	300.000,00
Neto dobit	1.200.000,00
Povećanje porezne osnovice za povećanu amortizaciju	18.750,00
Povećanje poreza (20 %)	3.750,00
Porez za plaćanje	303.750,00

Knjiženje u glavnoj knjizi:

0230 Poslovna zgrada		02900 Akumulirana amortizacija posl. zgrade	
S° 1.000.000,00			200.000,00 S°
			25.000,00 (2)
02901 Akumulirana amortizacija revalorizacije		0281 Vrijednosno usklađenje građevina	
	150.000,00 (1a)	1a) 750.000,00	
	18.750,00 (2)		
9300 Revalorizacijske rezerve		2600 Odgođena porezna obveza	
1b) 120.000,00	600.000,00 (1a)	4b) 3.750,00	120.000,00 (1b)
4a) 15.000,00			
4310 Amortizacija građevina		434 Povećana amortizacija s temelja revalorizacije	
2) 25.000,00		2) 18.750,00	
800 Dobit prije poreza		803 Porez na dobit	
5) 1.500.000,00	1.500.000,00 S°	3) 303.750,00	300.000,00 (5)
		4b) 3.750,00	
2430 Obveze za porez na dobit		940 Zadržani dobitak	
	303.750,00 (3)		15.000,00 (4a)
804 Dobit razdoblja (neto)			
	1.200.000,00 (5)		

Odgođene porezne obveze se aktiviraju i postaju obveza za plaćanje realizacijom revalorizacijskih rezervi. Porez na dobit koji se prikazuje u računu dobiti i gubitka ne uključuje dio poreza koji se odnosi na oporezivanje prijenosa revalorizacijskih rezervi koji se prikazuje u poreznom izvještaju (Obrazac PD – Prijava poreza na dobit). Naime, taj porez će biti plaćen i on se prikazuje na kontu 2430 - Obveze za porez na dobit, ali on ne pripada obračunu poslovnog rezultata nego poreznom obračunu.

Primjer 3.2. Smanjenje vrijednosti poslovne zgrade u slučaju kada je zgrada ranije revalorizirana naviše

Nabavna je vrijednost poslovne zgrade 1.000.000,00 kn, a revalorizacija je nabavne vrijednosti 750.000,00 kn. Akumulirana je amortizacija nabavne vrijednosti nakon obračuna amortizacije do dana smanjenja vrijednosti 250.000,00 kn, a akumulirana amortizacija revalorizacije 187.500,00 kn. Revalorizacijske rezerve nakon prijenosa rezervi po osnovi revalorizacije iznose 450.000,00 kn, a odgođena porezna obveza 112.500,00 kn.

1. Na datum bilance 31. prosinca 2015. godine utvrđeno je da je nadoknadiva vrijednost 1.200.000,00 kn pa je potrebno smanjiti vrijednost poslovne zgrade. Knjiži se smanjenje revalorizacije i njezinih učinaka.

Smanjenje vrijednosti poslovne zgrade koja je prethodne godine revalorizirana naviše:

- Nabavna neto knjigovodstvena vrijednost zgrade = $1.000.000,00 - 250.000,00 = 750.000,00$ kn
- **Neto knjigovodstvena vrijednost revalorizacije = $750.000,00 - 187.500,00 = 562.500,00$ kn**
- Ukupna revalorizirana vrijednost zgrade = $750.000,00 + 562.500,00 = 1.312.500,00$ kn
- Nadoknadiva vrijednost = $1.200.000,00$ kn
- **Smanjenje revalorizacije = $1.312.500,00 - 1.200.000,00 = 112.500,00$ kn**
- Kad se smanjuje vrijednost prethodno revalorizirane dugotrajne imovine na teret revalorizacije, potrebno je koristiti indeks revalorizacije koji se izračuna na sljedeći način:
Indeks smanjenja revalorizacije = smanjenje revalorizacije / neto knjigovodstvena vrijednost revalorizacije
- **Indeks smanjenja revalorizacije = $112.500,00 / 562.500,00 = 0,2$ ili 20 %**
- **Revalorizaciju nabavne vrijednosti (vrijednosno usklađenje), akumuliranu amortizaciju revalorizacije, revalorizacijske rezerve i odgođene porezne obveze potrebno je smanjiti za 20 %:**
 - Vrijednosno usklađenje (revalorizacija nabavne vrijednosti) = $750.000,00 \times 0,2 = 150.000,00$ kn
 - Akumulirana amortizacija revalorizacije = $187.500,00 \times 0,2 = 37.500,00$ kn
 - Revalorizacijske rezerve = $450.000,00 \times 0,2 = 90.000,00$ kn
 - Odgođena porezna obveza = $112.500,00 \times 0,2 = 22.500,00$ kn

Knjiženje u glavnoj knjizi:

<div>0230 Poslovna zgrada</div> <div>S° 1.000.000,00</div>	<div>02900 Akumulirana amortizacija posl. zgrade</div> <div>250.000,00 S°</div>
<div>0281 Vrijednosno usklađenje građevina</div> <div>S° 750.000,00 150.000,00 (1)</div>	<div>02901 Akumulirana amortizacija revalorizacije</div> <div>1) 37.500,00 187.500,00 S°</div>

9300	Revalorizacijske rezerve
1)	90.000,00 450.000,00 S°

2600	Odgođena porezna obveza
1)	22.500,00 112.500,00 S°

U ovom slučaju revalorizacijsko smanjenje vrijednosti zgrade nije se knjižilo na rashode jer iznos smanjenja nije veći od revalorizacijske rezerve za tu zgradu.

Nakon smanjenja vrijednosti zgrade na nadoknadivu vrijednost, stanje u bilanci izgleda na sljedeći način:

0230	Poslovna zgrada
S°	1.000.000,00

02900	Akumulirana amortizacija posl. zgrade
	250.000,00 S°

0281	Vrijednosno usklađenje građevina
S°	600.000,00

02901	Akumulirana amortizacija revalorizacije
	150.000,00 S°

9300	Revalorizacijske rezerve
	360.000,00 S°

2600	Odgođena porezna obveza
	90.000,00 S°

Primjer 3.3. Smanjenje vrijednosti stroja ako stroj nije prethodno revaloriziran

Poduzeće ABC koristi stroj za potrebe proizvodnje čija je nabavna vrijednost 180.000,00 kn, a akumulirana je amortizacija nakon obračuna amortizacije do dana smanjenja vrijednosti 60.000,00 kn. Knjigovodstvena vrijednost stroja iznosi 120.000,00 kn (180.000,00 - 60.000,00).

1. Na datum bilance 31. prosinca 2014. godine utvrđeno je da je nadoknativa vrijednost stroja niža za 10 % u odnosu na knjigovodstvenu, stoga je potrebno provesti vrijednosno usklađenje vrijednosti stroja. Smanjuje se nabavna vrijednost stroja i akumulirana amortizacija za 10 %, efekt vrijednosnog usklađenja iznosi 12.000,00 kn koliko iznosi i razlika između knjigovodstvene (120.000,00 kn) i nadoknadive vrijednosti (108.000,00 kn).

Knjiženje u glavnoj knjizi:

0301	Strojevi
S°	180.000,00

0390	Akumulirana amortizacija strojeva
	60.000,00 S°
	6.000,00 (1)

0380	Vrijednosno usklađenje strojeva
	18.000,00 (1)

4410	Troškovi vrijednosnog usklađenja
1)	12.000,00

4. Zaključak

Na svaki datum izvještavanja poduzetnik treba ocijeniti postoji li pokazatelj da neka dugotrajna materijalna imovina može biti umanjena. Ako takav pokazatelj postoji, poduzetnik treba procijeniti nadoknadiivi iznos imovine. Naime, svrha vrijednosnog usklađenja dugotrajne materijalne imovine je iskazivanje realnih i objektivnih vrijednosti u poslovnim knjigama i godišnjim financijskim izvještajima poduzetnika. Računovodstvo i financijsko izvještavanje u funkciji je korisnika informacija, odnosno računovodstvo nije samo sebi svrhom već je usmjereno širokom krugu korisnika koji na temelju informacija sadržanih u financijskim izvještajima donose poslovne odluke. Informacije sadržane u financijskim izvještajima moraju biti korisne u procesu poslovnog odlučivanja.

U ovom članku prikazani su računovodstveni i porezni postupci i knjiženja vezana uz smanjenje vrijednosti dugotrajne materijalne imovine te su prikazana knjiženja vezana uz priznavanje odgođene porezne imovine te uz iskazivanje odgođenih poreznih obveza. Odabrana metoda za naknadno vrednovanje dugotrajne materijalne imovine ima utjecaj na pozicije financijskih izvještaja, odnosno na računovodstvene informacije sadržane u financijskim izvještajima. Korisnici računovodstvenih informacija posebnu pažnju bi trebali usmjeriti upravo na to. Naime, korištenje metode revalorizacije u slučaju povećanja vrijednosti imovine poboljšava imovinski i financijski položaj poduzeća zbog povećanja ukupne imovine i kapitala na poziciji revalorizacijskih rezervi. S druge pak strane, rashodi od vrijednosnog usklađenja dugotrajne materijalne imovine prikazuju se u računu dobiti i gubitka smanjujući dobit tekuće godine. Osim toga, kod smanjenja vrijednosti dugotrajne materijalne imovine postoji mogućnost nastanka porezno nepriznatih rashoda koji povećavaju iznos poreza na dobit koji su poduzetnici obvezni platiti.

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Impairment of fixed assets

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Abstract. This paper analyses accounting and tax procedures and records related to the impairment of fixed assets and revaluation. Revaluation of tangible assets is the reduction of the asset's book value to market value, which may be higher or lower. However, the term "revaluation" in practice is typically used when the value of assets increases and for the revaluation on lower value terms, like "impairment" and "value adjustment". The consequences of the economic crisis are still present, so market value (fair value) of assets often decreases. The Republic of Croatia adopted the amendments to the Law on Profit Tax in 2014, and they have resulted in changes in the tax recognition of expenses that occur when the value of assets decreases. Regarding the above changes, this paper will show the calculation of profit tax and booking models related to non-deductible expenses from value adjustments of fixed assets, which lead to temporary differences, and deferred tax assets. Furthermore, procedures and records related to the impairment of revalued fixed assets will be shown.

Key words: *impairment, cost model, revaluation, deferred tax assets, deferred tax liability*

Indeks potrošačkih cijena u Republici Hrvatskoj za razdoblje od 1.1.2015. do 31.12.2015. godine

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Sažetak. Ovaj rad analizira indeks potrošačkih cijena u Republici Hrvatskoj (engl. *Consumer Price Index*, CPI) za razdoblje od 1. 1. 2015. do 31. 12. 2015.godine. Indeks potrošačkih cijena odražava promjene u razini cijena dobara i usluga koje u tijeku vremena nabavlja, koristi se njima ili ih plaća referentno stanovništvo (privatna kućanstva) radi potrošnje. U Republici Hrvatskoj izračunava se na temelju reprezentativne košarice koju čini oko 917 proizvoda i svakog mjeseca prikuplja se oko 36 700 cijena na unaprijed definiranu uzorku prodajnih mjesta na devet geografskih lokacija. Indeks potrošačkih cijena je službena mjera inflacije u RH te čini ciljnu varijablu monetarne politike Hrvatske narodne banke. Svrha rada je dati pregled indeksa potrošačkih cijena u razdoblju od proteklih 10 godina te provesti analizu za 2015. godinu. Rad isto tako uspoređuje harmonizirani indeks potrošačkih cijena u Republici Hrvatskoj s harmoniziranim indeksom potrošačkih cijena odabranih zemalja Europske unije.

Ključne riječi: indeks potrošačkih cijena, harmonizirani indeks potrošačkih cijena

1. Uvod

Indeks potrošačkih cijena (CPI - *Consumer Price Index*) računa se radi kvantifikacije promjene cijena dobara i usluga koje stanovništvo kupuje s ciljem potrošnje.¹ U Hrvatskoj je prvi put objavljen 18. 02. 2014. godine i on zamjenjuje dosadašnji indeks cijena na malo (RPI - *Retail price indeks*), indeks troškova života i indeks cijena ugostiteljskih usluga.² Indeks potrošačkih cijena može imati različite namjene i služiti za mjerenje inflacije, očuvanje vrijednosti kod ugovora s indeksom klauzulama (npr. za indeksiranje plaća u kolektivnim ugovorima, indeksiranje mirovina i slično), usporedbu kretanja cijena unutar zemlje između određenih gospodarskih sektora, kao osnova za deflacioniranje pojedinih kategorija nacionalnih računa i drugih statističkih serija te se primjenjuje za analitičke svrhe.

2. Skupni indeksi

U svjetskim ekonomijama svakodnevno se trguje milijunima različitih proizvoda i usluga. Fizičke i pravne osobe kupuju različita dobra i pritom se dio potražnje zadovoljava iz domaće proizvodnje, dok se dio pokriva iz uvoza. Opisani procesi odvijaju se uz vremenske fluktuacije količina i cijena dobara. S ciljem numeričkog izražavanja prosječne promjene relativnih cijena/količina promatrane košarice dobara u tekućem razdoblju u odnosu na neko prošlo razdoblje koriste se skupni indeksi.

Skupni indeks cijena je prosječna mjera promjene cijena skupine dobara u tekućem razdoblju u odnosu na neko prošlo bazno razdoblje. Skupni indeks količina je prosječna mjera promjene prodanih količina skupine dobara u tekućem razdoblju u odnosu na neko prošlo bazno razdoblje.

¹ Državni zavod za statistiku, www.dzs.hr (pristupano 3.12.2015.)

² Raiffeisen Bank, www.rba.hr (pristupano 3.12.2015.)

Najčešći oblici skupnih indeksa su Laspeyresov indeks cijena, Paascheov indeks cijena, Laspeyresov indeks količina, Paascheov indeks količina, indeks vrijednosti, Fisherov skupni indeks količina i Fisherov skupni indeks cijena.³ Nadalje, najviše upotrebljavan i najčešće korišten skupni indeks je indeks potrošačkih cijena.

3. Indeks potrošačkih cijena (Consumer Price Index, CPI)

Indeks potrošačkih cijena ima dugu povijest koja datira iz osamnaestog stoljeća. Laspeyresovi i Paascheovi indeksi, koji se još uvijek naširoko koriste i danas, prvi put su predloženi 1870. Koncept indeksa troškova života uveden je početkom dvadesetog stoljeća.⁴

Tradicionalno, jedan od glavnih razloga za sastavljanje CPI-a je nadoknaditi radnicima za inflaciju podešavanjem njihove stope plaća u odnosu na postotne promjene u CPI-u, postupak je poznat kao indeksiranje. Danas, indeks potrošačkih cijena ima različite primjene i može služiti za mjerenje inflacije, očuvanje vrijednosti kod ugovora s indeksnim klauzulama (npr. za indeksiranje plaća u kolektivnim ugovorima, indeksiranje mirovina i slično), usporedbu kretanja cijena unutar zemlje između određenih gospodarskih sektora, kao osnova za deflacioniranje pojedinih kategorija nacionalnih računa i drugih statističkih serija te se primjenjuje za analitičke svrhe.

Indeks potrošačkih cijena odražava promjene u razini cijena dobara i usluga koje u tijeku vremena nabavlja, koristi se njima ili ih plaća referentno stanovništvo (privatna kućanstva) radi potrošnje. U Republici Hrvatskoj izračunava se na temelju reprezentativne košarice koju čini oko 869 proizvoda. Svakog mjeseca prikuplja se oko 36 700 cijena na unaprijed definiranu uzorku prodajnih mjesta na devet geografskih lokacija.⁵ Objavljuje se jednom mjesečno, i to za prethodni mjesec.

CPI je indeks Laspeyresova tipa i izračunava se kao aritmetička sredina individualnih indeksa cijena promatranih dobara

$$CPI_t = \sum_{i=1}^k \frac{p_i^t}{p_i^0} \cdot w_i^0 \cdot 100,$$

Pri čemu je p_i^t cijena i -tog dobra u tekućem razdoblju, p_i^0 cijena i -tog dobra u baznom razdoblju, a w_i^0 relativna struktura vrijednosti prodaje i -tog dobra u baznom razdoblju

$$\left(w_i^0 = \frac{p_i^0 q_i^0}{\sum_{i=1}^k p_i^0 q_i^0} \right).$$

Konkretnije, ponderi w_i^0 su udjeli izdataka za potrošnju svakog pojedinog dobra u ukupnim izdacima stanovništva u određenom razdoblju.⁶

³Bahovec, V., Dumičić, K., Erjavec, N., Čizmešija, M., Kurnoga, N., Arnerić, J., Čeh Časni, A., Jakšić, S., Sorić, P., Žmuk, B., Palić, I. & Lolić, I. (2015). *Statistika : Analiza vremenskih nizova* (pp.143-172), Zagreb 2015., Element

⁴International Labour Office, Cpi manual, http://www.ilo.org/wcmsp5/groups/public/---dgreports/---stat/documents/presentation/wcms_331153.pdf (pristupano 11.1.2016.)

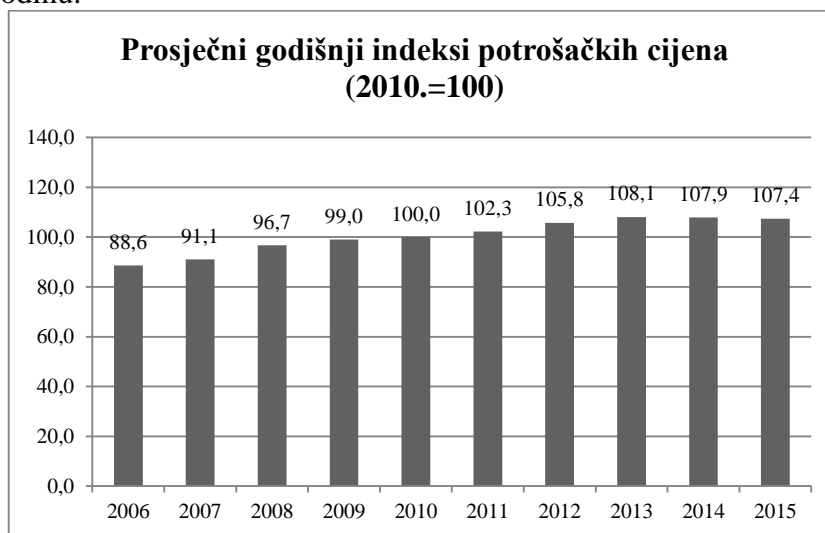
⁵Državni zavod za statistiku, www.dzs.hr (pristupano 3.12.2015.)

⁶Bahovec, V., Dumičić, K., Erjavec, N., Čizmešija, M., Kurnoga, N., Arnerić, J., Čeh Časni, A., Jakšić, S., Sorić, P., Žmuk, B., Palić, I. & Lolić, I. (2015). *Statistika : Analiza vremenskih nizova* (pp.143-172), Zagreb 2015., Element

Osnovni izvor podataka za izradu pondera za obračun indeksa potrošačkih cijena jest Anketa o potrošnji kućanstava, koju Državni zavod za statistiku redovito provodi od 1998. Za izračunavanje indeksa potrošačkih cijena od siječnja 2014. primjenjuju se ponderi koji se temelje na godišnjem prosjeku potrošnje kućanstava iz Ankete o potrošnji kućanstava od 2011. Ponderi obuhvaćaju cijeli teritorij Republike Hrvatske. Cijene se prikupljaju na devet lokacija (gradova) u zemlji (Zagreb, Slavonski Brod, Osijek, Sisak, Rijeka, Pula, Split, Dubrovnik i Varaždin) odabranih prema kriteriju broja stanovnika i reprezentativnosti za pojedinu jedinicu. Time se ukupno svakog mjeseca popišu cijene za više od 33400 proizvoda i usluga. Promatrana dobra podijeljena su u 12 osnovnih kategorija, u skladu s *Klasifikacijom osobne potrošnje prema namjeni* (engl. *Classification of individual consumption by purpose*, COICOP). Izdvojene kategorije dobara su: prehrana i bezalkoholna pića, alkoholna pića i duhan, odjeća i obuća, stanovanje, voda, promet, komunikacije, rekreacija i kultura, obrazovanje, ugostiteljske usluge te ostala dobra i usluge.⁷

4. Pregled indeksa potrošačkih cijena u RH od 2006.do 2016.godine

Indeks potrošačkih cijena u RH objavljuje se mjesečno u odnosu na prethodni mjesec, u odnosu na prethodnu godinu, u odnosu na 2010. godinu i u odnosu na dvanaestomjesečni prosjek. Na grafikonu su prikazani prosječni godišnji indeksi potrošačkih cijena u odnosu na baznu 2010. godinu.

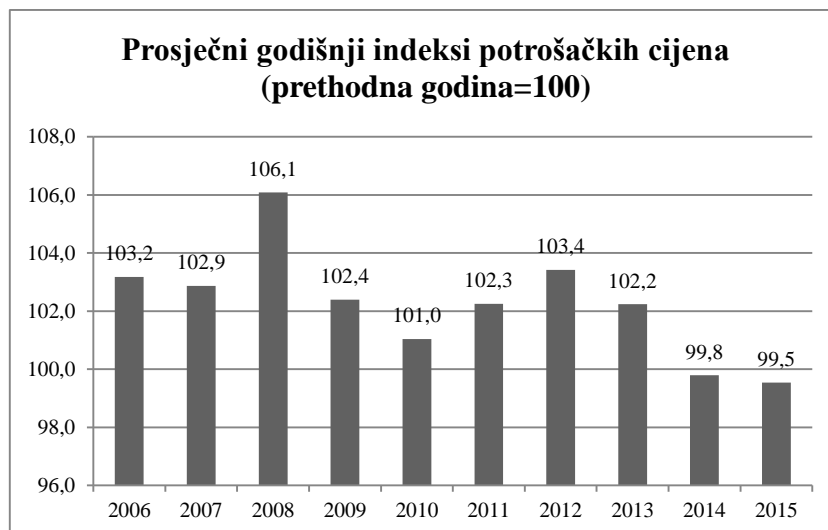


Slika 1. Prosječni godišnji indeksi potrošačkih cijena (2010.=100)

Iz tablice se može očitati da su prosječne godišnje cijene dobara i usluga za osobnu potrošnju, mjerene indeksom potrošačkih cijena u 2006. godini za 11,4 % niže, u 2007. su za 8,9 % niže, u 2008. su za 3,3 % niže, a u 2009. su za 1 % niže u odnosu na baznu 2010. godinu. Nadalje, u 2011. godini su za 2,3 % više, u 2012. godini su za 5,8 % više, u 2013. godini su za 8,1 % više, u 2014. godini su za 7,9 % više, dok su u 2015. godini za 7,4 % više u odnosu na baznu 2010. godinu.⁸

⁷ibid

⁸Državni zavod za statistiku,
http://www.dzs.hr/App/PXWeb/PXWebHrv/Selection.aspx?px_path=Cijene&px_tableid=T12_HR.px&px_language=hr&px_db=Cijene&rxid=fc9d580f-2229-4982-a72c-cdd3e96307d3 (pristupano 17.12.2015.)

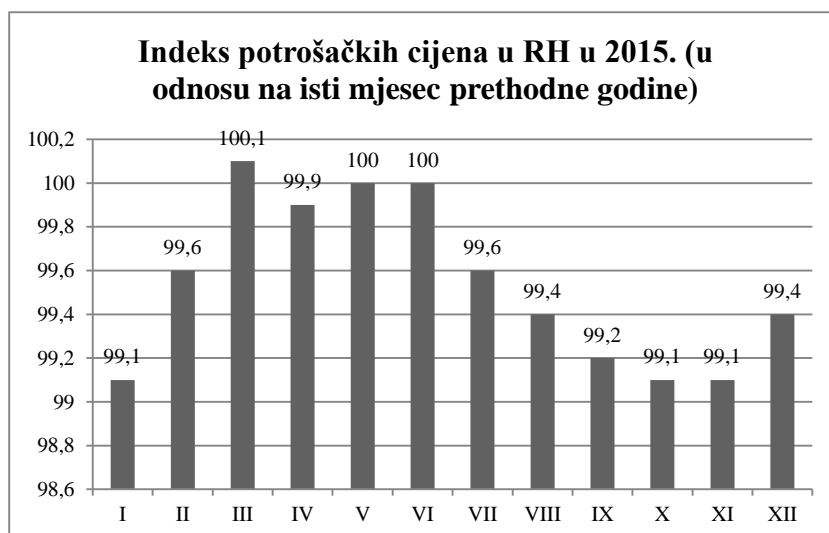


Slika 2. Prosječni godišnji indeksi potrošačkih cijena (prethodna godina=100)

Kada promatramo prosječne godišnje indkse potrošačkih cijena izračunate u odnosu na prethodnu godinu, vidi se da je najveći rast zabilježen u 2008. godini, indeks je viši za 6,1 % u odnosu na baznu 2007. godinu dok je najveći pad u 2015. godini, indeks je niži za 0,5 % u odnosu na prethodnu 2014. godinu.

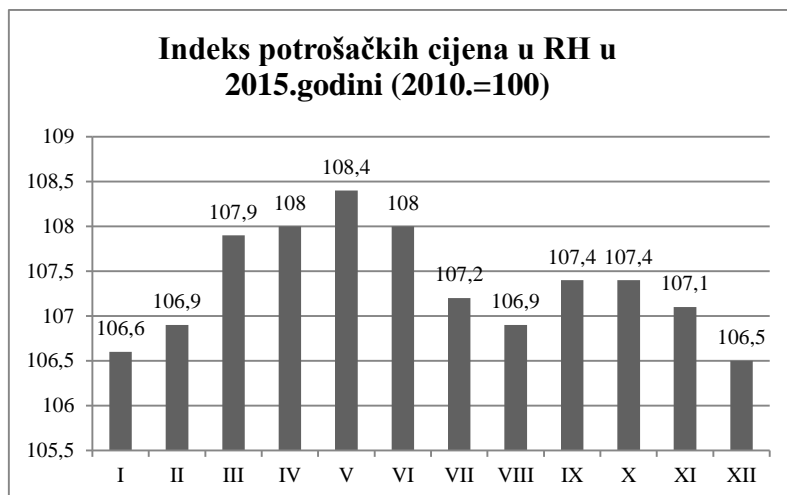
5. Indeks potrošačkih cijena u RH tijekom 2015.godine

U ovom dijelu promatrati ćemo indkse potrošačkih cijena tijekom 2015. godine po glavnim skupinama prema namjeni potrošnje i u odnosu na isti mjesec prethodne godine prethodni mjesec.



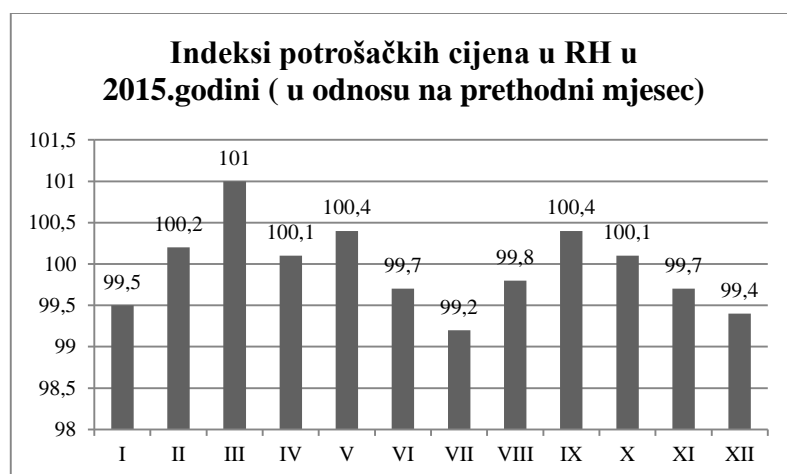
Slika 3. Prikaz indeksa potrošačkih cijena u RH u 2015.godini (bazno razdoblje je isti mjesec prethodne godine)

Kad uspoređujemo indkse potrošačkih cijena u 2015. u odnosu na isti mjesec u 2014. godini, vidimo da je on uglavnom niži. Jedini porast indeksa bilježimo u ožujku 2015., u odnosu na ožujak 2014. godine, i to 0,1 %. Najveći pad imamo u siječnju, listopadu i studenom, u odnosu na iste mjesec prethodne godine, i to za 0,9 %.



Slika 4. Prikaz indeksa potrošačkih cijena u RH u 2015. godini (u odnosu na 2010. godinu)

Kad uspoređujemo indekse potrošačkih cijena u 2015. godini u odnosu na baznu 2010. godinu, najveći prirast bilježimo u svibnju, indeks je veći za 8,4 % u odnosu na baznu 2010. godinu.



Slika 3. Prikaz indeksa potrošačkih cijena u RH u 2015. godini (u odnosu na prethodni mjesec)

U 2015. godini indeks potrošačkih cijena bilježi najveći porast u ožujku u odnosu na veljaču (viši je za 1 %), dok najveći pad imamo u srpnju, indeks potrošačkih cijena je u srpnju za 0,8 % niži u odnosu na lipanj.

Tablica 4. Indeks potrošačkih cijena u 2015.godini prema glavnim skupinama

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Indeks potrošačkih cijena	99,5	100,2	101	100,1	100,4	99,7	99,2	99,8	100,4	100,1	99,7	99,4
Prehrana i bezalkoholna pića	102	100,8	99,8	99,9	99,7	99,4	99,3	100,5	99,6	99,9	99,7	99,6
Alkoholna pića i duhan	100,1	100	99,9	101,6	100	100	100,1	100,1	100	99,7	99,7	99,9
Odjeća i obuća	91,8	99,7	110,4	103,2	100,9	97,1	89,7	97,7	113,9	106,6	100,4	94,5
Stanovanje, voda, el.en., plin i ostala goriva	99,6	100,2	100,4	98,9	100,3	99,7	99,9	99,9	101,2	99,8	99,6	100
Pokucstvo, oprema za kućanstvo i redovito održavanje kućanstva	100,6	100,4	99,2	100,2	100,1	99,7	99,6	100,1	100	100,8	100,4	99,1
Zdravlje	100	100,2	100,2	100,4	100,2	100,2	100,2	100,8	100	100	99,8	99,7
Prijevoz	94,9	99,6	104,1	100	102,4	100	99,7	97,6	97,7	99,4	99,3	99,3

Komunikacije	100,1	100	100	100,1	100,3	100	100	100	100	99,3	100	100
Rekreacija i kultura	100,2	100,2	100	100,5	100,4	100,1	100,7	100,4	99,2	99,7	99,7	100,2
Obrazovanje	100,1	99,8	100	100	100	100	99,2	99,9	99,9	100	100	100
Restorani i hoteli	99,9	100	100,2	100,4	100,3	100,2	100,3	100	99,8	99,9	99,7	99,9
Ostala dobra i usluge	100,2	100	99,9	100,1	99,9	100,5	99,9	100,4	99,8	99,7	100	99,9

Prema Državnom zavodu za statistiku cijene dobara i usluga za osobnu potrošnju, mjerene indeksom potrošačkih cijena, u siječnju 2015. u odnosu na prosinac 2014. u prosjeku su niže za 0,5 %. Najviše su pale cijene odjeće i obuće zbog sezonskih sniženja, koje su u prosjeku bile niže za 8,2 % i cijene prijevoza su bile niže za 5,1 %, dok su najviše porasle cijene prehrane i bezalkoholnih pića, koje su u prosjeku više za 2,0 %.

Indeks potrošačkih cijena u veljači 2015. u odnosu na siječanj 2015 u prosjeku su više za 0,2 %. Najviše su porasle cijene prehrane i bezalkoholnih pića, koje su u prosjeku više za 0,8 % (više cijene voća i povrća), dok su najviše pale cijene prijevoza, koje su u prosjeku niže za 0,4%.

U ožujku 2015. indeks potrošačkih cijena je u prosjeku za 1 % viši u odnosu na veljaču 2015. Najviše su porasle cijene odjeće i obuće, koje su u prosjeku više za 10,4 % (nova kolekcija odjeće i obuće) i cijene prijevoza, koje su u prosjeku više za 4,1 % (više cijene goriva za osobna vozila). Najveći pad bilježimo kod cijena pokućstva i opreme za kućanstvo i redovitog održavanja kućanstva, u prosjeku niže su za 0,8 %.

U travnju 2015. indeks potrošačkih cijena je u prosjeku za 0,1 % viši u odnosu na ožujak 2015. Najviše su porasle cijene odjeće i obuće, koje su u prosjeku više za 3,2 % (nova kolekcija odjeće i obuće. Porast indeksa potrošačkih cijena u travnju u odnosu na ožujak najviše su ublažile cijene stanovanja, vode, električne energije, plina i ostalih goriva, koje su u prosjeku niže za 1,1 %.

Indeks potrošačkih cijena u svibnju 2015. je u prosjeku za 0,4 % viši u odnosu na travanj 2015. Najviše su porasle cijene prijevoza, koje su u prosjeku više za 2,4 %, dok su najviše pale cijene prehrane i bezalkoholnih pića, koje su u prosjeku niže za 0,3 %.

U lipnju 2015. indeks potrošačkih cijena za 0,3 % niži je u odnosu na svibanj 2015. Najviše su pale cijene odjeće i obuće koje su u prosjeku niže za 2,9 % (sezonska sniženja), dok najveći rast bilježe cijene ostalih dobara i usluga, koje su u prosjeku više za 0,5 % (više cijene usluge smještaja).

U srpnju 2015. indeks potrošačkih cijena za 0,8 % niži je u odnosu na lipanj 2015. Najviše su pale cijene odjeće i obuće koje su u prosjeku niže za 10,3 % (sezonska sniženja). Porasle su cijene rekreacije i kulture, koje su u prosjeku više za 0,7% (povećanje cijena ulaznica za nacionalne parkove i pakete aranžmana).

Indeks potrošačkih cijena u kolovozu je za 0,2 % niži u odnosu na srpanj. Najviše su pale cijene prijevoza, koje su u prosjeku niže za 2,4 % (niže cijene goriva i maziva za osobna prijevozna sredstva. Najviše su porasle cijene u zdravstvu, koje su u prosjeku više za 0,8 % (više cijene bolničkih usluga).

U rujnu 2015. indeks potrošačkih cijena je za 0,4 % viši u odnosu na kolovoz 2015. godine. Najviše su porasle cijene odjeće i obuće, u prosjeku za više od 13,9 % (nova kolekcija odjeće i obuće). Porast su ublažile cijene prijevoza, koje su u prosjeku niže za 2,3 %.

U listopadu 2015. indeks potrošačkih cijena je za 0,1 % viši u odnosu na rujan. Najviše su porasle cijene odjeće i obuće, koje su u prosjeku više za 6,6 % (nova kolekcija odjeće i obuće). Najviši pad bilježimo kod rekreacije i kulture, koje su u prosjeku niže za 2,2 % (niže cijene rekreativnih i sportskih usluga te cijene paketa usluga).

Indeks potrošačkih cijena u studenom 2015. je za 0,3 % niži u odnosu na listopad 2015.. Najviše su pale cijene prijevoza, koje su u prosjeku niže za 0,7 % (niže cijene goriva za osobna prijevozna sredstva). Pad indeksa potrošačkih cijena u studenom 2015. u odnosu na listopad 2015. ublažile su cijene odjeće i obuće te cijene pokućstva, opreme za kućanstvo i redovitog održavanja kućanstva koje su u prosjeku, po svakoj skupini više za 0,4 %.

U prosincu 2015. indeks potrošačkih cijena za 0,6 % niži je u odnosu na studeni. Najviše su pale cijene odjeće i obuće, koje su u prosjeku niže za 5,5 % (sezonska sniženja). Porasle su cijene rekreacije i sporta i one su u prosjeku više za 0,2 %, u odnosu na studeni.

6. Harmonizirani indeks potrošačkih cijena

Harmonizirani indeks potrošačkih cijena (Harmonized Index of Consumer Prices, HICP) je skup europskih indeksa potrošačkih cijena izračunati harmoniziranim pristupom, koristeći posebne definicije koje omogućuju usporedivu mjeru inflacije u eurozoni, Europskoj uniji, Europskom ekonomskom području te za zemlje kandidate. HICP jest ekonomski pokazatelj koji mjeri promjenu u razini cijena dobara i usluga koje u nekom vremenu nabavljaju, koriste se njima ili plaćaju kućanstva.⁹ HICP se za zemlje članice sastavlja od siječnja 1997. godine.¹⁰

Najčešće korišteni harmonizirani indeksi potrošačkih cijena su:

- Indeks potrošačkih cijena monetarne unije (*Monetary Union Index of Consumer Prices*, MUICP) - agregatni indeks koji pokriva zemlje u euro zoni.
- Europski indeks potrošačkih cijena (*European Index of Consumer Prices*, EICP) – pokriva eurozonu i ostale zemlje Europske unije.
- Nacionalni indeks potrošačkih cijena - za svaku od država članica Europske unije.

Osim nabojanih, tu su i Indeks potrošačkih cijena za europsko ekonomsko područje (*European Economic Area Index of Consumer Prices*, EEAICP) i privremeni indeks potrošačkih cijena za zemlje kandidate i zemlje pristupnice u EU.

Glavni cilj za harmonizacijski projekt indeksa potrošačkih cijena bio je upotreba HICP-a kao kriterija konvergencije i glavne mjere za promatranje stabilnosti cijena u euro zoni. Pomoću HICP-a se mogu najbolje usporediti potrošačke cijene pojedinih članica unutar Europske unije i eurozone. Izračun HICP-a je obavezan za sve zemlje članice EU.¹¹ HICP je indeks Laspeyresova tipa i računa se u odnosu na četiri bazna razdoblja: u odnosu na prethodni mjesec, u odnosu na isti mjesec prethodne godine, u odnosu na 2005. godinu i u odnosu na dvanaestomjesečni prosjek.

7. Harmonizirani indeks potrošačkih cijena u RH u 2015. godini i usporedba s odabranim zemljama EU

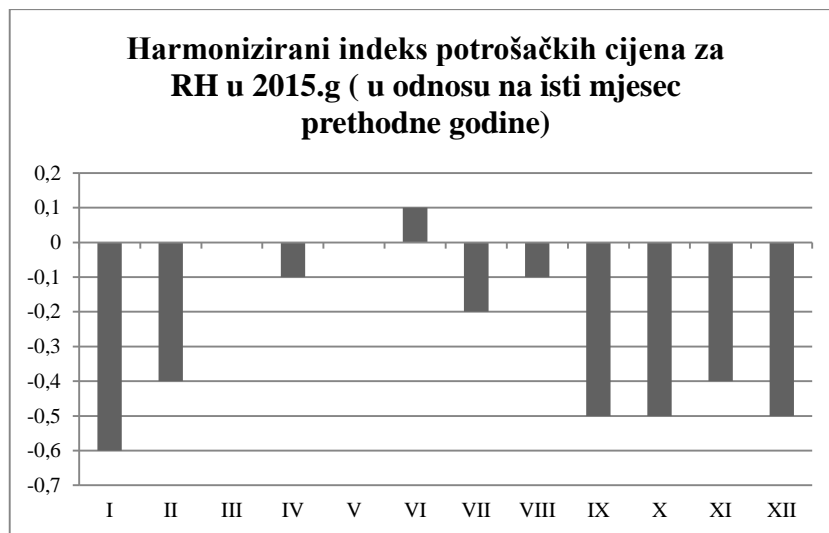
Kad promatramo harmonizirani indeks potrošačkih cijena za RH u 2015. godini (bazno razdoblje je isti mjesec prethodne godine) vidi se da je najveći pad zabilježen u siječnju,

⁹ International Labour Office, Cpi manual (2004.), http://www.ilo.org/wcmsp5/groups/public/---dgreports/---stat/documents/presentation/wcms_331153.pdf (pristupano 21.1.2016.)

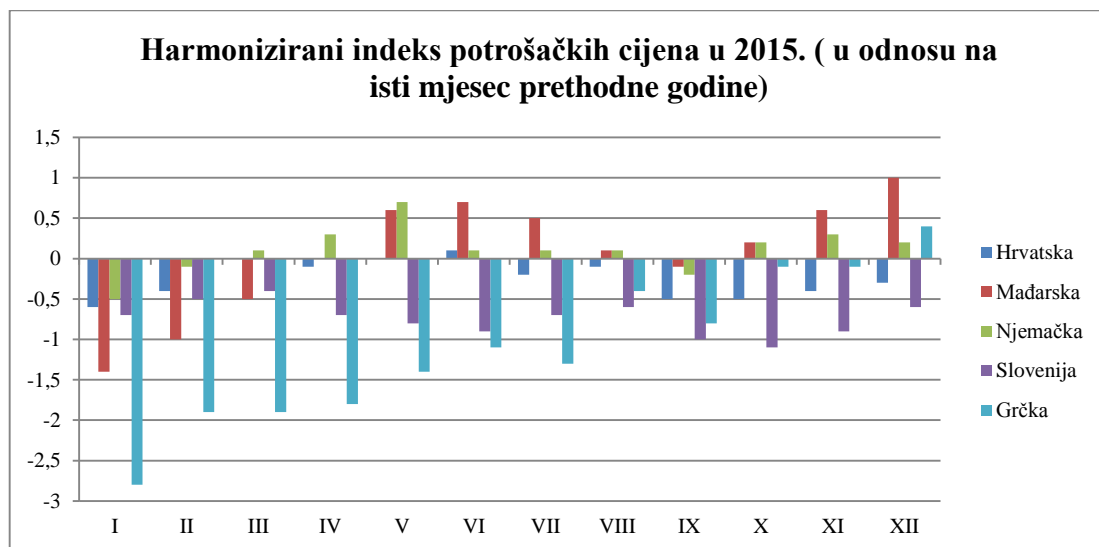
¹⁰ Botrić, V. (2001.), *Harmonizirani indeks potrošačkih cijena, koncept i implikacije za Hrvatsku*, Privredna kretanja i ekonomska politika, Broj 86/2001.

¹¹ International Labour Office, Cpi manual, http://www.ilo.org/wcmsp5/groups/public/---dgreports/---stat/documents/presentation/wcms_331153.pdf (pristupano 11.1.2016.)

indeks je niži za 0,6 % u odnosu na siječanj 2014. godine. Jedini rast bilježimo u lipnju, indeks je za 0,1 % viši u odnosu na lipanj 2014. godine.¹²



Slika 6. Prikaz harmoniziranog indeksa potrošačkih cijena u RH u 2015.godini (u odnosu na isti mjesec prethodne godine)



Slika 7. Prikaz indeksa potrošačkih cijena u RH u 2015.godini (u odnosu na prethodni mjesec)

Kad uspoređujemo neke druge zemlje, članice Europske unije (za potrebe ovog rada izabrala sam još Mađarsku, Njemačku, Sloveniju i Grčku), vidimo da je najveći pad u odnosu na prethodnu godinu kod Grčke, dok rast harmoniziranog indeksa potrošačkih cijena imamo kod Mađarske i Njemačke. Hrvatski indeks potrošačkih cijena je negdje pri sredini promatrane skupine.¹³

8. Zaključak

Indeks potrošačkih cijena u svojim statističkim sustavima imaju sve zemlje članice Europske unije. Glavni cilj praćenja ovog indeksa je mjerenje i predviđanje inflacije. Isto tako, koristi

¹²Eurostat, Europski ured za statistiku, ec.europa.eu (pristupano 15.1.2016.)

¹³ Eurostat, Europski ured za statistiku, ec.europa.eu (pristupano 15.1.2016.)

se za očuvanje vrijednosti kod ugovora s indeksnim klauzulama, za usporedbu kretanja cijena unutar zemlje te za analitičke svrhe. Harmonizirani indeks potrošačkih cijena promatra za usporedbu stabilnosti cijena među zemljama članicama Europske unije.¹⁴

Ponašanje indeksa potrošačkih cijena ima sezonske oscilacije koje, kako se navodi u tekstu, imaju veze sa sezonskim sniženjima, npr. pad cijena sezonske odjeće u siječnju i srpnju utječe na pad indeksa potrošačkih cijena. Isto tako, nove kolekcije odjeće i obuće u ožujku i rujnu imaju više cijene pa tako djeluju na rast indeksa potrošačkih cijena. Nadalje, tijekom lipnja i srpnja bilježi se rast cijena rekreacije i kulture, kao i cijena smještaja tijekom turističke sezone, dok u listopadu i studenom bilježimo pad cijena istih dobara.

Neki ekonometrijski modeli za 2016. godinu predviđaju pad indeksa potrošačkih cijena, odnosno pad cijena dobara i usluga u Republici Hrvatskoj.

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Consumer price index in the Republic of Croatia for the period from January 1 2015 to December 31 2015

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Abstract. This paper analyzes the Consumer Price Index (CPI) in the Republic of Croatia for the period from January 1 2015 to December 31 2015. CPI reflects changes in the prices of goods and services in the acquired, used or paid over time by a reference population (private households) for consumption purposes. CPI in the Republic of Croatia is calculated on the basis of a representative basket (consisting of over 917 products) every month, and around 36 700 prices of a fixed panel of outlets in nine geographical locations are collected. CPI is the official measure of inflation in the Republic of Croatia, and it makes the target variable of the monetary policy of the Croatian National

¹⁴ Čizmić, D., *Planovi uzoraka pri formiranju indeksa potrošačkih cijena i njihov utjecaj na grešku uzorka*, Ekonomski pregled, 2003.

Bank. The purpose of this paper is to provide an overview of the CPI in the period of the past 10 years, and an analysis for 2015. The work also compares the harmonized consumer price index in the Republic of Croatia with the harmonized consumer price index of selected EU countries.

Key words: *consumer price index, harmonized consumer price index*

The emergence and development trends of electronic payment systems in the Republic of Moldova

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Abstract. The rapid development of Internet in the Republic of Moldova has enhanced the development of electronic payments since its inception in 2005. The development of these systems has been a significant over the past ten years. At present, Moldova has different means of payment for goods and services, such as bank cards, internet banking, online payments, and through different websites (PayPal, WebMoney and others). Considering all the benefits of electronic payments, as opposed to cash payments - safety, speed, convenience and security - only 30-35% of the population carries out such payments. Even bank cards, that offer the possibility of withdrawing cash and payment, are most often used to withdraw money. This trend will be maintained as long as the world realizes the benefits the electronic payments bring.

Key words: *electronic payments, credit card, Internet*

1. Introduction

A payment always involves a transfer of funds; however, a transfer of funds is not always a payment [5; p.1].

In a broader sense, a payment is a voluntary execution of any obligation, but in a narrower sense this involves providing amounts of money. According to the Thesaurus Dictionary of the Romanian Language, a payment is way of offering someone a sum of money for a certain work, the counterpart of a purchased or used object.

The emergence and development of trade has contributed to the modernization of payment methods. Since ancient times the payment method was barter, i.e. exchange of goods, then exchange goods and services for gold, and later receiving payment in cash and or cashless payments: based on checks, payment orders, letters of credit. Cash and cashless payments are used up to nowadays; however, currently, electronic payments have a development trend.

Electronic payments represent the transfers of funds being based on different payment instruments, such as bank cards, electronic checks, payment instructions, wire transfers and all these types of payments can be performed at different payment terminals and are designed to pay the value of the purchased product or service.

2. The emergence of electronic payment systems in the Republic of Moldova

Currently, electronic payments in the Republic of Moldova are still developing, and individuals prefer making payments in cash. This can be explained by the fact that people do not realize the benefits of electronic payments versus cash payments or, they consider the disadvantages of electronic payments are more significant than the disadvantages of cash

payments. A number of factors have contributed to the emergence and growth of electronic payment systems in Moldova, such as:

- ✓ emergence and rapid development of the Internet in Moldova;
- ✓ emergence and development of information technologies;
- ✓ increase of number and value of payments;
- ✓ development of trade

Internet appeared in Moldova in the late 80s – beginning of 90s and since that time it is in continuous process of development. The 90s were not characterized by an intensive development of the Internet; however, the XXI century and especially starting with 2005-2006, Internet had a rapid progress. Various Internet providers such as Moldtelecom, StarNet and Sun Communications offer new Internet applications and facilitate the access of large masses of users to Internet. Nowadays, Information Technologies is one of the main areas of development in Moldova.

Moldtelecom is the national telecommunications operator and also the largest telecommunications company in Moldova. During its work, Moldtelecom has experienced a period of continuous development, initially as a state monopoly, and now it is a company open to collaboration, offering a wide range of services: fixed telephony, mobile telephony, Internet, data transmission and digital TV. At present, it is the leading company offering Internet access services (70.3%) and also first according to the sales volume on this market segment, with a share of about 57%. Moldtelecom annually invests MDL 700-800 million in the implementation of new technologies and new types of services [13].

StarNet, like Moldtelecom, is a telecommunications operator. The company was founded in 2003, providing Internet services, digital TV and fixed telephony in Chisinau and other cities. Currently, StarNet is part of the top companies in the field of electronic communications in Moldova and is one of the leaders of Internet providers, being the first provider in the country to offer Internet access and high-speed data transmission via optical fibre. During its activity, StarNet managed to develop and implement in Moldova a wide range of services of the latest generation needed in every home and business [13]:

- ✓ access to fast Internet and data transport over optical fibre;
- ✓ Wi-Fi network;
- ✓ corporate networks;
- ✓ Data Centre services;
- ✓ IP transit services for other operators;
- ✓ fixed telephony;
- ✓ digital television;
- ✓ licensed solutions to protect computers.

Sun Communications is the third largest Internet provider in Moldova. Besides that, the company is an operator of digital television and telephony. The company was created in 1993 and currently has over 110 thousand customers of different types of services. In 2001 Sun Communications updated its network by replacing the existing wired network with optic fibre [13].

Generally speaking, during 2007-2011 the Internet speed grew by 690%, thus ranking Moldova second in the world. Since 2010 and up to now Moldova has variable positions in the world's top 15 countries with the highest Internet speed [13].

In 2014 Audit Bureau of Circulations and Internet in Moldova (BATI) conducted a survey on the number of Internet users, their classification by age and sex, and other classifications [12].

According to the survey, the results are as follows:

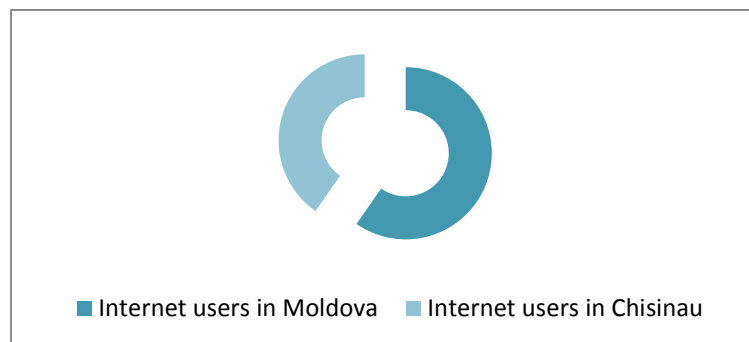


Figure 1. Internet users in Moldova

Source: <http://mediapoint.md/wp-content/uploads/2014/05/unde-locuiesc.jpg>, accessed 5/8/2015.

According to Figure 3.3, we conclude that about half of the Moldovan population accesses the Internet for different purposes, and about half of this population (45%) are residents of the capital city. No wonder this because the headquarters of the main Internet providers are in Chisinau.

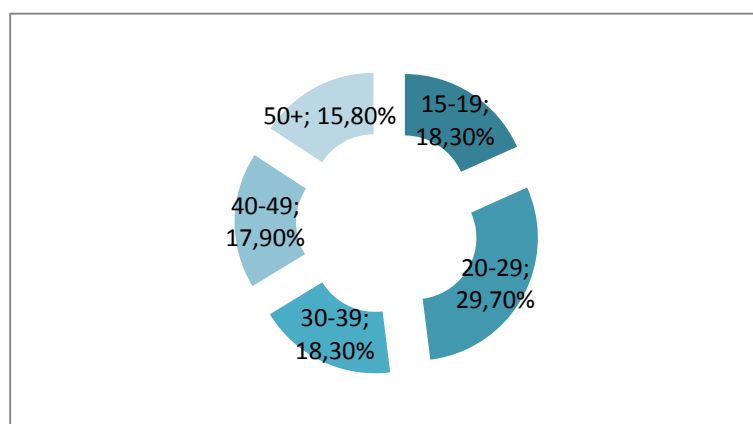


Figure 2. Classification of Internet users by age

Source: <http://mediapoint.md/wp-content/uploads/2014/05/virste.jpg>, accessed 5/8/2015

According to the above figure we can see that in 2014 most Internet users age 20-29 (30%), followed by teenagers and people aged 30-39 years (18.3% each), followed by people aged between 40-49 years (17.9%) and persons under the age of 50 years (15.8%).

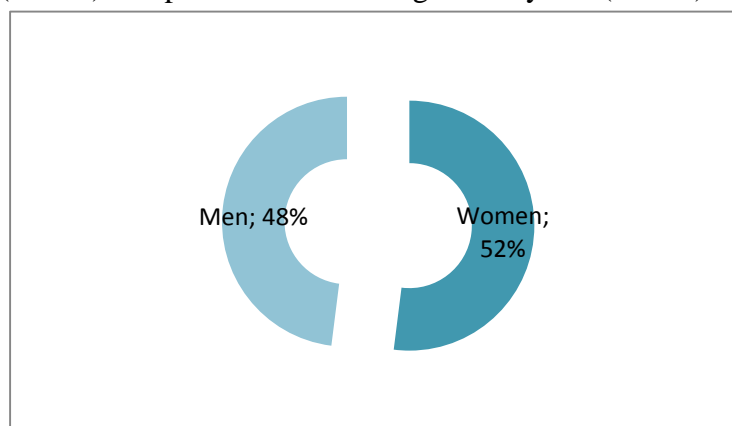


Figure 3. Classification of users by gender

Source: <http://mediapoint.md/wp-content/uploads/2014/05/sexe.jpg>, accessed 4/8/2015.

According to the survey conducted by the Audit Bureau of Circulations and Internet in Moldova (BATI), women access the Internet more often. Concerning the electronic payments in electronic trade, the figure below presents the results of the survey.



Figure 4. Electronic payments in e-commerce

Source: <http://mediapoint.md/cine-sunt-utilizatorii-internetului-din-republica-moldova-pentru-luna-martie2014/>, accessed 4/8/2015.

According to the above mentioned, we can observe the major influence of the factor that contributed to the development of electronic payment systems. Basically, without the Internet it would be impossible for electronic payment systems to exist, and also it would be impossible the existence of the concept of electronic payment. Thus, the Internet is the main factor that contributed to the emergence of electronic payments and contributed to their development through new technologies. According to the survey, 36% of Internet users are buying goods online. Although this number is low compared to developed countries, where more than 80% of payments are electronic payments, these 36% show that there is a development trend in this segment, which is considered as being positive.

Another important factor that contributed to the advancement of electronic payment systems in Moldova is developing techniques and technologies. Payments are made via various electronic devices: computer, mobile phone, tablet, payment terminals. All these devices are imported by Moldova from developed countries in this type of industry, such as: the USA, Japan, South Korea, Taiwan and China.

The increase of payments and of their value is directly related to the wide range of goods and services that are offered to citizens. Payments may be different, cash or cashless, but when performing considerable payments it is likely to lose this amount. Typically, large payments are made between organizations, different companies and in case of loss or theft of money, the person bears responsibility for it. So, people began to invent faster and safer ways of payment. This is how electronic payments appeared, which, to some extent are based on primary documents: payment order, checks, letters of credit, i.e. according to the principle of non-use of banknotes.

The development of electronic payment systems in the Republic of Moldova is one of the state's major plans. In 2013 was adopted the Government Decision no. 857 on the National Strategy for Information Society Development "Digital Moldova 2020", according to which any legal or official document can be achieved by using electronic signature in the ID [2].

3. The modalities of electronic payments in the Republic of Moldova

Similarly, any bill can be paid online from anywhere in the country, just by entering the code on bank card. The initiative belongs to the e-Government Centre, aiming to facilitate people's access to public services. Experts in information technology, mention that due to such business methods there is no longer needed to present stacks of documents. According to Strategy "Digital Moldova 2020", cash payments will be replaced by electronic payments. Thus, the world will be able to make various payments in a quicker way and receive notifications without losing time standing in queues at counters [1].

Although electronic payments have a development trend in Moldova, individuals still prefer to make cash payments in our country. A great number of population has not realised the benefits that electronic payments bring, others do not even know about the existence of such payments. The update of electronic payment systems in the Republic of Moldova cannot be compared to that of developed countries. This significant difference can be explained by the following factors:

- Moldova does not have such advanced technologies as the USA, China, Japan and other developed countries;
- intensive development of the Internet and technology has begun in the XXI century while in the world in the mid-late of 80s;
- Moldovan citizens have more confidence in cash payments, and, the more they trust the cash payments, the slower the electronic payments will develop.

However, electronic payments in Moldova are not something out of the ordinary and they can be made through the following instruments:

- Credit cards;
- Payments via the Internet;
- Internet banking;
- Payment terminals

Bank cards are issued by commercial banks in Moldova, whose activity is regulated by the National Bank of Moldova. Thus, the entire banking system in Moldova consists of the Central Bank and commercial banks.

Bank cards can be issued to both individuals, as well as legal persons. In order to do so, any person should contact any branch of one of the commercial banks and submit the necessary documents.

For *individuals* are necessary the following documents:

- ✓ Account opening application;
- ✓ ID.

For *legal entities* are necessary the following documents:

- ✓ Account opening application and for the use of bank cards;
- ✓ contract on MasterCard Business card usage;
- ✓ copy of the ID of the cardholder;
- ✓ other documents required for account opening.

Once the person has obtained the bank card and has a certain amount of money on its account, he can perform different payments, such as booking a hotel, making a ticket reservation, pay his cheque in a restaurant etc. This person can also withdraw money from ATMs. The figure below shows the structure of cards use by purpose.

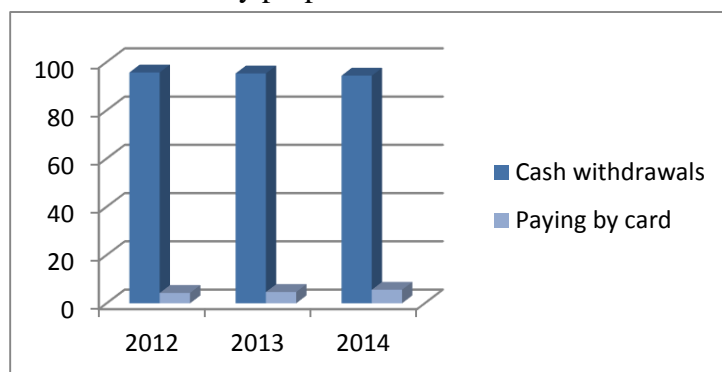


Figure 5. The value of transactions in Moldova with cards issued in Moldova for 2012-2014

In 2012, out of the value of card transactions in Moldova with cards issued in Moldova, the biggest share is given to cash withdrawals (MDL 19,170,073. 5 out of MDL 20,038,111. 6, about 96%). In 2013, the tendency of paying by card increased, but not significantly (from 4.3% to 4.7%). In 2014 compared to 2012 and 2013, the share of card payments has increased at a higher rate, but this increase was not significant. In 2014, card payments represent 5.62% of all card operations.

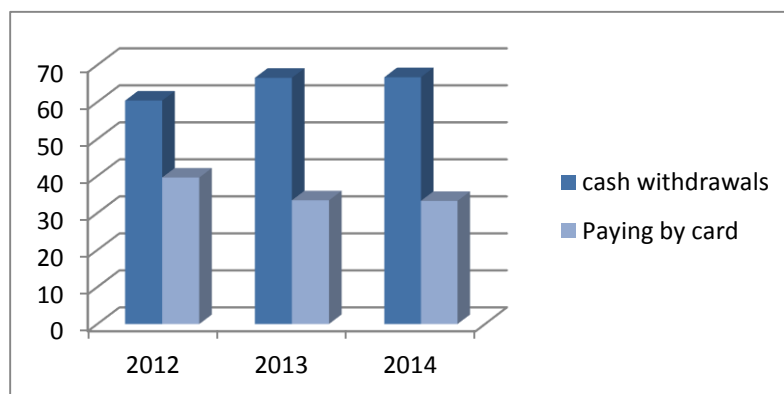


Figure 6. Transactions in Moldova with cards issued abroad for 2012-2014

Out of the value of transactions with cards issued abroad and transactions made in Moldova a higher percentage is given to cash withdrawals. On average, about 65% of transactions carried out in Moldova with cards issued abroad, represent the cash withdrawals, while payments amounted to about 35%. Foreigners prefer to withdraw money than pay by card, which demonstrates the growth of cash withdrawals during the last 3 years (from 60.4% to 66.71%).

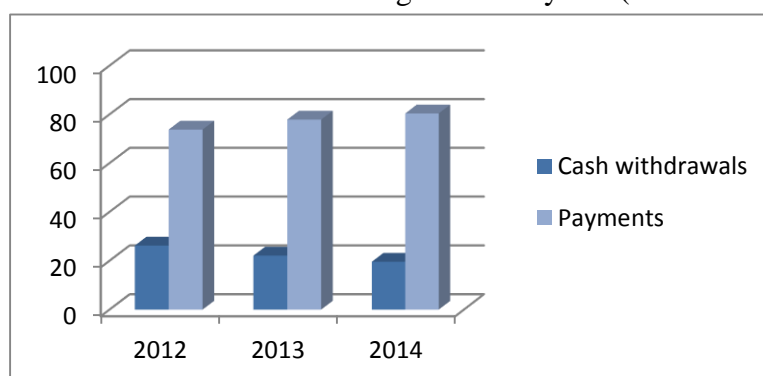


Figure 7. Average value of transactions made abroad with cards issued in Moldova

The value of transactions carried out abroad with cards issued in Moldova is characterized by the fact that the share of payments exceeds the average share of withdrawals – 77%. However, the value of payments is higher only abroad, while in Moldova individuals prefer withdrawing cash, especially those with cards issued in the country and making payments here. This again demonstrates the high level of development of electronic payment systems outside the Republic of Moldova. This can be explained by people's confidence in security and efficiency of electronic payment systems while being abroad, which is currently not specific for electronic payments in the country.

According to statistics presented by the National Bank we see an increase in the number of cards in circulation for the last 3 years, from 1,011,673 cards to 1,150,969 and 1,302,225 cards, which means an increase by 13.8% in 2013 compared to 2012 and 13.1% in 2014 compared to 2013. Both types of transactions, with cards issued in Moldova and abroad and carried out in the country or abroad, had an increasing trend. The value of all these transactions varies depending on the place of operations and the country of issuance. The number of payment devices, namely ATMs and POS-terminals during these three years was

only growing. This growth emphasises that banks and different economic entities offer more possibilities for card payments, thus making easier the process of payment for services and promoting cash payments limiting policy.

Internet payments are made through certain websites. In Moldova the largest sites where payments can be made online are:

- ✓ www.paypal.com (PayPal);
- ✓ www.wmtransfer.com (WebMoney);

PayPal is considered the largest company processing online payments globally. It is the biggest site that deals with brokering of transfers and electronic payments to and from users of this site. Through this website individuals can buy different products from various online stores that accept PayPal. In order to perform a payment via PayPal, the person must open an account on this site and charge his account using a bank card that is compatible with online payments. In this way the money from the traditional account is transferred to the electronic account. PayPal added Moldova to its list in June 2014. Taking into account that PayPal has recently appeared in Moldova, it is not very popular in our country. For example, in developed countries PayPal enables money transfers through mobile phones. Its appearance in Moldova is considered a great advantage for the economy, because besides facilitating money flow, it encourages the development of trade in the country and abroad [9].

WebMoney system is most widespread in CIS countries and in Moldova. In order to use this system, it needed to have installed the WebMoney program on the computer which is called “WebMoney KeeperClassic” [9].

Once this program is installed, the person can perform the following operations:

- ✓ pay for various products and services: mobile telephony, television, utilities;
- ✓ visualize the account;
- ✓ receive messages from different users of the system and also receive messages from the system.

Account replenishment is carried out similar to the PayPal system, i.e. via a bank card compatible with online payments [13].

On account of the individual can have several deposits in different currencies and for each currency he can create a special electronic wallet:

- WMR for Russian rubbles;
- WME for Euro;
- WMZ for USD.

According to statistics provided by this site, more than 55% of users have at least one electronic wallet. The problem is that the transfer of funds can be done only between the wallets of the same type [13].

Besides PayPal and Web Money, there are other sites but of a smaller size, which also can make instant payments. These sites are:

- www.oplata.md;
- www.dostavka.md;
- www.darwin.md;
- www.plati.md

Just as with PayPal and WebMoney, they allow making payments for services like:

- ✓ mobile and fixed telephony;
- ✓ utilities, financial services, Internet;
- ✓ television;
- ✓ games, social networking donations.

Internet banking is an information solution offered by the bank to its customers, which allows the bank account holder to remotely access resources available on this account for electronic payment transactions, to obtain information on performed payments, as well as visualizing the account statements. Internet banking allows the use of banking services anytime and anywhere. It also gives the possibility avoids queues and go to the counter. This payment instrument enables the remote management of finances quickly and affordable [10].

In order to access the online account through Internet Banking is needed a computer, a mobile phone, a tablet or any other device connected to the Internet. All financial institutions in Moldova offer the possibility to perform various transactions online. The figure below renders the use of Internet banking scheme.

Payment terminals represent payment devices offered by some companies. Payment is made through different payment instruments; the person chooses the required service and then enters the data required for payment. In Moldova these terminals are provided by the following companies:

1. QIWI;
2. Netto Pro;
3. Premier Telecom;

QIWI company is a market leader, offering its subscribers a convenient, safe and fast method of payment for mobile operators, Internet providers, digital television, IP telephony. Its purpose is to provide consumers a modern, safe and convenient payment service. QIWI brand was established in 2007 and became the first brand on the instant payments market. The priority of QIWI brand is the final user. QIWI has created for its users a unique system of payments, which combines almost all worldwide used payment technologies, providing a simple, fast and convenient way to pay a wide range of services anytime and anywhere in the world. International payment service QIWI appeared on the Moldovan market in 2011 and offers Moldovan users a technology of micro payment collection points, operating 24 hours a day, 7 days a week [7].

Among the services that can be paid through the terminals QIWI are: utilities, Internet, lotteries, games, social networking, donations, E-money, banking service, online payments, cable TV, flight tickets, mobile phone charges, State taxes and fines, etc.

Netto Pro Company is a big processing centre, which has more than 300 terminals in Moldova in more than 15 cities. The company was founded in 2007 and registered its first transaction in the system in March 2008. The company was founded in order to meet the payments system that will meet the entire cycle of technical, legal and financial projects in the field of payments acceptance; achieve a stable increase in the volume of accepted payments based on active incorporation of new technologies, that would enable the development of electronic payment market segments that have not been yet covered. Currently, the company's terminals allow the payment of more than 20 services. The company's terminals were used by more than 500 000 users, and the number is constantly growing. Compared with QIWI terminals, Netto Pro terminals offer a more restricted range payment services, including:

- Mobile telephony
- Cable Television
- Internet and IP telephony
- E-Commerce
- Utilities, etc.

Premier Telecom specializes in the development of telephone communications and IP-telephony worldwide. The purpose of this company is to provide a high-quality telephone connection and customer satisfaction [8].

Terminals offered by this company are called MMPS and its services are:

- International connection;
- Lease of phone numbers abroad;
- Classic IP-telephony;
- IP-telephony for mobile phones;

The payment of these services can be made through the following instruments:

- PayPal;
- Bank transfer to the company's bank account;
- Directly through MMPS terminals;
- Via www.oplata.md web site;

The company also offers a wide range of benefits, such as cheap calls, call forwarding, additional bonuses, calls statistics, etc.

Moldova has also implemented a special service for the payment of utilities. This service is called Government e-payment gateway (MPay Service).

MPay service represents a unique mechanism of electronic payment of public services available via such payment instruments like: credit card, Internet banking or even cash. Operation of this service is performed by "E-Government Centre" and in terms of providing technical and technological platform for the technical infrastructure, required for electronic payments, is responsible S.E. "Special Telecommunications Centre" [1]. The participants of the MPay Service are:

1. public service providers and payment services (Ministries, other central administrative authorities subordinated to the Government and organizational structures);
2. payers (individuals and businesses);

Any payer decides on the payment instrument of public services and the following actions to be taken depend on the chosen payment instrument. For example, if he chooses to pay with a bank card, the MPay service will identify the bank which will carry out the transaction, after which it will offer the payer to choose the bank that issued the card and will direct the payment to the accepting bank that serves the bank that issued the card. If the issuing bank cannot be identified, MPay Service will distribute equally the transactions between banks participating in MPay service [1].

The Government e-payment gateway offer to individuals and businesses the following public services: criminal record, payment for standard forms of primary documents, Apostille services, identification means for domestic animals, transport authorizations, payment of police fines, payment of income tax, licensing activity, services of SE "CSIR "Registru", e-Visa, service SE "Cadastre", payment of real estate tax, payment for civil services, payment for AGEPI services, eSignature.

4. Tendencies of development of electronic payment systems in the Republic of Moldova

Electronic payment systems in Moldova are developing and their development is hampered by the mass use of cash payments. It is obvious that cash payments are still popular, as most of Moldova's population hitherto only knew about the existence of this type of payment. A more intensive development of electronic payments is due to the rapid development of the Internet in Moldova, i.e. since 2005. During the last 10 years, the development of these systems has been significant. Currently, different payment instruments are available for the payment of goods and services, such as bank cards, Internet banking, online payments through different sites: PayPal, WebMoney and others. Although the advantages of electronic payments are obvious, compared to the cash payments: safety, speed, convenience, security,

only 30-35% of the population carries out such payments. Even bank cards that offer the possibility of cash withdrawal and payment; it is often used to withdraw money. This tendency will persist, as long as the individuals shall not realise, the benefits of electronic payments.

Another reason in favour of cash against electronic payments is the low level of security of electronic payments in Moldova. Even though in developed electronic payments are also subject to fraud, however, the security measures are at a higher level, encouraging people to conduct electronic payments. Thus, the problems that determine a poor use of electronic payments in Moldova are:

- ✓ lack of information about the benefits of electronic payments;
- ✓ low security level determined by attacks on electronic payments;
- ✓ e-commerce is not developed;
- ✓ mass use of cash payments;

If we solve these four big problems, electronic payments have a chance of rapid development. Considering separately each issue (mentioned above) we can establish measures to solve them:

- a wide range of information sources are currently available: newspapers, magazines, books, television, Internet. People must be informed about the availability of these payments, about the way they are performed, the instruments used for these payments and of course about the benefits they bring. Billboards can be displayed all over the city and also information brochures can be edited, offering useful information about these services.
- offering bonuses for electronic payments.

For example, in October of 2014 a campaign was launched by the E-Government Centre, in partnership with the National Bank of Moldova and with the support of VISA, offering a bonus of MDL 25 lei on the mobile phone to those paying for the public services via MPay and using VISA card. Anyone paying for a service a minimum of MDL 100 can benefit of this offer, thus promoting cashless payments [4, p.14].

The security of electronic payments can be enhanced through advanced technology, but since Moldova still lacks such technology, combating fraud such as skimming, creating ghost web pages, cloning of cards, the following measures can be taken:[3; p.18]

- a) purchase products only in trustworthy stores with security certifications;
- b) using a credit card instead of a debit card;
- c) while shopping online, make sure the financial information is transmitted via SSL - Secure Sockets Layer - which provides a secure connection without interfering with the process of sale;

Limiting cash payments can also be achieved by implementing certain laws. Once the person violates the law, he will be liable to pay a fine or risk years in prison. Thus, we can implement a Law limiting cash payment, just as it was implemented in some European countries [6; p.287].

Development of e-commerce will have a positive impact on the development of electronic payment systems. For example, transactions between businesses generally represent high value transactions. The greater is the number of successful value transactions, the less will be fear of making small value payments. Development of e-commerce can be encouraged by the following measures, carried out by companies:

- ✓ operate non-stop;
- ✓ be present on the Web;
- ✓ maintain regular contact with customers, partners, employees, suppliers;

- ✓ have network storage solutions that enable the management of huge volumes of information [11];
- ✓ have solutions for virtual applications, which ensure permanent availability, scalability, performance and security [11].

If talking about the role of government, there are two aspects:

- The first is related to financial literacy;
- The second is related to infrastructure development, especially in rural areas.

The problem is not just that people withdraw cash from ATMs, but also that there are no businesses willing to accept cards. We cannot blame people for not using cards, as they actually do not have where to use them [14]. Government should encourage businesses, especially smaller ones, to accept payments by cards.

In this situation, the state is interested in cashless payments, as cash payments bring prejudice to the state budget. The card is a key product in the banking business and these institutions are interested in promoting them in the first place [14].

5. Conclusion

In conclusion we can say that the implementation of such measures would contribute significantly to the development of electronic payment systems. Their development is necessary for the country's economy, as electronic transactions have become an important component of economy and the modern world. These payment systems can remove some processes that cause state regress, like: the shadow economy and tax evasion.

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Financial management of risks as a vital condition for the economic and financial stability for an enterprise

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Abstract. Today, under the influence of the globalization process of the financial international markets and the instability of the global financial situation, sound financial management of enterprise risk is needed more than ever. The financial risks management objective consists in their minimization through realizing a proper strategy for obtaining the financial stability of the enterprise. It is necessary to mention that the risk evaluation represents the quantitative calculation of the level of risk, of its characteristics, its causes, and possible consequences as a result of the influences on enterprise performance. An entrepreneur constantly faces problems regarding the elaboration of the strategy for avoiding the threat of a potential crisis situation. Therefore, the entrepreneur has to estimate the potential possibilities of a dangerous situation, to forecast the risk of apparition of insolvency or bankruptcy, to elaborate and to adopt measures in order to assure the financial stability of its activity.

Key words: *financial risks, entrepreneur, strategy, insolvency, financial management*

1. Introduction

According to the economic doctrine, each person has a patrimony that includes the active side, for example- rights and the passive side - obligations. It is well known that to start an entrepreneurial activity, people have to put in circuit some material values, that represent the entrepreneur's initial assets.

As the purpose of economic activity, the entrepreneur seeks to increase the value of assets put into circuit, whose surplus represents the profit of the entrepreneur. If the debts exceed the revenues, the entrepreneurial activity is ineffective, does not achieve the intended purpose and should be suspended.

At the same time, the entrepreneurial activity is performed partially on borrowed money and therefore, the participants in the various contractual relationships have the responsibility to honor its obligations in time. Unfulfilling an inefficient activity can lead the entrepreneur to a state of cessation of payments and failing to honor its obligations, getting to the maturity of a bill.

This is the outward manifestation of the difficulties faced by the entrepreneur, because they are felt immediately by the creditors.

Thus, at any stage of activity, enterprise managers are forced to estimate the potential possibilities of occurrence, of the destabilizing situation, forecasting the state of insolvency

and bankruptcy. They have to develop and adopt measures, to ensure the security of their activity.

As a result, we can mention, that the entrepreneur, permanently, is faced with problems related to the development strategy of avoiding the crisis situation of the company.

2. Considerations regarding the particularities of financial management of firms being in crisis situations.

Management instability and develop strategies avoidance of the financial crisis, must include measures and recommendations, in order to diminish the consequences, that may arise from taking various decisions.

This would allow the manager to evaluate the economic agent status, related to uncertainty, which may result in failure on goals set, and to obtain valuable information, on possible damage.

Therefore, the environment activity imposes the enterprise a new variable, which must be taken into account in maintaining the level of liquidity, namely - the risk it means the enterprise uncertainty from the results obtained. It has been founded, that the current concerns of research in Financial Management, is the problem of risk and inflation.

Starting from this, the risk is addressed in correlation with inflation, interest rate rises, leading to both, to an increase of capital cost, as well as, reducing the potential of an investment, to produce profit.

The risk may be defined, as a probability, and the expected outcome may differ from the actual return. The person who makes the decision, however, may predict, whether the obtained outcome, will compensate the effort.

The risk assessment, determines the degree of comfort, of the person, which is taking the decision, being abreast with the negative outcomes that can arise. In this context, the risk should be viewed as a possibility of loss or income.

So, in the scientific literature, the risk is characterized as "an opportunity to be exposed to dangers, it deals with troubles or losses, potential danger," it can be calculated and assumed, by the initiator of the business, and has a reward, the discounted profit of the business. It reflects the degree of probability, associated with failure, and the key character of the business development, is the entrepreneur, himself.¹

It is well known, that the future always is uncertain, so any decision taken, regarding the future, involves a higher dose or low of risk, it is a measure of concordance between different possible outcomes, more or less favorable or unfavorable, for a future action.

On the other hand, the entrepreneur is faced with uncertainty often just he contributes to its occurrence. Uncertainty (lack of certainty, insecurity, doubt, hesitation), of several types, it is manifested at various levels, represents an assembly of the potential events susceptible to occur, and which can be expected, thus affecting the company's activities.²

Bearing in mind, that the driving force of the development of entrepreneurship activity are uncertainty and risk, which have an objective character, we can mention, that they are the result of the influence of the external environment factors and, for these reasons, the focus is

¹ Marchesnay, M., Julien, A. (1988) - La petite entreprise, acteur de la stratégie industrielle. -In: Julien, P.; Marchesnay, M. (org.). *La petite entreprise: principes d'économie et de gestion*. (pp. 63-83). Paris: Librairie Vuibert, Editions G.Vermette

² *Dicționarul explicativ al limbii române*, (2000) București: Editura Univers Enciclopedic..

on ensuring mutual connection, between the forecasting process and the outcome of the current reality.

The external environment includes the objective conditions of: economic, social and political nature, within the limits, which the company operates, and the dynamics, which is required to adjust.

Concerning the question of uncertainty, we can assert, that it persists at all stages of the lifecycle of enterprise, due to the multitude of participants in the business process, whose behavior in different situations, cannot be predicted precisely.

At the same time, the enterprise activity, is influenced by the strategies, goals and criteria that cannot be invariable at the appropriate level of performance. Also, the activity of the economic agent is permanently affected by uncertainty of economic conjuncture, on which stand the instability of supply and demand, factors of production, combining capital for making investments.

In this context, a firm in difficulty is the result of a long series of deficiencies, regarding the business management, financial policy, and human resources management etc. But, for a normal activity, it is important to take into account, the value of risk exploitation, then for less profitable enterprises, and in loss, this assumed risk, is extremely high. Less profitable companies, have a lower market value, than of the net asset. For them, Trade Fund, being "badwill".³

A business owner of the company in loss assumes the risk, failing to recover it, and even to liquidate the company. However, for these cases, there is a limit, when the recovery is uncertain and when the recovery is achievable, but at great expense funds.

We also consider, that the financial risk indicators, give us a clear overview, over some phenomena of the negative influence of risk factors, and on this basis, may be elaborated the forecasts, in order to avoid or minimize the future risks, within the enterprise. As a result, the risk of insolvency issues, focuses on two financial conditions, namely: the state of the working capital and solvency status, highlighted by several installments.

In the case of insolvency risk, for managing the activity, a great importance, rests to the use of contemporary insurance methods and the usage of reserve funds and their distribution systems.

In this chapter, we can mention that, according to some opinions, insolvency, under economic aspect, represents a reflection of the insufficient situation, of gross income, intended to cover incurred expenditure. But in case, as the criterion of the enterprise insolvency, it serves the incapacity of production factors utilization, with some level of effectiveness, ia registers functioning in loss, of the economic agent, it may be made by the following findings:

- Unsatisfactory condition of the company, caused by the effect of loss, does not characterize the phenomenon of insolvency, as it could be the result of the marketing strategy of the economic agent, because, in this case, the losses committed, with the purpose of achieving a long-term stability, have a short duration character.
- Profitable enterprise activity, cannot serve as a guarantee, for maintaining the efficiency and solvency of the managerial object, as the incorrect investment policy, inefficiency of organizational and management structure, and the other factors, could attract the decrease in profitability.
- As a result, may occur the situation, when the economic agent, maintaining technical potential state and production, will become insolvent, as a subject of entrepreneurship. So unprofitability, reflects only final criterion insolvency side, when unfavorable situation of the company, becomes visible to all the business partners.

³ Dumitrescu D., Dragotă V., Ciobanu A. (2002). *Evaluarea întreprinderilor*, București: Editura Economică.

So, from the above, can be noted some causes of insolvency. One of which, is to reduce long-term demand, related to the completion of the life cycle of production or changing demand for the production of enterprise, which may transfer the price level, in the segment, located below the level of average costs.

The second cause assumes that, after spontaneous growth of the permanent expenditure or of those variable, may be increased the global costs to a level, which exceeds the price of the commodity.

As can be seen, the first cause of insolvency refers to the field of marketing and states, where the marketing strategy, is the starting point of the overall plan, of financial reconstruction of the economic agent. The second issue, concerns the financial sector and financial restructuring strategy, which is the final point.

Thus, we conclude, that the concept of risk management insolvency, involves a procedure in which, in a certain way, it is stipulated the danger crisis. It is performing the analysis of its peculiarities, and it is elaborated measures pertaining, to reduce the consequences of the crisis, and the use of factors, that will influence the enterprise development.

It should be noted, that at different stages of the crises development, and at the different variations of the economy, for ensuring the financial stability of the enterprise, it has to be adjusted and corrected. For an efficient achievement of the financial crisis management, it is necessary, to apply the following measures:

I. Prevention measures of the crises at the enterprise;

II. Measures to overcome the crisis.

The anti crisis management at the enterprise can be shown by the following figure:

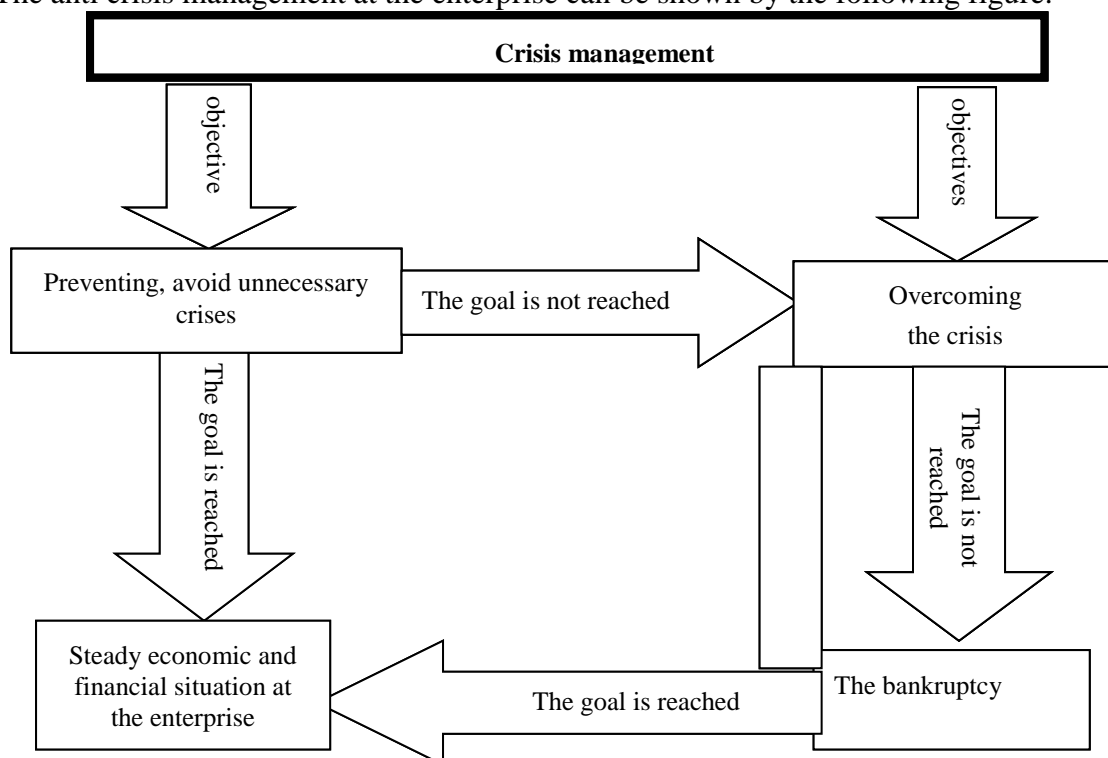


Figure 1. The anticrisis management

In this context, drawing up the strategy, regarding to the enterprise financial situation implies a process of an effective economic management, of the patrimony, which involves a complex of organizational, technical and financial resources, that will enable optimum correlation of

production factors. Not least of these, is the manager skills, to mobilize the team, to overcome the crisis situation and of avoiding panic spirits.

3. Methods of anticipating, avoiding and reducing the negative effects of the financial crisis at the enterprise.

We think that a big issue in the insolvency process is assigned to the company leadership which sometimes, is enough to change the administration and implementation of anticrisis management, in order to obtain financial growth. Therefore, regular payment of wages and extinguishment of the debts to the budget. From here, the conclusion is apparent that, for the formation of the own financial resources, is sufficient to go through a period of rehabilitation.

Therefore, the entrepreneur assumes the responsibility for drawing up an individual program of action that would avoid its insolvency. By activating in the competition environment, the economic agent is imposed to provide its customers the facilities, to the sale of goods, ia goods to sell on credit, which conditioned probabilistic character and high degree of risk.

The economic-financial management of entrepreneurship is a complex correlation, which is formed in the development process and conduct of business activities, between different elements of the material structure, technical potential and of the labor force, which expresses the possibilities of the economic agent, the way they are used, and which are the obtained results.

At the same time, it is necessary to compare them with the achievable level, depending on the existing potential. Thus, using the economic management, need to ensure constantly, a set of correlations, allowing a balance between:

- Capital goods and labor force;
- Production capacity and production obtained;
- Labor productivity and average wages;
- The volume of achieved production and its market demand;
- The investment allocated and the obtained results from thereof.

Referring to the economic management, we consider that it may be treated as a specific process, which consists of a set of planning activities, organization and control, aimed at establishing and plotting goals, which have to be achieved. And the interaction of economic means, will allow to achieve these goals, in which it is included a complex of forms, of an effective management, of the entire patrimony of the company.

The actions on the chosen strategic directions cannot be funded solely from internal resources, which, of course, are not enough in the crisis situations.

Respectively appear necessary, to hiring the sources from outside the enterprise, which is quite difficult, since the financial crisis at the enterprise requires its insolvency, respectively very few, are willing to risk and provide means, to such an enterprise.

It is very important for the enterprise, not to close its activity that, after this, will proceed to the other anticrisis measures. In this direction, the organization may use the following measures and actions, to overcome, the crisis situation:

- Reducing the enterprise consumptions and expenditures;
- Increasing and accelerating, the entrances of funds at the enterprise;
- Restructuring or rescheduling of financial debts;
- Establishment of a new enterprise development strategy, towards overcoming the crisis;
- Performing the reorganization and restructuring of the company.

Currently, the problem of evaluation, analysis, management instability and financial crisis of the enterprises activity, in Moldova, requires a survey, which would include theoretical and practical aspects, which should become a key element of the theory, of economic management.

The management procedure, allows the appreciation of ways and ensuring possibilities, of the economic stability of the enterprise, of its ability to resist to the unfavorable events. In the process of studying the problems of the financial crisis occurrence, it is necessary to take into account first of all, the level, at which the enterprise is, and the stage of its life cycle.

Anticrisis management, implies the elaboration of a prior plan, with the aim of avoiding critical situations, insurance against the risks, and at liquidating the consequences produced. There is a difference between steady planning, which is based on the use of certain resources and between planning restoring of the enterprise normal activity, before unpredictable and unpleasant events. It allows the economic agent, in a short-term, to rebuild its solvency and to meet its commitments, towards the partners.

In order to determine the financial stability, it is necessary to calculate the indicators that characterize the sources of patrimony formation. One of the indicators is the coefficient of the correlation, between own and borrowed sources. The greater the size of the coefficient is, the greater the risk of entrepreneurship is, which imposes the implementing methods, of reduction and avoidance of risk.

Among these methods, we can mention the diversification, that allows a greater stability in the financial performance, thus reducing the vulnerability of the company.

This consists of, capital allocation in various areas of activity, the results of which are not in the direct interdependence. Due to the multiplication of production, can be mitigated the impact of the favorable cyclical fluctuations in the sector, diminishing risks, connected with imperfect foresight, the market downturn or the appearance of new competitors.

When it supports the loss in a field of activity, it can gain a profit from another sector. From here, we can say, that the diversification, preserves the enterprise stability, regardless of internal and external factors, that have a negative influence. Another method, is the assurance of risks, by an insurance company; often using the hedging, ie the insurance of the commodity price, against the risk or unforeseen reduction for producers, and the unsatisfactory increase for consumers.

The method of limiting, entails the establishment of a limit, for the amount of expenses, selling credit and capital investment amounts..

Formation of resources, reserved for covering unexpected expenses, is done by correlation between potential risk and increasing expenditures, for incurring such risks.

This method, as a rule, is used in the implementation of various projects. The risks are divided between project participants, the longer the period of investment is, (modern technologies are innovated), and the greater the risk of the project is. As a method of the risk sharing, factoring operations occur, which ensure high risks.

The efficiency decrease of an enterprise, and the loss of market segment, creates a negative state. The management proposals are numerous, of "successful solutions", in order to prove their managerial potential, still not exhausted, and the financial exigency, includes the fulfillment of at least two conditions: the cost of implementing the proposal and earnings, brought by the respective proposal.

In the specialized literature, the achieving process, in confrontation procedures of financial crises, related to borrowers- enterprises activity, it is appreciated, as a process of avoiding the crisis, which in conditions of market economy, is considered, as a controlled process.

This situation emphasizes two concepts: management against crisis, and realization of actions against the crisis. The first is a microeconomic category, which represents all forms and methods of implementation of procedures, to avoid the crisis, within the corresponding company and reflects the production relations, which is formed at the stage of sanitation or of its liquidation.

The second, being the macroeconomic category, includes organizational, economic, legal and regulatory measures, aimed at protecting, against the crisis situations, preventing insolvency or liquidation of enterprises, in the case of unprofitable business.

In this context, in specialized literature, the focus is on preventive procedures, to avoid financial crisis, and anticrisis management, is aimed at avoiding insolvent situations, of the company.

According to data approach, determining the essence of anticrisis management, it is manifested in a certain extent, in the narrow sense, since it provides the management process, under the existing financial crisis, and it is directed, towards the redressing situation data.

Directly, the main cause in the management of the financial crisis is to ensure the conditions, in which financial difficulties cannot have a permanent and stable character.

So, in our view, the concept of anticrisis, involves the operation of the company management system, with systemic and complex character, which aims, is to prevent or avoid unfavorable phenomena for business, implementation and realization, throughout the economic agent, of a strategic special program, that allows overcoming the temporal difficulties, maintaining and extending from the own sources, in different circumstances, of the subject positions to the market.

However, such a formulation of this category, does not allow the management structure, the disclosure of avoiding the crisis, and does not determine the importance, of financial restructuring, in case of the company sanitation. The theories of management, determines that, the management of avoiding financial crisis, needs to overcome and prevent the insolvency of the company. Using management procedures, allow insurance, over a long period of time. Level of competitiveness that will create conditions, to produce the required goods on the market, and ensure sufficient cash flow, to pay all the bonds. Based on the above, the management of financial crisis can be divided, into the following modules:

- ✓ external environment analysis of the internal potential of competing priorities;
- ✓ a preventive diagnosis of the creation crisis situations reasons, in financial and economic processes of the enterprise;
- ✓ complex analysis of economic and financial situation of the company, in order to establish methods of financial rehabilitation;
- ✓ business plan for the company's financial sanitation;
- ✓ management procedures of avoiding financial crises and controlling their performing.

Thus, this anticrisis management determination reflects the structure and its contents, as for the first three modules, they are oriented towards determining the current state of the enterprise, and the last two, are aimed at moving out of crisis.

From this point of view, the enterprise management activity, in conditions of insolvency, can be studied, as a process guided toward preventing or avoiding the crisis, based on objective tendencies of development.

In this context, anticrisis management problems in the financial situation of the company can be grouped as follows:

1. Issues related to the state of insolvency detection ;
2. Methodological, economic and financial issues, that comprise the key areas of the company's volatility.
3. The problems of forecasting crises.

Thus, the notion of Anticrisis management, consisting in the financial restructuring of the company and shaping processes, can be related to different groups of issues.

Those mentioned above, allows to conclude, that insolvency, represents a complex characteristic, that reflects the internal processes, deployed within the enterprise, which finally reflects on its financial condition.

In turn, for the most of the management subjects, management mechanism should not be directed towards avoiding crisis, but towards the expectation, in order to prevent, insolvency and the ensuring possibility, also to prevent the bankruptcy.

At the same time, concerning the insolvent enterprises, both, those from national economy as well, as those from the system of consumer cooperatives, we can mention, that the main direction of anticrisis management, consists in financial restructuring.

It is well known, that any management decision, is taken, when the results are still not known and information is limited, therefore, should be considered some principles of risk reduction, namely: you should not risk more, than allowing your capital, you must not forget ,about the consequences of the risk, do not risk more, in order, to obtain less.

4. The elaboration and implementation of stabilization programs, as a mechanism for enterprises management, being in an insolvent state.

The financial condition of the enterprise stability is in a relationship with bankruptcy and with the aim of avoiding financial crises. Thus, each company is imposed to develop a strategy that would allow operation, in a timely manner.⁴

The process of formulating a strategy of avoiding financial crisis, must take into account the managerial policy, regarding to the organization and production process, marketing policy, investment and personnel management.

In turn, management policy combines, production management, technical and scientific policy, technology policy, politics assortment and producing competitive goods.

So, through organizational management, is carried out the direct management of the company, taking into account the main goal of reaching it, namely expanding market segment.

This objective is confirmed by position of launching on the market, of certain types of products. As an element, we can mention, the operative management, which involves determining the conditions and means, that ensure supporting process of execution, stimulate industrialization trends, in production and maintenance of scientific potential and personnel employed, in order to avoid crisis.

For performing functions, that underlie the organization of the production process, it is necessary to take into account, a multitude of factors, namely: ecological, territorial, social and economic, as well as plans and programs, relating to the future development of both, the enterprise data, as well as, associated businesses, that can ensure, the normal operation of the economic agent.

Referring to the investment process, for a relatively short period, we highlight that, it consists in the elaboration and implementation of programs, on renewal of the technical potential, creating stocks of material resources, by an appropriate volume, training and retraining of managerial and production staff.

⁴ Гаген А. (2007) *Антикризисное управление предприятием. Основные моменты*. Информационное Агентство "Финансовый Юрист, from http://www.financial-lawyer.ru/newsbox/economistu/financial_management/132-528135.html

Concerning the solving problems, related to a long-term funding initially, it is assumed a preventive analysis, regarding to the study of marketing, under which is determined the production potential, that would ensure market demand simultaneously, it is necessary to examine the possibility of the company placement.

The organization of the exercise process includes:

- the establishment of modern manufacturing processes of production and creating the best placement of the enterprise;
- developing such a management structure and production of the enterprise subdivisions, that would allow to achieve the best results.

Technical and scientific policy is based on the intangible management assets, which are: patents, licenses, trademarks, information assurance, improvement measures of the exercise process, new scientific and technical elaborations etc.

To achieve the objectives set, and the appropriate use of these assets by insolvent enterprises, are necessary the processes of inventory and analysis, of the effectiveness of using the scientific basis and the development of the appropriate management measures, related to intangible assets.

The positive effect obtained in the process of exercise as a rule, is determined by increasing the level of use, within the enterprise data assets. Another very important particularity for enterprise is referred to the investment attractiveness of intangible assets. They serve as the basis, for ensuring the appropriate level of liquidity, and for determining the type and degree of risk, for the elaboration of measures, for preventing the risks of investment projects. Mechanism of the elaboration strategy, for avoiding insolvency and financial crises, stipulates preventively, purposes of, technical, and scientific and technological policy. In this chapter, we can note, that the main goals are:

- the formation of a progressive structure of production;
- implementation of new technologies as the basis for increasing the competitiveness of the products offered on the market;
- the potential use of the applied sciences and innovation support.

Technical integrity of science and technology policy within the enterprise, contributes to attracting investments and project financing of technical renewal. In planning for the financial reconstruction, the enterprise must provide for the use the advanced technologies.

For supporting its vitality, the company, is imposed to renew the production assortment, proposed permanently to consumers. Taking into account the possibility of offering basic and auxiliary assortment, ia goods, which depends largely on the scope and level of production, investment size and know-how.

Taking into account the crisis situation of the enterprise, it is necessary to elaborate policy measures assortment, increasing the volume of production that can be presented on the market. For this purpose, it requires traditions analysis and consumer requirements, the possibility of using new technologies and expansion of production potential.

Simultaneously, it must be determined the marketing mechanisms of production, and the possibility of organizing sales procedure, through the third parties.

Organizing the activity on avoidance of financial crises, requires the implementation of measures, for restoring the production process, determination of the optimum parameters of the activity, assessing the possibilities for an efficient use of surface, analysis the production base of technological processes, costs, related to the enterprise supply, with the necessary resources etc.

As a separate direction, of enterprise managing ,in a state of difficulty, it can be highlighted the elaboration problem of a financial reconstruction plan, which must be based on a complex set of measures, related to the formation of an optimal marketing strategy. Under this strategy, related to the avoidance of crisis, is highlighted the following⁵:

- assortment policy, including policy renewal nomenclature, based on the analysis of enterprise competitiveness;
- optimal pricing policy;
- Promotion Policy for goods and stimulating sales.

The marketing strategy should be based on the cost recovery marketing programs, both entirely, as well as its component parts.

As the particular problem, it can be highlighted the marketing strategy, which is a complex of activities, which represents a system of views and actions, related to the study of the needs and possibilities of exercise process, and the exchange of manufactured products, with the aim of meeting their market demand, using a minimal volume of resources and ensuring as full effect of consumption.

In this case, vision system, ie the concept of management under current conditions, must be oriented towards consumer.

This requirement is implemented in practice through marketing related tools, which are based on a special technique, for the analysis of market processes.

Thereby, marketing as an integral process, which represents the theory and practical management tool of the market economy at microeconomic and macroeconomic level.

Marketing programs require the elaboration of a strategy, which could correspond to the state economic policy, and at the same time, would ensure the commercial structures, an adequate level of efficiency, cost effectiveness and material incentives.

Using marketing methods, allow coordination of interests and goals of entrepreneurship of management structures, with the purposes and state interests, which ultimately, will contribute to the economic development and for diminishing the risk of bankruptcy.

Management activities, permanently, is faced with the problem of balancing the necessities and the needs of the real possibilities of their sufficiency; distribution of resources for fulfilling the particular economic tasks, ensuring the appropriate level of efficiency.

For the study of marketing, it is necessary, the use of planning procedure, as a management flexible lever, of the market process.

Marketing tools – offer. audition, price, being the main market regulators, are in a permanent correlation, reflects the law of supply and demand actions, ia their level of balance and compliance, in the viewpoint of volume, structure and period.

A frequent analysis of market segment and its expansion possibilities and forecasting the changes in the main market instruments, enabling enterprise in time, to form a strategy for avoiding the financial crisis.

5. Conclusion

So far, the financial crisis management of the company was constrained by the insufficient development of information base, in this direction.

⁵ Zugrav, I. (2009). *Reflecții privind insolvabilitatea întreprinderilor sistemului cooperației de consum și perfecționarea mecanismului de gestionare a acestora*. Unpublished doctoral dissertation, Trade Co-operative University of Moldova, Republic of Moldova

In this context, not only native experience, but also the global experience, has shown that, the use of crisis situations management, is quite difficult from the practical point of view, ie, it requires a development and perfection in the methodological plan.

This would allow a more profound understanding of the crisis phenomena that underlie the causes of occurrence at enterprises, at the same time, it would generate a more appropriate reaction, upon the crisis factors, that endanger the attainment of the objectives;

Finally, it would ensure the increased efficiency of anticrisis actions and measures, applied by economic agents. In the current conditions of the domestic economy, this is one key issue, determining in a large extent, the survival of businesses in the national economy.

The global crisis of the recent years has made the financial risk management, to become one of the most popular terms of the economic life. The situation difficulties are confirmed by the worsening of financial state of enterprise, of the losses increase, and of the number of firms, being on the brink of insolvency.⁶

This makes an extremely actual issue, of the efficient management organization of the enterprise activity, to choose the management methods of crisis situations, and its transformation into an effective tool, of the entrepreneurial activity.

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⁶ Mihalachi, R. (2012). *Gestiunea situațiilor de criză financiară la întreprinderile din Republica Moldova*. Unpublished doctoral dissertation, Republic of Moldova

Searching for optimal financing opportunities for cooperative enterprises in adverse economic conditions

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Abstract. In the current economic situation, achieving financial stability is an essential condition to every company, regardless of property form or their field of activities. This is even truer for the entrepreneurs or for cooperative consumer enterprises that are facing cash flow problems often. Identifying optimal financing sources is not an easy task, but every financial manager should give special attention to this issue. In practice, there is not a universal recipe of the optimal financing structure but, in this paper, we will try to present some theoretic aspects on this subject and identify some financing solutions for the local consumer cooperatives enterprises. Internal financing, borrowing and/or equity issue, which is the best alternative to raise money or improve the cash flow for the entrepreneurs and cooperatives in the Republic of Moldova.

Keywords: *financing, debt, plowed back, equity, cash flow*

1. Introduction

Any company has to adapt to the business environment where activates, maintaining at the same time the internal cohesion and reducing the risks implied by transformations generated through the internal and external factors. Obviously, it is vital for any company is vital to be wisely financed in order to function properly.

Financing a company is the process of gathering financial funds from different sources, in the determined conditions, reimbursable or not, at a specific cost. Choosing the right financing sources for the cooperative enterprises is crucial, because the capital, borrowed or equity, implies costs that are reflected directly in the financial results of those entities.

The ratio between equity and borrowed capital has a significant impact on the financial performances of the cooperative enterprise because they have different characteristics such as costs, maturities etc.

Depending on the specific activity area of the cooperative enterprise, different sources of financing are used. Experience, observation and systemic analysis of the financial markets play an important role in deciding which financing sources are the best for the consumer cooperative enterprises.

2. General consideration regarding the financing of the consumer cooperatives enterprises

The adverse economic conditions, that manifested in the past and still exist in the national economy, have deep implications on the economic activity of the consumer cooperative system from the Republic of Moldova. From this perspective, the consumer cooperative enterprises need to permanently and carefully trace any negative conditions that can result in potential threats to the cooperative consumer enterprise.

The problematic financial situation of the cooperative consumer enterprises is determined, to some extent, by its own characteristics: statute, ownership, democratic member control, social orientation, management hierarchy, multiple management strategies etc.

Empirical analyses and theoretical research indicate that any enterprise has the following goals: survival, maintaining an optimal liquidity level, satisfactory balance sheet structure, profitability and, finally, maximization of the enterprise value.

The enterprise development is influenced by the proposed strategies and objectives. The ultimate objective of an enterprise is represented by the profit that can be distributed to the owners or retained for future investments in new equipment, new technologies and so on.

The cooperative consumer enterprise is one of the few associations of different individuals that do not have an objective to obtain the maximum profit, but the satisfaction of the material and spiritual needs of its members under the condition of reimbursement of the expenses. Therefore, we can observe that the main financing sources for the consumer cooperatives enterprises are the membership fees and the profit that results from their activities.

The economic reform regarding the consumer cooperatives system ruined the production planned system related to the commercial relations, determined the reduction of agricultural and industrial production, disturbed the financial and monetary system and resulted in increased prices. Moreover, the state has stopped regulating commerce and acquisitions, passing from planned relations to contractual relations with the consumer cooperatives. This fact had a negative impact on the financial situation of the cooperative enterprises and on their unions. The cooperative enterprises were not capable to fully adapt to the market economy rules and now they have found themselves in a difficult financial situation characterized by low liquidity.

The consumer cooperatives are still running in Moldova based on the old system. The commercial activity often is not profitable and the introduction of the payment in advance forced many cooperative organizations to sell enterprises in order to obtain working capital, because the interests on the loans were too high. As a result, it might be necessary to use short term financing that will increase the net working capital and would accelerate the insolvency.

At the same time, powerful competition arises for the consumer cooperatives that tend to monopolize the market and to push out the cooperatives even from their traditional segments: buying and processing the agricultural products, selling in the rural areas etc.

The consumer cooperative enterprises are not able to perform their activities unless they dispose of the resources, like physical and human capital. Physical capital, that includes financial and real assets, is involved in a continuous process of transformation through which financial assets are converted into real assets and vice versa. Financial assets are necessary for buying real assets and human capital, while real assets together with the human capital are producing goods and from their selling they get the financial assets.

The efficient use of one enterprise resources requires that every monetary unit that was invested has to bring profit and not to exist unused assets. Therefore, the exact estimation of

material and financial resources , as well as getting them at the lowest cost, represent one of the main responsibilities of the financial management in any enterprise.

The peculiarity of the consumer cooperative enterprises is the fact that individuals can do better things in groups than separately.

Nowadays, the consumer cooperatives are facing a lot of problems in Moldova. First of all, the inflation that affects both, the buying and the selling price. Also, the inflation makes it difficult to correctly estimate the dynamics of changes in expenses and incomes. Altogether, these factors make it difficult to forecast precisely the efficiency of the cooperative enterprise.

Secondly, the production expenses record is not separate for inputs and outputs, and more than that, it would be necessary to conduct a separate record for every activity.

Evaluating the enterprise activity consists in evaluating their assets. In order to compare, the assets value they have to be evaluated at their current value. In order to evaluate the investment profitability we need to calculate the return on equity.

In the Republic of Moldova, like in other countries that were characterized by a centralized and planned economy, accumulating financial funds for starting an enterprise is a true challenge for an entrepreneur. The advantage of little competition in some areas is annihilated by the scarcity and limited access to the financing sources.

In addition to the importance of the accumulation of financial funds for starting a business, correct and complete financing represents an essential condition for the future development of the enterprise. The volume of the required financing depends on the type and the characteristics of each specific business.

If an enterprise does not have enough financial resources, it will make its survival on the market difficult, even if the acquisition and the selling process are well organized. From this point of view, we can mention that a delayed payment from a customer, can create a financial obstruction for the creditor who cannot pay his own obligations and this fact might lead, in some situations, even to insolvency.

3. Optimal financing opportunities for consumer cooperative enterprises

We can say that nothing created by the man is perfect. This is true also in relation to the management of the consumer cooperatives' activities. Even if, the decision appears to be perfect at the beginning, the rapid changes in the economy, on the markets or the imperfections of those who execute it, demand periodical corrections of this decision, and sometimes for the whole decision chain.

In our opinion, the main obstacle for a successful financial management of the cooperative enterprises is represented by one truly efficient investment policy. The economic growth can be achieved only through the reduction of the bureaucratic barriers, stimulation of the investments and reorganization of the insolvent enterprises.

In many countries, the development of the cooperative enterprises is done by innovation, while in Moldova cooperative entrepreneurship is in crisis due to wasting of the huge potential resources. This fact led to a significant decrease in the cooperatives contribution to the national budget and to the formation of the GDP.

In former times, in the planned economy the enterprises used to receive financial subsidies from the state without reimbursing them and often producing noncompetitive goods.

Today, the consumer cooperatives system is in full process of restructuring. The consumer cooperatives are searching for new forms and methods of activities, elaborating new organizational and management strategies, finding solutions for consolidating the relations

with the cooperative members, as well as for increasing the efficiency of the whole activity in general.

The financial situation of the cooperative enterprises depends on the sources of financing, internal available resources and their placement. According to the data available, the consumer cooperative system is characterized by the major proportion of equity in the total of the financing resources. At the same time, we can observe that in the consumer cooperatives system, little investments are made on the account of the long term debts.

After choosing the business idea and elaborating the business plan, follow the search and the accumulation of the necessary capital for financing the project. Depending on the specificity of the business, different types of financing can be identified and examined. Each of these sources requires a different approach and lately, a different management. Also, significant differences will be in the financing costs depending on each source.

Basically, any enterprise can choose between three main sources: internal financing, new equity and debt. The choice between these sources is a difficult task, especially between equity and debt. The managers have to find an optimal financing combination that minimizes the cost of capital and maximizes the enterprise value.

Easy to say, but we don't have a magic formula for finding this optimal capital structure. However the FRICTO analysis can help. FRICTO analysis framework was developed in the 1960' at the Harvard Business School and this is an acronym for six important factors that we can take in consideration when fundamenting the financing decision: Flexibility, Risk, Income, Control, Timing and Other¹.

The FRICTO analysis raises questions related to these factors and answering these can help the managers to better fundament their financial decisions²:

F - Which of the financing sources assures a better flexibility for the enterprise in case of difficult situations?

R - What is the risk level that the enterprise can accept?

I - What is the interest or dividends level that can be supported by the enterprise?

C - To what extent the current shareholders and the management are willing to share the property rights?

T - What opportunities can be found currently on the monetary or the capital market?

O - Which are other factors that can help find the optimal financing combination?

The majority of the financing, even in the United States³, but also in some other well developed economies like Germany, Japan or United Kingdom, comes from internal sources that are represented mostly by the plowback profit and the cash flow allocated to depreciation.

The optimal capital structure is difficult to be defined properly, because financing decisions are taken by persons, who act differently, according to their own perception of the business environment. The optimal capital structure has to lead to maximization of the enterprise value. This can be appreciated through the model that reflects the impact of the debt financing on the enterprise profitability. Thus, we have an equation with two unknown elements:

1. The weight of the equity in total capital - measured with the financial leverage. When the leverage is big, the debt is the same and the return on equity is high.

¹Kester G., McKellar J., Mulcahy J. (2010). *The Application of FRICTO Analysis to Making Financing Decisions in Practice: Two Case Examples in Australia*. Journal of the Academy of Business Education from <http://abeweb.org/proceedings/proceedings10/kester.pdf>

²Silbiger St. A. (2006). *MBA în zece zile*, București: Casa de Editură Andreco Educational Grup , p.214-215

³Brealey R., Myers S., Allen F. – *Principles of Corporate Finance*, 11th edition, McGraw Hill Irwin, 2014, p.349

2. The interest to be paid that directly influences the net profit. The enterprises with high debts have larger financial expenses and, in the end, the net profit will be lower. In this case, the return on sales will be lower and this will decrease the return on equity.

The economic growth ratio indicates the efficiency in using the assets and shows the changes in the sales and assets volumes. It is important for the enterprise to know the required effort to increase the sales and this is more positively perceived than the assets increase.

Regarding the flexibility, we can mention two approaches: a defensive one that is receptive and can adapt to all modifications in the economic conjuncture and an offensive one that offers the enterprise the opportunity to make changes in the internal economic environment searching for the most efficient investments.

Flexibility should impose to the manager a way of thinking that will permit him to efficiently allocate the financial resources. The main ratios that characterize the financial flexibility are: debt ratio, internal financing capacity, expenses structure, unused asset level.

The consumer cooperatives model, compared with other spheres of the national economy, can create a real climate to overcome the negative aspects regarding the goods sold on the market. This model focuses on serving the most vulnerable social categories with low incomes.

The consumer cooperatives model is based on the "open economy" model that can influence the dynamic of the evolutionary process that is characterized by an external "shock" which is supported by the system. We are talking, on the one hand, about the competition level in the private sector, and on the other hand, about the inflationist process. Among the most frequent characteristics that can highlight when evaluating the cooperative enterprises activities one can mention:

- enough incomes for the co-associated persons;
- principles of the democratic goals and activities;
- adopting special rules when dealing with the capital.

Taking into consideration that the activity of the cooperative system is done mostly on internal accumulations, this should be developed on the basis of innovation and investment policies that can ensure a structural orientation under the influence of the elastic demand of the market segment. This supposes the elaboration and implementation of a flexible model of activity that operatively adapts the production process, the commercial volume, the structure and quality of the liquid demand of the market

The consumer cooperative enterprises have to use, rationally and according to their destination, the investment and material resources, including those related to the acquisition of new technologies, creating a modern production flow that can keep pace with the competition. In the absence of this, it will be difficult for the consumer cooperatives system to get enough market shares from an already oversaturated market.⁴

In addition to the regular sources of financing, the cooperatives systems have their own mechanisms for financially helping each other's through associations, like the Central House of Credit Cooperatives.

The Central House of Credit Cooperatives is a credit institution that is created through the association of cooperatives in order to manage their common interests, to follow how the legal issues are respected, to supervise and control their administrative, technical and financial

⁴ Zugrav, I. (2009). *Reflecții privind insolvabilitatea întreprinderilor sistemului cooperației de consum și perfecționarea mecanismului de gestionare a acestora*. Unpublished doctoral dissertation, Trade Co-operative University of Moldova, Republic of Moldova

organization and functioning.⁵ As an example, we propose the following financial mechanism presented in the Figure no.1.

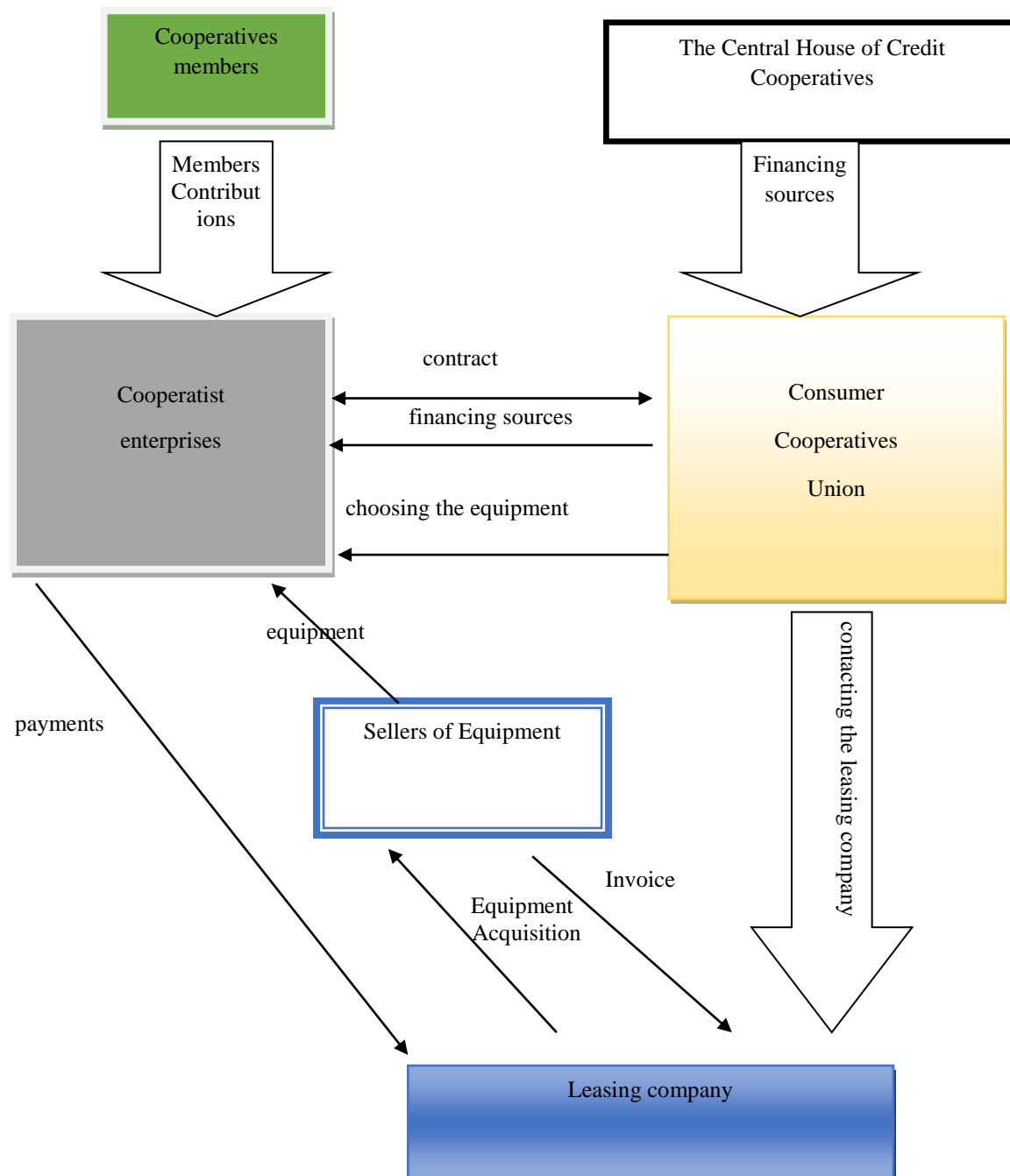


Figure 1 Financial mechanism of consumer cooperative enterprises

The liquidity of cooperative enterprises can be sustained with the help of internal reserves because the cooperative enterprises are limited in their opportunities of attracting financial funds. In crisis conditions, the increase in production and selling costs is usually more

⁵ Смирнова Н. (2011). *Что такое кредитный кооператив и зачем он нужен*. Новый бизнес: социальное предпринимательство. from <http://www.nb-forum.ru/business/advice/что-такое-кредитный-кооператив-и-зачем-он-нужен.html>

intensive than the increase in the profit of the cooperatives, derived from the assets and goods rotation.

Therefore, we can conclude that, ensuring the financial stability of consumer cooperative enterprises, in the strategic development stage, can be obtained when an equilibrium level is reached.

The maximal period of stable functioning, in the situation of a financial equilibrium, can be determined by the period corresponding to the equity increase with the values estimated based on the stable economic growth model. Any deviation from the ratios calculated can lead to the unbalancing of the financial situation and to insolvency.

The stable economic growth of an enterprise can be achieved through these main parameters, when they correspond to the estimated levels, such as follows:

- the coefficient for the return on sales;
- capital structure policy formation, reflected with the aid of financial dependence coefficient;
- assets policy formation, determined by the assets rotation ratio.

By changing any parameter related to the financial strategy, the consumer cooperatives can achieve different levels of economic growth in the financial equilibrium conditions.

All the parameters of the economic growth are fluctuating over the time. From this point of view, in order to ensure the financial equilibrium one enterprise has to make periodical corrections, taking into consideration internal development conditions, changes on the financial markets and other factors from the external environment.

Therefore, the financial strategy parameters of the consumer cooperatives enterprises system regarding the stability and development process have to be accordingly corrected, taking into account the increasing opportunities of the equity. In these situations, the financial stability is considered to be achieved, if following the increase in economic growth, the equity increase is ensured in the future periods.

4. Conclusions

Any enterprise can finance its activities from three main sources: internal financing, equity and debt. As we saw before there is no magic formula for the best financing combination, but we have indicated some important principles to take into consideration when making the financing decision.

The financing of cooperative enterprises has some particularities compared with other types of enterprises. We saw that internal financing represents the major source of cash for investments for most of the companies, even in the most developed countries. This is even more important in case of the consumer cooperative enterprises that have no pressure to distribute dividends, so that they can almost always plowback the profit, which together with the cash flow allocated to depreciation represents the most important source of financing.

Internal financing offers many advantages for the consumer cooperatives: it is the cheapest source of financing, you don't need to pay interest on it, and you don't have to share control or ownership with others and so on. Thus, this financing source offers flexibility, safety and independence. Also, this is an advantage in the perspective of attracting external financing, proving that the enterprise is serious and uses wisely its own capital.

As the main external financing source, debt can come in many forms: various loans, bonds, payables, leasing and so on, with different interest or maturities. Out of these, we consider that operational leasing represents a good financing opportunity for the consumer cooperatives, because in this case they do not have to block too much capital in assets.

A good form of loans for cooperative enterprises is the loans that can mutually borrow one from each other or from their associations. In the short term, financing with payables can be a solution in difficult times, but for limited periods and with their agreement. Also, financing with receivables, notable through factoring, can be a short term financing solution for the cooperative enterprises.

In the entrepreneurial activity of the consumer cooperative enterprises, they can find themselves very often in difficult financial situations. That can be the result of wrong financial decisions and incorrect actions with major impact on the financial resources of the cooperative, which can lead in extreme situations, even to insolvency or bankruptcy. Therefore, finding the right financing solutions is vital for the consumer cooperative enterprises, especially in difficult times.

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Investments and venture capital as an option to development and innovation in the consum cooperative enterprises from the Republic of Moldova

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Abstract. Currently, the success of ensuring economic growth firms in the consumer cooperatives of Moldova is totally dependent upon the technical modernization and restructuring potential, which is bounded by increasing funding opportunities and investment projects that can be performed through investment and venture capital. The use of venture capital investment requires the preparation and implementation of investment policies related to investment potential, which allows selecting the optimal financing, taking into account the cost effectiveness and risk. Financing investments is a significant step in the investment process, in which financial resources are embedded in the investment budget and can be used to achieve the project following the investment decision. Efficiency investment process is influenced by the amount and quality of resources and the size of the output of enterprises. But in terms of economic instability, namely the opportunity of undertaking investment policy depend potential enterprise level providing technical, structural reorganization possibilities. Based on this reason, venture capital investments impose to elaborate, to develop and implement an investment policy related to the enterprises investment potential and economic growth. One of the innovative ways in RM and an important external source of financing investments other than bank financing is venture capital.

Keywords: *business, investment in venture capital funding, investment project*

1. Introduction

Currently, within the national economy, the servicing of the rural sector population is carried out by business structures that are part of the system of consumer cooperatives in Moldova. These entities represent a viable alternative for promoting the interests of the member of these cooperatives and for covering their consumer needs. Under the local Moldovan legislation, the consumption cooperation system is a system of cooperative organizations and cooperative enterprises designed to meet the needs of members of these organizations, and other consumer and the creation and development of infrastructure, expansion of consumer cooperatives, consumer protection.

Consumer cooperatives in Moldova represents one of the largest organized systems in the country. During its economic activity for almost a century and a half this system was stated as one of the most stable segment in cooperatives, impacting not only economic but also social. In this regard it needs to be mentioned that unlike other forms of cooperative activity, consumer cooperatives economy is highly social. It has continually expanded its areas of activity becoming permanent multi sectoral and developed its own infrastructure, which penetrates the entire geographical area of the country.

Currently the main focus of consumer cooperatives keep developing the main areas of activity, including: trade, public catering, procurement, investment activity, exports and imports of goods and products.

Implementation and development of market relations was accompanied by the development of competition in cooperative entities and could not face the first stage, and this resulted in downsizing of this sector and decreasing performance indicators of the business.

Thus, starting with commercial services providing for members and with selling varieties of goods, mostly goods for life necessity, the consumer cooperatives in the Republic of Moldova came to perform various activities whose development mostly depends on investment activity, which can be achieved by attracting investment and availability of venture capital instrument.

2. The methods and techniques of the applications

For preparing this study research were used various methods, including as follows: systemic, regulatory, statistics, dynamics, and other research methods such as synthesis; economic analysis; induction and deduction, dialectic applied knowledge aspect investigated and other processes, instruments and methods of economic research, such as statistical and economic comparison.

The methodological and theoretical research is the basic concepts of financial theory and economic concerning the possibilities of financing business structures laws and regulations of the Republic of Moldova and documents developed and adopted by the governing bodies of consumer cooperatives, Strategy development of consumer cooperatives and others.

3. Conceptual issues regarding the funding of the cooperative enterprises through investment and venture capital

The economic potential of a country, its ability to meet the needs of economic and social population, the place it occupies in the national economy and the extent of participation in the GDP depend on the efficiency of the economic activities of the business, in which a special place belongs businesses system of consumer cooperatives. Their activities are conducted in accordance with Consumer cooperatives Law No.1252-XIV from 28.09.2000, which in terms of sustainable development is influenced by increased competition, changes in technology, fluctuations in interest rates and exchange rates, inflation, loss monopoly held in rural areas that have major impact on sustainable development entities in the system.

The viability and efficiency of development of these cooperatives depends on economical and rational and prudent management of financial mechanisms, under which, among the most important is the investment process. Within the economic activities of the cooperatives these processes require rigorous quantitative and qualitative substantiation, as they prepare capabilities and production conditions to be achieved in the future and that are measured in terms of resources consumed for the purposes of project activities.

During the period of 2008 - 2014 years, based on the data analyses of the dynamic of economic activity of the consumption cooperative system of RM, which was performed using the consolidated balance sheet and financial information of the Central Union of Consumer Cooperatives in Moldova "Mold Coop", they have achieved the value of assets of 766.4 million lei, registering an increase from 27.8 million lei in 2013 year to 43.8 million lei compared to 2008. Total value of current assets of the cooperative system of RM at the end of 2014 is constituted of 235.1 million lei, which is high by 18.1 mln lei compare with the results of 2013. Comparing 2014 year performances with 2009 results, we can observe an increase of value of assets by 98.7 mln lei, while comparing with 2008 performances, we have observe an increase is only 16.3 million lei.[10]

The value of equity is increasing over the years from 442.9 mnl in 2008 to 471.7 million lei in 2014. The value of payables at the beginning of 2015 is constituted of 223.4 mln lei, increased versus the same period of the previous year by 17.8 million lei. Looking at bank loans in 2014 their value was at 23.4 million lei and increased by 1.0 million lei, and an decrease by 7.6 million lei compare with 2008.

The volume of turnover in 2014 constituted of 796.7 million lei, or 102.5% over the previous year. The volume of wholesale during of 2014 constituted 104.7 million lei, growing by 19.9 million lei or 23.4% compare with 2013. The volume of purchases in 2014 was achieved of 80.1 million lei, or by 103.9% more compare to 2013. The total volume of service income in 2014 amounted of 150.3 million lei or 106.5% compared to 2013. Gross profit from the sale of goods, products and services was registered the amount of 182.6 mln lei or 106.6%. The return on sales in 2014 was 20.7% compared to 20.1% in 2013 and to 2014.

Over the period of 130 years of economic and operational activity of Consumption Cooperative System of RM always has been and continues to remain as one of the largest non-governmental public organizations. To achieve and realize of its tasks, they need to ensure their growth and development of all economic aspects, the main ones being: trade, services industry and catering industry, including also the acquisition activity.

From this point of view the purpose of applying the financial mechanisms is in connection with optimal correlation between equity and borrowed funds; net profit and risks related to the objectives of solvency and investment portfolio flows; assets and the risks for each kind of asset in terms of their influence on each financial performance.

The success of investment activity is largely determined by its financial insurance and financial performances. Financing of investments is a significant step of the investment process, in which, following the decision making process of investment, financial resources are integrated in the investment budget and can be used to achieve the performances of the project.

The efficiency of the investment process is influenced by the amount and quality of resources and the size of the output of enterprises. But within of economic instability, the mean role are investment policy of the company, which depend by the technical potential of enterprise, the reconstruction capacity and depend by the level of assets capacity. For this reason, venture capital - financial investments impose the elaborate of and develop of an n investment policy related to the investment potential of enterprise and economic growth.[10]

Due to the fact that the main objective of venture capital instrument is to maximize profits, the companies must fully to identify and estimate the financing needs at the right time. This requires selecting the most appropriate way of meeting this need. When choosing this alternative take

account of a wide spectrum of factors, among which the most important are: the cost of capital raised, the return on his capital, in terms of maintaining financial independence, the level of risk. Recently, in practice the entrepreneurship, for the examination of investment funding issues can be used a variety of methods.

The simplest method is the profit achieved level, including ROA and ROE during the life cycle of the investment project, which compares the volume of investments. The method allows the selection prompt the projects, but does not allow to establish the project preferably in situations where several projects have the same amount of profit, but different sizes investment, whereas ignore such costs as depreciation and income from the sale of assets which are replaced with Other new possibilities for reinvestment of earnings, time value of money.[3]

The investment project net present value method is used when analyzing projects with different sizes of cash flows. But it is necessary to take into account the size of this indicator can not be considered as a criterion sure if the choice of project cost high initial and initial costs low in situations where projects are contrary to the terms of the actuarial value, net during recovery thereof. It does not allow to determine the safety threshold and the rate of financial return of the project. Method marginal efficiency of capital project involves updating value based on internal profitability. The drawbacks of the method are apparent both in complexity and by not always allow to highlight the most profitable situation, as it involves reinvesting capital at all the intermediate stages in the rate of marginal income.

In practice the use of these methods for evaluating investments allow entrepreneurs to appreciate some specific parts of the project, to highlight the specific nuances. In developed countries, to assess the effectiveness and determinations as to economic investment are used as methods that: comparing the amount of capital invested to the amount of income received during the life of the investment and comparing the rate of return of the project (ROR) interest rate, or other criteria like. In a market economy the organizational form of the investment process is the investment project, which is the basic document that determines the need for investment, describing the main features of the project and financial indicators related to its realization. The investment project is a comprehensive plan of action that includes substantiation of rationality investments aimed at widening, upgrading or training of a new mode of production of goods or services for profit or social effect hoped.[1]

Funding in this case is generally through fund participation in the share capital of the company. The investment fund is not interested in taking over the business, but reserves the right to be consulted on major decisions being taken in the company with the investment. In principle, an investment fund seeks to place a sum of money for a limited period, while high rates of return. Selecting the investment required in terms of projects studying the commercial, financial, technical, fiscal and personnel. After studies and evaluation of the main characteristics is possible to use financial criteria to investment decision. They can be selected a number of financial criteria for approving the optimal variant of the investment, including a special place belongs: profitability criterion, criterion of liquidity and risk criteria.

The profitability criteria is in connection with selecting of the best project investment is more favorable available funds. This is the most important criteria for the in order to approve the investment project. In this context, the return of assets ratio (ROA) should be higher than the cost of their own funding sources or borrowed. Net present value - the difference between the present values of future income streams and expenses.

Liquidity criteria. is the ability of the company to monetizing assets at its disposal. The liquidity criteria for selecting investment projects aims to recover the investment as soon as possible, ie the investor to take possession of the invested capital and profitability expected within shortest possible to use it to initiate other projects. Typically, liquidity is determined by number of years to recover the invested capital, reporting initial value of the project to the amount of the annual financial flow positive input or the exploitation project. If annual positive financial flows are unequal, then proceed to summing up year by year flows reach baseline or very close to it without exceeding it and the resulting number of years of recovery.

The risk criteria, currently, the performance of their entrepreneurial consumption cooperation system is characterized by complex and diverse industries, which are influenced by a complex of economic and social factors, such as rising prices for material resources, salary increase, variability of sales volume, increased competition etc. This phenomenon requires a balancing of the risk with the results of the enterprise, as acceptance of risks and their control is the key point in ensuring business performance. Such balancing is possible only if they are reasonable, can be controlled and not exceed the amount of financial means. Incorrect assessments of the risks or lack of possibility to oppose them sufficiently effective measures involve undesirable consequences for all business partners.[2]

From a conceptual aspects, the risk can be characterized as a set of methods, procedures and measures by which to behave highlighting, assessing and sizing consequences of its impact on his business. It can be characterized by the following features: it is an uncertain event, but possible, which is based on uncertainty; phenomenon manifests itself as detrimental, both materially and morally; its effects, once produced, can not be removed and can occur as a result of entrepreneurial activity. It is important to highlight that the theory and practice of global risk category as deals with a certainty of uncertainty, that even if there is the risk has some probability of manifesting.

When examining issues relating to risk, a primary interest posed questions regarding the diversification of risk categories in terms of the probability of their occurrence and extent of their impact on enterprise activity, the main ones being: economic risk, financial risk, liquidity risk, solvency risk and others. Examination of economic risk can be performed through a model that can be achieved on three coordinates: variability, cost and its treatment. Variability of losses reveals size, severity and size of phenomena producing all consequences of the loss and the cost of economic risk that assesses the size of expected losses for businesses.

Economic risk treatment includes set of techniques applied to reduce the consequences, and hence the cost of risk. These techniques consist of preventive actions, forecasting and risk transfer. One of the most effective technics administration and supervision of economic risks is the technique that was realized for the first time in the US during the '70s as "Assets and Liabilities Management" and was widespread in other countries, as' asset-liability management. " One such way is to look for the business management of all forms of manifestation of risk.

Assets and liabilities management tools (ALM) covers all financial risks (interest rate, exchange rate, liquidity, currency risk, risk of bankruptcy) and the methodologically involves the following steps: inventory, assessment, strengthening financial risks that their coverage through options depending on the degree the risk that the bank is exposed.

The financial risk reflects the sensitivity of earnings to changes because financing conditions of business entity. He is the risk borne by the owners as a result of the company's decision to use borrowed capital. Financial risk assessment policy must design an appropriate mechanism for

assessing the possibility of accomplishment and risk prevention. For cooperative enterprises in the interest of operational risk measurement methods, ie the probability that the volume of work will not cover the total expenditure incurred due to their structure. In this case, the procedure of risk analysis involves distribution costs compared to the dynamics of production costs and expenses variable nature of conventional constant.

In terms of ensuring the company's financial performance very important is liquidity risk estimation problem, which reflects the probability that the company will honor its obligations to business partners due to maturity disconcordanței resources collected with maturities of investments made. The indicator reflects the possibility of losing part of the value of the claim or to devalue its total non-performance due to the payer. Getting liquidity A greater effort to improve the performance and efficiency of the indicators and methods for determining resource needs by calculations based forecast. Therefore, the main task of the economic entity is to estimate and fully cover liquidity needs provided for.

No less important for the enterprise is the solvency risk or overall debt ratio (debt-to-Assets Ratio), which measures the company's assets financed by debts. A higher value of this indicator means that high indebtedness or financial risk and higher probability of bankruptcy. In examining the issues concerning the size and scope of hedging, we note the need to examine quantitative and qualitative indicators of the risk, the causes of and possible consequences resulting from the impact of various risk categories on the output of cooperative enterprise.

From this point of view, the quantitative assessment is established likelihood of identified risks, the size of losses, the impact of different factors on the risk situation and the qualitative assessment identifies provocative actions risk zones are established risk, changing its dynamics, is outstanding statements related to achieving positive and negative risk decision. No less important is the problem of determining the size of tolerable risk, which will allow you to compare the result with the optimum size for a specific situation.

We have recorded that in order to assess risk and determine the effects of the level of risk you can use a set of methods and systems of indicators. This phenomenon requires management companies to analyze the types of risk in terms of the worst possible scenario. To function optimally, permanent cooperative enterprises must ensure a balance between profitability, liquidity and risk.

In terms of practicality in entrepreneurial activity, any strategy must have both performance programs and management procedures and risk assessment to minimize the likelihood of them oriented. [8]

Thus, at present, the main objective of entrepreneurship, is to maximize the company's market value and minimize risk. However, the impact on the efficient functioning and economic growth potential firms in the consumer cooperatives timely returns of investment policy and directions for use of spectrum resources investment.

In order to evaluate the results of the investment, in addition to indicators is required and a financial estimate on the dynamic characteristics of business as a result of the use of invested capital. This study should be conducted in terms of ensuring efficiency and stability of enterprise operation. Therefore, there is need to develop and use a financial model quasi-static, would appreciate such as "getting profit from sales", "the plight of Business", "leverage operational and financial", "financial leverage" etc. [10]

Therefore, in order to correctly assessing the financial performance, it is useful to implement a full financial model for estimating the efficiency of invested capital, which includes the following three models: the financial situation; Circuit model of resources and effective model of ownership

and sales. It allows to obtain information on the results of the lower level to the upper hierarchy in terms of dynamic, static and quasi-static. Economic policy promoted in the consumer cooperatives will support the development of all branches of activity of this system and encourage the initiation and development of other fields necessary to achieve the objectives of the cooperative. The support for economic growth and sustainable development will ensure investment in fixed capital, rehabilitation of the industrial, commercial and financial management efficiency and Heritage, which will increase the volume of turnover. Implementing innovative strategies is related to the high volume of investment. According to economic theory profitability of the enterprise is directly proportional to the size of capital investment. Taking into account the specific investment project dynamics and meeting the difficulties in assessing the viability of each stage of the project, we propose the system for evaluating the effectiveness of investment strategies to be considered in dynamic while under the influence at every stage of the project. At the moment t_0 for elaboration of investment project, the profitability of the investment project can be calculated/estimated in according to the following formula:

$$R_I /_{t=t_0} = \frac{\int_{t_4}^{t_8} \frac{CF_t^0(t)}{(1+k(t))^t} dt}{\int_{t_0}^{t_4} \frac{I_t^0(t)}{(1+(t))^t} dt} \quad (1)$$

where $CF_t^0(t)$ means volume of forecasted cash flow during the period t_4 - innovating marketing phase and up to the time t_8 - amortization at the end of on completion of the operation stage product innovation; $I_t^0(t)$ - Forecasted investments during t_0 function – indicates the moment when the project preparation stage innovation is initiating and t_4 – means the stage of finishing the investments; $k(t)$ - function change in coefficient of analysing period.

Also is not overlooked the probability of obtaining $RI/t=t_0$ the result of profitability P ($R_I/t=t_0$). Simultaneously need to estimate the expected effect of trading following the implementation of investment strategy, means the difference between costs and results of operation of the system:

$$E/_{t=t_0} = P/_{t=t_0} - S/_{t=t_0}; \quad (2)$$

where $P/_{t=t_0}$ - is the estimated economic and financial results at the moment t_0 for the period $T_{8-4} = t_8 - t_4$ of implementing the investment project; $S/_{t=t_0}$ - the forecasted value of expenditures of financial-economic activity of the entity at the time t_0 for the period T_{8-4} .

After finishing of the first phase of investment project the duration $T_{1-0} = t_1 - t_0$, additionally need to made a forecast of the project profitability based on the data from the period T_{1-0} used in the following formula:

$$R_I /_{t=t_1} = \frac{\int_{t_4}^{t_8} \frac{CF_t^1(t)}{(1+k(t))^t} dt}{I_{1-0} - \int_{t_0}^{t_4} \frac{I_t^1(t)}{(1+(t))^t} dt} \quad (3)$$

where $CF_t^1(t)$ means the volume of forecasted cash flow at the moment $t = tI$ for time period to time T_{8-4} ; I_{I-0} - means real investment amount during the period T_{I-0} ; $I_t^1(t)$ - means the investment function currently forecasted for the period T_{4-1} .

Simultaneously calculates the probability of obtaining $R_{I/t=tI}$ the result of profitability $RI/t=tI$ $P(R_{I/t=tI})$ and projected the effect of operational activity:

$$E_{I/t=tI} = P_{I/t=tI} - S_{I/t=tI}; \quad (4)$$

where $P_{I/t=tI}$ - is the projected economic and financial results for the period T_{8-4} currently functioning investment strategy; $S_{I/t=tI}$ - Expenditures of the forecast value of financial-economic activity of the entity at the time tI for the same period T_{8-4} .

But it should be noted that the actual situation it is necessary to analyze the dynamic influence on the profitability and the expected effect.

The next stage sizes are determined deviations calculated with the planned and predicted:

1. profitability deviation within the first phase of the investment project:

$$\Delta R_I(t_{1-0}) = R_{I/t=tI} - R_{I/t=t0} = \frac{\int_{t_4}^{t_8} \frac{CF_t^1(t)}{(1+k(t))^t} dt}{I_{1-0} - \int_{t_0}^{t_4} \frac{I_t^1(t)}{(1+(t))^t} dt} - \frac{\int_{t_4}^{t_8} \frac{CF_t^0}{(1+k(t))^t} dt}{\int_{t_0}^{t_4} \frac{I_t^0(t)}{(1+(t))^t} dt} \quad (5)$$

2. comparison of the achieved profitability with the forecasted data:

$$\Delta P(R_{I/t=tI}) = P(R_{I/t=tI}) - P(R_{I/t=t0}); \quad (6)$$

forecast of the deviation $\Delta E_{I/tI-0}$ when $t = tI$ taking into account the reference of the results conducted by developing and implementing investment strategy:

$$\Delta E_{I/tI-0} = E_{I/t=tI} - E_{I/t=t0} \quad (7)$$

The next step is realising the control of deviations compare with the prediction obtained from:

$$\Delta R_I(t_{I-0}) \nabla \delta_R, \quad (8)$$

where δ_R - is admissible deviation of projected profitability, where the company is not need to change their investment strategy. In case $\Delta R_I \geq \delta_R$, forecasted profitability increases or still to the same level. In our point of view, for the companies on the one hand is positive result, on the other hand, increased profitability should be constantly checked. The development and implementation of investment strategy arises normally when $\Delta R_I > \delta_R$ și $\Delta P(R_{I/t=tI}) > \delta_R$ and the companies can analyze the effect of innovations. In the situation when $\Delta R_I > \delta_R$ și $\Delta P(R_{I/t=tI}) < \delta_R$ the enterprise must analyze the factors that influenced the decrease in profitability projections.

Thus, the algorithm constitutes the basis of the evaluation of the efficiency system and investment strategies and can be implemented for assessing the effectiveness of investment projects in the Moldovan system of consumer cooperatives.

At present the choice of any external sources of financing must be a serious argument, since the investor must predict the consequences of debt settlement formats and this influence on the final results of its work. Financing investment has a content unit, but complex, reflecting the use of resources in connection with the technique of their formation and mobilization. It represents a

significant stage of the investment decision, in which financial resources are embedded in the investment budget and can be used to achieve project investment

The mechanism of financing investments involves several actions regarding:

- Determination of financing;
- Establishing appropriate capital structure;
- Assessing the cost of resources for financing medium and long term.

External financing is an alternative for investors when the self-financing capacity is below investment program. This is ensured by banks, investment institutions, public sector bodies and private. One of the innovative ways in RM and an important external source of financing investments other than traditional funding source in the form of bank credit is risk capital (venture capital). [7]

Facilitators financial theory made clear references to financial risk, having one at the center. Scientists F. Modigliani and M. Miller in his works have analyzed the formation of revenues under risk. This research was continued by M. Miller who formulated a new concept called "risk capital" (venture capital). According to this scholar's vision is venture capital available to the company's long-term unsecured (ie only based a business plan and the prospects for profit enterprise). This capital can be helpful, especially for businesses that can not be listed.

The competitive advantage of venture capital to the investors strategy has addressed the manner in which enterprise development investee as this capital does not require collaterals instead. Unlike strategic investors seeking to maintain its share of participation of venture capital funds provide businesses a means of financing the system in order to develop them. Venture capital funds provided by investors, are a category of private capital attracted by enterprises for their business development. As investors may be equity partners include persons and institutions possessing a large amount of capital and funds diponibil private or state pensions, donations, foundations, insurance companies, investment funds, called mutual funds.

Unlike traditional financiers (banks, etc.), venture capital bidder get a profit from the growth and high profitability of an enterprise. Traditional funders claim interest and repayment of term debt, regardless of the existence of a profit or loss.

Usually the process is performed by changing the financing of venture capital on a considerable part of the package of shares in an amount that may vary between 20% and 49%, or a share capital funded company. In practice, the most commonly used form of investment Joint venture, whereby part of capital funding is allocated as a shareholder other form of investment credit. As it is usually the medium-term investment and involves a high degree of risk.

Venture capital is reimbursed only at the end of the investment period and do not generate interest costs, so there appears no free cash-flows. Bidders capital are business partners that supports its risks and supporting the experience and advice.

Thus, venture capital ones is constituted capital, usually from the contributions of investors, which represent an important source of funding ăntreprinderilor growth prospects, but no money. Individual investors can buy financial instruments programs providing venture capital companies or invest in investment funds specialized in this field.

As a holder of a part of shares of the company capital, venture capital investors will share the risk for the business. This type of financing is conducted principle of risk spreading between the owners of capital. Given the high degree of risk, investors will show interest only if convinced that there will be real opportunities for obtaining a high return on its investment.

This type of business financing has become an important development in recent years and is advantageous in many ways, being used especially for small firms at the beginning of the road. Equity participation in a new business called venture capital funding (venture capital) and it is provided by specialized companies, individuals or investment funds.

Getting venture capital financing is not easy. The first step is to prepare a business plan. It describes the product, market potential, production method, the necessary resources for the business to succeed. When developing a business plan, it is important to those wishing decision of such type of financing to invest money in the business itself, providing an important signal about the confidence it has in the success of the business. Venture capital can play a vital role in financing firms in the consumer cooperatives in Moldova through capital injections (in exchange for their share) higher than they are willing to invest, usually, business angels.

A type of venture capital investment is desirable and multiplier effect: after ensuring rounds of financing from a venture capital fund recognized, access to financing and other credit type financing becomes easier. However, in the current economic situation, venture capital remains, as well as other funding sources, often inaccessible.

The competitive advantage of venture capital to strategic investors lies in the manner in which it approached the development of enterprises in the system. Venture capital funds are financial partners. Normally, unlike strategic investors, funds in their portfolio no similar business activities and operates similar businesses in which they invest.

Strategic investors and venture capital funds presents the diferent time of horizons on investment in an enterprise. To capture the interest of the investor, the entrepreneur must demonstrate a knowledge of the industry and the firm's operations, ability to present business convincingly knowledge of financing alternatives through capital investment, the ability to reduce risk perception by investors .

Compare with traditional financiers (banks, etc.), venture capital investors get a profit from the growth and high profitability of an enterprise. Traditional funders claim interest and debt repayment term, irrespective of the existence of a profit or loss. The profit made by the tenderer risk capital depends on company profits.

Based on the tipe of destination highlights several categories of venture capital as follows:

- Seed funding: the development and application of a concept in enterprise, one prototype production and financing the research, before the product is ready for market.
- Start-Up Financing: Financing for product development and implementation of a marketing concept, nmai especially for new enterprises, which are the foundation and there is even less time, without having sold products.
- Funding for Expansion for the growth and expansion of established companies (finance increased capacity, product development, market, etc.)

Thus the benefits and advantages of the venture capital funding are:

1. possibility of funding when other resources are not available;
2. Do not pay interest or installments funding for the period for which the contract was signed original financing;
3. collateral is not required;

4. financing solution in situations where it is considered that leverage loans would limit the growth of businesses;
5. helps maximize company value by improving the structure visible through financial and strategic advice;
6. increase business visibility for customers, partners, other investors.
7. venture capital is less present in Moldova, but with the right incentives from the state, such funding could develop visible.

4. Conclusion

While venture capital funds have become increasingly important external source of financing that remains fragile. Venture capital sector in Europe does not benefit fully from a single market and is also less profitable and efficient than in the US.

In order to increase the number of foreign operations, it requires a regulatory framework more flexible and adaptable that would help reduce costs and increase fund structuring venture capital flows in Europe.

A uniform European approach would be for investors in venture capital to be treated in the same way as direct investors in each investee company important.

Venture capital companies would benefit from more efficient operations, both in terms of attracting funds and in terms of investments, enabling them to benefit from economies of scale and specialize.

In order to correctly assessing the financial performance, it is useful to implement a full financial model for estimating the efficiency of invested capital, which includes the following three models: the financial situation; Circuit model of resources and effective model of ownership and sales. It allows to obtain information on the results of the lower level to the upper hierarchy in terms of dynamic, static and quasi-static.

Economic policy promoted in the consumer cooperatives will support the development of all branches of activity of this system and encourage the initiation and development of other fields necessary to achieve the objectives of the cooperative. And support for economic growth and sustainable development will ensure investment in fixed capital, rehabilitation of the industrial, commercial and financial management efficiency and Heritage, which will increase the volume of turnover.

Venture capital can play a vital role in financing firms in the consumer cooperatives in Moldova through capital injections (in exchange for their share) higher than they are willing to invest, usually, business angels.

A type of venture capital investment is desirable and multiplier effect: after ensuring rounds of financing from a venture capital fund recognized, access to financing and other credit type financing becomes easier. However, in the current economic situation, venture capital remains, as well as other funding sources, often inaccessible.

European venture capital markets are more efficient that could promote growth and competitiveness, to contribute in particular to the creation of new jobs, the design and use of new knowledge and technologies.

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Financijska ponašanja dobnih skupina

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Sažetak. Stanovništvo u Republici Hrvatskoj prema različitim istraživanjima provedenim od strane OECD-a i drugih relevantnih institucija pokazuje nisku razinu financijske pismenosti. Promjene društvenog uređenja, orijentacija prema tržišnoj ekonomiji u posljednje dvije dekade unijele su čitav niz promjena u poziciji odgovornosti pojedinca za svoju financijsku budućnost. Odlazak u mirovinu predstavljao je u prošlim vremenima ulazak u period života koji su karakterizirali smanjeni, ali dostatni i sigurni prihodi. Međutim, današnje vrijeme uz čitav niz nepogodnih demografskih trendova, visoku stopu nezaposlenosti, usporen gospodarski rast, stavlja pred sektor stanovništva nove uloge odgovornosti u pogledu financijske budućnosti svakog pojedinca. Poznavanje financijskih proizvoda i njihovih performansi važan je korak u kreiranju zrelih financijskih odluka. U ovom radu istražit će se financijsko ponašanje pojedinaca pripadnih različitim dobnim skupinama.

Ključne riječi: *financijsko ponašanje, financijski proizvodi, financijska reforma*

1. Uvod

Na današnjem dinamičnom i složenom financijskom tržištu, financijsko obrazovanje mora biti cjeloživotna potraga koja omogućuje potrošačima svih starosnih dobi i financijskih položaja da ostanu usredotočeni na promjene koje se pojavljuju u njihovim financijskim potrebama i okolnostima te da iskoriste proizvode i usluge na način koji najbolje odgovara njihovim potrebama.

Financijska edukacija važan je proces koji omogućuje svakom pojedincu da unaprijedi svoje razumijevanje financijskih proizvoda i svih informacija koje su s tim povezane, a kojima se pridonosi razvijanju svijesti o financijskim rizicima i mogućnostima. S obzirom na razvoj financijskog tržišta i svakodnevnu pojavu novih proizvoda i usluga, potreba za financijskom edukacijom sve je izrazitija i neophodna je za donošenje kvalitetne odluke o izboru pojedinoga financijskog proizvoda ili usluge primjerenih vlastitim mogućnostima i očekivanjima.

S obzirom na demografsku strukturu stanovništva RH vidljivo je da udio mladog stanovništva u procesu osnovnoškolskog i srednjoškolskog obrazovanja malen u odnosu na zrelo i staro stanovništvo, tj. preostaje još veliki broj građana koji neće biti u mogućnosti se upoznati s pojmom financijske pismenosti kroz redovno osnovnoškolsko i srednjoškolsko obrazovanje već će se o tome morati samostalno educirati.

Kako bi se primjereno zaštitili pojedinci i podigla razina njihove financijske pismenosti, Vlada Republike Hrvatske pristupila je izradi Nacionalnog strateškog okvira te je objavila prijedlog

Akcijskog plana prema kojem bi se trebalo ustrojiti i provoditi sveobuhvatno financijsko obrazovanje pojedinaca svih uzrasta, od predškolske djece do osoba starije životne dobi.

U ovom radu istražit će se financijsko ponašanje pojedinaca pripadnih različitim dobnim skupinama te će se analizirati podaci iz ankete (istraživanja) koja je provedena u gradu Splitu na neprobabilističkom uzorku.

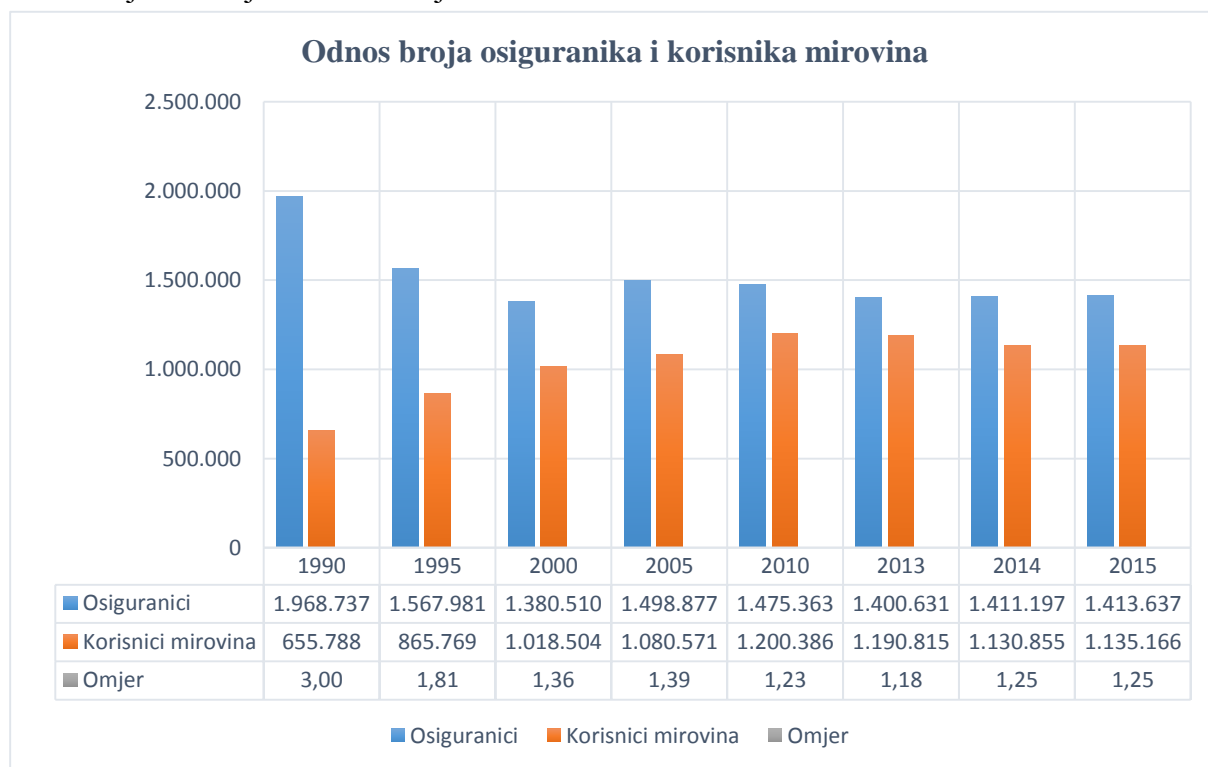
2. Financijska budućnost sektora stanovništvo u Republici Hrvatskoj

Posljednjih godina, zbog izrazite gospodarske recesije i problema s gospodarskim i tehnološkim viškovima radne snage, uočava se trend priljeva umirovljenika što ugrožava gospodarstvo, a mirovinski sustav dovodi do ruba. Mirovinski sustav se nalazi pred krupnim izazovima, kao što su negativni demografski trendovi, financijski pritisak radi postizanja konkurentnosti, promijene na tržištu rada te snažan otpor stanovništva u provedbi mirovinskih reformi. Sve to govori o potrebi konstantnog nadzora, analiziranja, otklanjanja nedostataka te u konačnici reformiranja postojećeg mirovinskog sustava.

2.1 Nepovoljni trendovi

Hrvatska mirovinska reforma provedena je 2002. godine zbog neodrživosti postojećeg stanja unutar mirovinskog sustava. Kao glavni razlog provedbe mirovinske reforme navode se nepovoljni demografski trendovi iako postoji čitav niz razloga. Nepovoljni demografski trendovi odnose se na povećanje udjela starijeg stanovništva u ukupnom stanovništvu te opadanje stope nataliteta. Kao posljedica toga dolazi do populacijske neravnoteže zbog koje malobrojniji mlađi i srednji kontingent moraju uzdržavati sve brojniji stariji kontingent stanovništva.

S obzirom na to da danas ljudi žive sve dulje, produžava se i razdoblje njihova korištenja mirovinskih prava. Upravo iz tog razloga su nastale velike promjene u odnosu broja osiguranika i umirovljenika koje možemo vidjeti na slici 1.



Slika 1 Odnos broja osiguranika i korisnika mirovina

Izvor: vlastiti rad prema podacima HZMO-a

Iz grafa možemo vidjeti da je odnos između zaposlenih koji plaćaju doprinose i umirovljenika u stalnom smanjenju sve do 2013. godine. U posljednje dvije godine odnos se malo popravio, ali time nisu otklonjeni problemi unutar mirovinskog sustava. S obzirom na današnju situaciju, teško je očekivati da će se ovakav trend promijeniti. Ovakav nepovoljan odnos uvjetuje povećanje jaza između visine uplaćenih doprinosa i potreba za isplatom mirovina.

Pored demografskih, postoje i ekonomski razlozi provedbe mirovinskih reformi. Oni se svode na to da u sadašnjem mirovinskom sustavu ne postoji nikakva izravna veza između visine uplaćenih mirovinskih doprinosa i visine isplaćene mirovine budući da se sve uplate troše na izdržavanje današnje generacije umirovljenika. Takav oblik preraspodjele sredstava unutar mirovinskog sustava uvelike utječe na njegovu pravednost.

Uz navedene razloge, Hrvatska je bila suočena s dodatnim problemima. Prvenstveno se radi o pojavi pojačanog prijevremenog umirovljenja i invalidskog umirovljenja. Poseban problem predstavlja izbjegavanje plaćanja doprinosa zbog bujanja nelegalnog sektora, rada na crno, loše državne uprave, rasta korupcije u državi i sličnih problema. Dodatni ključni razlog potrebe za reformom mirovinskog sustava u Hrvatskoj je smanjenje oslanjanja na državni proračun (Alibegović J., 2000.).

2.2 Mirovinska očekivanja

Mirovinska reforma u Hrvatskoj potaknula je građane da se sami pobrinu o vlastitoj socijalnoj sigurnosti, tj. oslobodila ih je sindroma ovisnosti o državi. U prilog tome govori činjenica da su u porastu životna osiguranja i drugi oblici štednje. To ipak ne znači da državu treba potpuno isključiti od uloge jamca socijalne sigurnosti građana. Ključ je, dakle, u pronalasku odgovarajuće kombinacije državne intervencije i individualne odgovornosti za socijalnu sigurnost.

Mirovinski sustav utemeljen na tri stupa, kakav je danas u Hrvatskoj, dizajniran je tako da se stopa izdvajanja za drugi stup polako podiže sa trenutnih 5 % na 6 % izdvajanja. Mirovinska društva već dugo predlažu da se stopa izdvajanja za drugi stup poveća za jedan postotni poen nakon svake godine u kojoj bi BDP rastao iznad 2 %. Time bi se deficit u državnom proračunu povećavao samo u godinama s gospodarskim rastom. Povećanje stope izdvajanja za drugi stup za jedan postotni poen povećalo bi mirovine iz drugog stupa za točno 20 % za novozaposlene članove drugog stupa. Istovremeno, državni proračun bi bio u deficitu milijardu kuna. Povećanje izdvajanja za drugi stup dio je gospodarskog programa Vlade, ali do današnjih dana to nije učinjeno.

Nadalje, za očekivati je da će se mijenjati regulacija ulaganja obveznih mirovinskih fondova, budući da je imovina mirovinskih fondova prerasla veličinu hrvatskih kompanija. Mirovinski fondovi se moraju aktivnije uključiti u upravljanje kompanijama u kojima su vlasnici. Mirovinska društva trebaju sudjelovati u infrastrukturnim projektima, privatizacijama, dokapitalizacijama, uz uvjet da je prihvatljiv odnos rizika i dobiti. Ulaskom Hrvatske u Europsku uniju ograničenja ulaganja izvan Hrvatske nestaju. S obzirom na to, vrlo je važno otvoriti veći prostor za ulaganje jer će, uz postojeći uzak prostor, sve više imovine odlaziti izvan zemlje na likvidnija tržišta. Za mirovinske fondove kuna zarađena u Hrvatskoj vrijedi više nego kuna zarađena vani. Time se stvaraju nova radna mjesta, a nova radna mjesta znače nove članove u fondovima. Kuna zarađena u Hrvatskoj povećava plaće, čime se povećava i uplata na osobni račun u mirovinskom fondu. Također, ulaganjem obveznih mirovinskih fondova u Hrvatskoj jačaju javne financije u čije obveznice mirovinski fondovi znatno investiraju.

Štednja u obveznim i dobrovoljnim mirovinskim fondovima je privlačna, ali u uvjetima rasta gospodarstva, tj. u uvjetima u kojima je stopa rentabilnosti mirovinskih fondova veća od stope rasta gospodarstva. Međutim, takav oblik štednje vrlo je rizičan što se ne smije zanemariti. To poglavito dolazi do izražaja tijekom posljednje gospodarske krize u 2011. godini kada su

mirovinski fondovi imali značajne gubitke te na taj način poljuljali povjerenje osiguranika. Na dugi rok kapitalizacija mirovina je isplativa, tako da od nje najviše mogu profitirati najmlađe generacije, dok je na kratki rok vrlo rizična.

3. Istraživanje

U ovom poglavlju prezentirana je analiza podataka prikupljenih tijekom istraživanja koje je bilo usmjereno na građane Splitsko-dalmatinske županije.

Istraživanje je provedeno pomoću anketnog upitnika *google forms*. Anketni Upitnik je namijenjen svim punoljetnim fizičkim osobama neovisno o drugim kriterijima. Anketni upitnik fizičkim je osobama poslan e-poštom i preko društvenih mreža. Rezultati prezentirani u ovom radu bazirani su na odgovorima 198 ispitanika što čini 0,054 % ukupne ciljane populacije. Usprkos tome što je uzorak neprobabilistički, nepostojanje prijašnjih rezultata na ovu anketu daju važnost ovom istraživanju. Istraživanje je provedeno tijekom veljače 2016. Anketni upitnik sastoji se od 19 pitanja koja su otvorenog tipa te pitanja višestrukoga odabira.

Metodologija istraživanja

Kao instrument primarnog istraživanja korišten je anketni upitnik proveden pomoću alata *Google forms*.

Online, za razliku od terenske ankete, ima neke specifičnosti koje proizlaze iz dostupnosti Interneta i e-adresa. Generalno, uzorci se najčešće dijele po kriterijima reprezentativnosti u odnosu na populaciju, to jest, je li svakoj statističkoj jedinici populacije garantira jednaku vjerojatnost ulaska u uzorak ili ne. Oni u kojima to postoji zovu se probabilistički nasuprot neprobabilističkom, tj. prigodnom uzorku. Najveći broj online istraživanja koristi uzorke koji se ne baziraju na vjerojatnosti. (*Tvoj stav, Centar online istraživanja, 2015.*,

http://www.tvojstav.com/online_surveys_basics.html)

Zbog nedostupnosti okvira za izbor uzorka, ovo istraživanje se bazira na neprobabilističkom uzorku, nazvan prigodni uzorak, najčešće korišten u studijama iz oblasti menadžmenta i biznisa (Bryman and Bell, 2007.). Prigodni uzorak podrazumijeva ne slučajnu selekciju dostupnih elemenata istraživanjem utvrđene populacije. To je laka, brza i troškovno efektivna tehnika, no glavni nedostatak je nereprezentativnost u odnosu na populaciju (Churchill, 1995; Saunders et al., 2012.). Korištenje uzorka je opravdana alternativa provođenju istraživanja nad cijelom populacijom što je nepraktično zbog vremenskih, prostornih i novčanih ograničenja (Saunders et al., 2012.).

3.1 Rezultati provedenog istraživanja

U ovom dijelu će se razmotriti je li dob ispitanika utječe na razinu rizika koju su spremni prihvatiti.

Razina rizika	Dob		UKUPNO
	≤29	≥30	
Minimalna razina	63	38	101
Srednja razina	61	23	84
Visoka razina	11	2	13
UKUPNO	135	63	198

Ho – dob ispitanika ne utječe na razinu rizika koju su spremni prihvatiti

H₁ – dob ispitanika utječe na razinu rizika koju su spremni prihvatiti.

Elementi ocjene hipoteze:

U tablicama broj stupnjeva slobode je jednak (broj redaka-1)*(broj stupaca-1). U ovom primjeru je broj stupnjeva slobode $(3-1)*(2-1)=2*1=2$.

Empirijska vrijednost χ^2 testa = 3,95

Granična vrijednost $\chi^2_{0,05}(2) = 5,99$

Nivo značajnosti (α) = 0,05

Iz tablice hi-kvadrat možemo očitati da je granična vrijednost hi-kvadrat testa uz 2 stupnja slobode na razini značajnosti od 5 % jednaka 5,99.

Budući da je empirijska vrijednost hi kvadrat testa manja od granične vrijednosti ($3,95 < 5,99$), ona pada u područje prihvatanja nulte hipoteze. Znači da se uz nivo značajnosti 5 % prihvaća nulta hipoteza, odnosno da dob ispitanika statistički ne utječe na razinu rizika koju su spremni prihvatiti.

U ovom dijelu će se razmotriti je li dob ispitanika utječe na iznos koji žele ulagati na mjesečnoj razini.

Željeni iznos ulaganja	Dob		UKUPNO
	≤ 29	≥ 30	
0-1000	103	38	141
1000-2000	27	18	45
>3000	5	7	12
UKUPNO	135	63	198

H_0 – dob ispitanika ne utječe na iznos koji žele ulagati na mjesečnoj razini

H_1 – dob ispitanika utječe na iznos koji žele ulagati na mjesečnoj razini.

Elementi ocjene hipoteze:

U tablicama broj stupnjeva slobode je jednak (broj redaka-1)*(broj stupaca-1). U ovom primjeru je broj stupnjeva slobode $(3-1)*(2-1)=2*1=2$.

Empirijska vrijednost χ^2 testa = 6,81

Granična vrijednost $\chi^2_{0,05}(2) = 5,99$

Nivo značajnosti (α) = 0,05

Iz tablice hi-kvadrat možemo očitati da je granična vrijednost hi-kvadrat testa uz 2 stupnja slobode na razini značajnosti od 5 % jednaka 5,99.

Budući da je empirijska vrijednost hi kvadrat testa veća od granične vrijednosti ($6,81 > 5,99$), ona pada u područje odbacivanja nulte hipoteze. Znači da se uz nivo značajnosti 5 % prihvaća alternativna hipoteza, odnosno da dob ispitanika statistički utječe na iznos koji žele ulagati na mjesečnoj razini.

U ovom dijelu će se razmotriti je li dob ispitanika utječe na iznos koji trenutno ulažu na mjesečnoj razini.

Iznos ulaganja	Dob		UKUPNO
	≤ 29	≥ 30	
0-1000	117	48	165
1000-2000	15	9	24
>3000	3	6	9
UKUPNO	135	63	198

H_0 – dob ispitanika ne utječe na iznos koji trenutno ulažu na mjesečnoj razini

H_1 – dob ispitanika utječe na iznos koji trenutno ulažu na mjesečnoj razini.

Elementi ocjene hipoteze:

U tablicama broj stupnjeva slobode je jednak $(\text{broj redaka}-1) \cdot (\text{broj stupaca}-1)$. U ovom primjeru je broj stupnjeva slobode $(3-1) \cdot (2-1) = 2 \cdot 1 = 2$.

Empirijska vrijednost χ^2 testa = 5,96

Granična vrijednost $\chi^2_{0,05}(2) = 5,99$

Nivo značajnosti $(\alpha) = 0,05$

Iz tablice hi-kvadrat možemo očitati da je granična vrijednost hi-kvadrat testa uz 2 stupnja slobode na razini značajnosti od 5 % jednaka 5,99.

Budući da je empirijska vrijednost hi-kvadrat testa manja od granične vrijednosti ($5,96 < 5,99$), ona pada u područje prihvatanja nulte hipoteze. Znači da se uz nivo značajnosti 5 % prihvaća nulta hipoteza, odnosno da dob ispitanika statistički ne utječe na iznos koji trenutno ulažu na mjesečnoj razini.

U ovom dijelu će se razmotriti je li dob ispitanika utječe na način ulaganja.

Način ulaganja	Dob		UKUPNO
	≤ 29	≥ 30	
Ne ulažu	56	19	75
Obrazovanje	32	1	33
Nekretnine	14	10	24
Bankovna štednja	11	9	20
Životno osiguranje	2	8	10
Ostalo	20	16	36
UKUPNO	135	63	198

H_0 – dob ispitanika ne utječe na način ulaganja

H_1 – dob ispitanika utječe na način ulaganja.

Elementi ocjene hipoteze:

U tablicama broj stupnjeva slobode je jednak $(\text{broj redaka}-1) \cdot (\text{broj stupaca}-1)$. U ovom primjeru je broj stupnjeva slobode $(6-1) \cdot (2-1) = 5 \cdot 1 = 5$.

Empirijska vrijednost χ^2 testa = 30,08

Granična vrijednost $\chi^2_{0,05}(5) = 11,07$

Nivo značajnosti $(\alpha) = 0,05$

Iz tablice hi-kvadrat možemo očitati da je granična vrijednost hi-kvadrat testa uz 2 stupnja slobode na razini značajnosti od 5 % jednaka 11,07.

Budući da je empirijska vrijednost hi-kvadrat testa veća od granične vrijednosti ($30,08 > 11,07$), ona pada u područje odbacivanja nulte hipoteze. Znači da se uz nivo značajnosti 5 % prihvaća alternativna hipoteza, odnosno da dob ispitanika statistički značajno utječe na način ulaganja.

4. Zaključci i preporuke

U Hrvatskoj je i dalje prisutno mišljenje kako se država dužna pobrinuti za socijalni status stanovništva. Međutim, zbog problema unutar mirovinskog sustava u budućnosti će se odgovornost za socijalni status u potpunosti prenijeti na pojedince. To znači da će pojedinci morati donositi odluke koja će dodatna ulaganja poduzimati žele li osigurati socijalni status pri umirovljenju.

Na temelju dosadašnjeg iskustva mješoviti, odnosno djelomično kapitalizirani mirovinski sustavi osiguravaju višu razinu mirovina od sustava koji se isključivo temelje na međugeneracijskoj solidarnosti. Zbog toga mnoge zemlje, a među njima i Hrvatska, razmatraju mogućnost povećanja izdvajanja stope doprinosa u drugi kapitalizirani mirovinski stup. Iz razloga što je stopa povrata obveznih mirovinskih fondova veća od stope rasta plaća pa se na temelju toga osiguravaju veće mirovine. Međutim, treba napomenuti kako kapitalizirani mirovinski fondovi stvaraju pozitivne rezultate samo u uvjetima gospodarskog rasta, što znači da nose određeni rizik. Unatoč svemu, možemo zaključiti kako je diversifikacija mirovinskih izvora pravac u kojem mirovinski sustavi trebaju ići kako bi postigli međugeneracijsku ravnotežu i socijalnu sigurnost umirovljenika.

Rezultati istraživanja, koje je provedeno u ovom radu, pružaju mnogo informacija o financijskom ponašanju različitih dobnih skupina. Utvrđena su karakteristična obilježja i obrasci ponašanja mlade populacije do 30 godina i starijih, na području Splitsko-dalmatinske županije.

Došlo se do zaključka da postoji značajna razlika u iznosu željenog ulaganja ove dvije skupine. Premda mlađa populacija nije u mogućnosti ulagati mnogo, na mjesečnoj razini, statističkim testovima je potvrđeno da ni starija populacija ne ulaže značajno više. Podaci govore da mladi imaju različite preferencije u pogledu izbora financijskih instrumenata za ulaganje. Velika većina mlade populacije nije se financijski osamostalila, a financijski ovisna mlada osoba i ne može izdvojiti velike iznose za ulaganje i uglavnom ulažu u obrazovanje. Zrelije osobe (stariji od 30 godina) ulažu u nekretnine ili bankovnu štednju. Ulaganje potiče pojedinca na rad, posebno kada rezultati postaju vidljivi. Ulaganjem osoba napreduje. Iako danas nisu svi u mogućnosti ulagati, prisutna je težnja k ulaganju.

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Financial behavior of age groups

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Abstract. The population in Croatia, according to various surveys conducted by the OECD and other relevant institutions, indicates a low level of financial literacy. Changes in social structure and the orientation towards a market economy in the last two decades have brought on a number of changes in the position of individual responsibility for personal financial future. Retirement used to represent the process of entering a period of life that could be characterized with reduced, but sufficient and secure income. However, with a series of unfavorable demographic trends, high unemployment, sluggish economic growth, delegates to household sector new roles of responsibility in regard to the financial future of each individual. Knowing the financial products and their performance is an important step in making mature financial decisions. This paper will explore the financial behavior of individuals belonging to different age groups.

Keywords: *financial behavior, financial products, financial reform*

Swiss franc mortgage loans from the perspective of Polish borrowers

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Abstract. Foreign currency loans, especially denominated in Swiss franc, were commonly granted in many countries of Central and Eastern Europe in period 2004-2009. In majority, such type of loans was used for financing the purchase of flats or houses but in some countries Swiss currency loans were financing also consumption. In Poland loans denominated in Swiss franc become the most important type of credits used for housing purposes and thus the most significant type of asset in the banking sector. Despite initial high benefits generated for borrowers due to interest rate disparity Swiss franc loans due to strong appreciation of Swiss currency become volatile and strongly influencing financial condition of majority of borrowers. The aim of the paper is to evaluate influence of changes of exchange and interest rates for Swiss currency onto repayment and relative financial condition of borrowers which took mortgages denominated in francs in years 2005-2012. i.e. when such loans were available in Poland. The paper compares costs and benefits of Swiss franc loans against loans in Polish zloty and euro. To assess the relative financial condition of borrowers, the author uses differential indices based on model of mortgage repayment in annuities indexed by exchange rates and interbank reference rates. The results of the research show that Swiss currency mortgage loans, despite strong appreciation of Swiss currency, are beneficial to Polish borrowers taking loans up to 2007 and from 2009 to 2012.

Key words: *foreign currency, loans, Poland*

1. Introduction

Foreign currency loans (FCL) are some of the most important types of financing used in many CEE countries. Since mid 2000s such loans, due to lower interest rates and predictable valuation of foreign currencies, become prevailing in financing of real estate and in case of some countries they were used also for purchase of cars and consumption. The main reason behind taking of such loans was lower costs of interest and thus lower value of monthly instalments. In some countries of CEE, especially where local currencies rates were fixed to euro (Estonia, Latvia, Lithuania, Bulgaria) the dominant currency of financing became euro. Other countries (Poland, Hungary, Croatia) received substantial share of Swiss franc as the currency of crediting (mostly for mortgages) [Yeşin P. 2013]. The choice of the Swiss currency was determined primarily by the highest interest rate disparity and hence the possibility of implementing carry trade strategy on the real estate market and belief in its stability as a safe heaven asset. Very often such loans were promoted by banks owned by foreign investors, which had an easy access to foreign exchange funding on international markets [Brown and De Haas 2012]. Amongst them Austrian banks were some of the most active in almost whole CEE region [Pann et al 2010]. In Poland Swiss franc loans became crucial types of assets in the banking sector and also dominant type of mortgages with repayment period between 20 and 30 years. Due to very favourable conditions of the Polish economy in period 2004-2008, rising salaries and decreased unemployment, stable and profitable banking sector, as well as an easy access to foreign sources of financing, banks in Poland started to liberalise credit policy and increased sales of mortgages in foreign currencies. The choice of foreign currencies, predominately Swiss

francs, was motivated on the one hand by the lower instalments and foreseeable lower total costs of the loan for the borrower and on the other hand by higher profits for the banks comparing to the mortgages denominated in domestic currency. The disparity of interest rates in case of many borrowers prevented them from taking loans in Polish zloty but gave possibility to get CHF-denominated financing [Biała 2015]. As Polish zloty and Swiss franc pricing has been floating, the risk of foreign currency loans has been materialising since July 2008, i.e. when five years long trend of depreciation Swiss currency against Polish zloty reversed [Buszko 2013]. As Polish currency started to loose value in the long-term, the repayment of the CHF denominated loans become more difficult for the borrowers as instalments calculated in Swiss currency required significantly higher repayments in PLN. The subprime crisis in 2009, the Greece public finance debt crisis in 2011 as well as the decision of Swiss National Bank to cease peg to euro in 2015 influenced the abrupt revaluation of Swiss franc deteriorating the terms of repayment of the instalments calculated upon the current exchange rates CHF/PLN. As in Poland most of the FCL were indexed with CHF LIBOR 3M or 6M rate the negative effects of the increase of the exchange rate in some part had been compensated by the strong reduction of the interest rate of Swiss currency, what maintained the level of instalments at the amount able to repay. Despite FCL in many countries are treated as risky, negatively influencing financial safety and condition of the borrowers and banks as well as stability of whole financial system, such loans has not been neither negatively influencing the results of Polish banking sector nor distressing majority of borrowers, although the volume and value of such loans remains significant.

2. Research methods and hypothesis

The paper focuses on the problem of the influence of changes of economic conditions onto repayment of Swiss franc mortgage loans and thus onto financial condition of borrowers. In particular, the main goal of the paper is to investigate the influence of changes of exchange and interest rates of Swiss currency onto repayment terms, especially absolute and relative value of instalments and then financial condition of borrowers which took mortgages denominated in franc in period 2005-2012. i.e. when such loans were available in Poland. The paper compares repayment of Swiss franc loans against loans denominated in Polish zloty.

In the paper the author uses research method such as: study of literature, statistical analysis of exchange and interest rates, as well as quantitative evaluation of repayment of loans based on mathematical model of 20- and 30-years mortgage loan repayment in fixed instalments indexed with actual reference rates (CHF LIBOR 3M, PLN WIBOR 3M). The model assumes recalculation of instalments every 3 months altogether with a change of reference rate and exchange repayment amount of Swiss franc loans into PLN with 7% bid-offer spread.

The author puts forward two hypotheses. The first one is that despite abrupt, steep increase value of Swiss currency mortgage the financial condition of Polish borrowers did not deteriorate systematically to fail to repay the loans. The second states that mortgage loans denominated in Swiss franc are more beneficial for borrowers than loans in Polish zloty.

3. The results

3.1. Conditions of Swiss mortgage loans development in Poland

The Swiss franc mortgage loans became the commonly spread out type of loan in Polish banking sector since 2005. The reasons of using such type of financing were as follows:

1. Large disparity of interest rates between foreign currencies and Polish zloty (with significantly lower interest rates of CHF than EUR);
2. Lack of credit ability of some part of borrowers in PLN;
3. Long-term depreciation of foreign currencies against Polish zloty in period 2004-2008;
4. Good perspectives of development of Polish economy after joining EU in May 2004;

5. An easy access to foreign currencies financing on international markets (in majority provided by foreign parent companies of Polish banks);
6. Belief of borrowers in stability of exchange rate of Swiss franc (Swiss franc was considered as safe heaven currency);
7. Expectation of joining eurozone by Poland in the nearest future and hence reduction of foreign exchange risk;
8. Lack of legal barriers of using foreign currencies in crediting of households;
9. Active policies of banks in selling foreign currencies loans instead of Polish zloty loans;
10. Lack of housing policy of the state and thus lack of long-term saving solutions for housing purposes;
11. Active media promotion of low cost loans in foreign currencies;
12. Expectation of long-term bull market of the real estate in Poland.

From 2005 the foreign currencies, primarily Swiss franc, had dominated financing of the real estate purchase. Due to higher interest rate disparity of PLN WIBOR 3M over CHF LIBOR 3M than EURIBOR 3M (Fig. 1) as well as due to similar relative pricing of Swiss and euro currency (Fig. 2) the only real offer of loans in period 2004-2008 was Franc instead of euro.

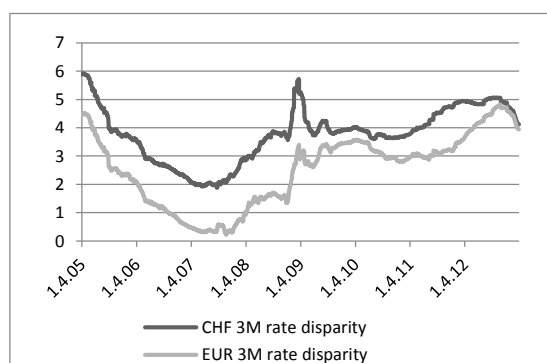


Fig 1. Interest rate disparity CHF and EUR vs. PLN (2005-2012; %).

Source: own elaboration based on interbank market data

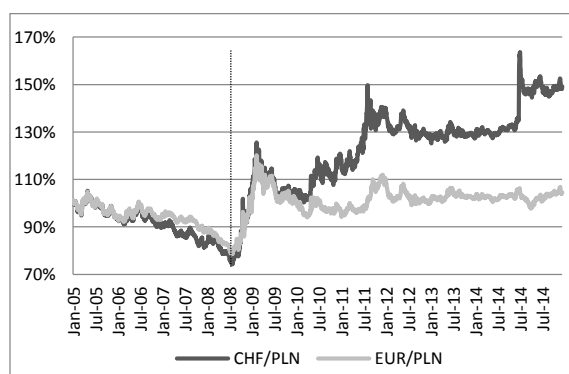


Fig 2. Relative pricing of EUR and CHF in Poland (2005-2014, 01.01.2005 = 100%).

Source: own elaboration of NBP data

As Swiss franc was systematically depreciating versus Polish zloty in period 2005-2008, even faster than euro, what was a result of depreciation of CHF versus EUR on the international market, the borrowers dominantly preferred Helvetic currency. Euro started to be utilized after commencing subprime crisis, when first problems with Swiss franc volatility and availability on the international market emerged (Fig. 2 and 3). Until 2012 the banks structurally limited the mortgage loans in foreign currencies granted to borrowers because of sharp increase of value of Swiss currency versus Polish zloty. In 2014 the foreign currency loans had been banned by the Polish Financial Supervisory Authority and started to be available only for borrowers receiving incomes in foreign currencies. At present foreign currency mortgage loans portfolios are maturing and the share of new loans in foreign currencies is minimal (Fig. 3). Due to lack of new FC mortgage loans the structure of the loans in the banking sector is changing revealing increasing share of Polish zloty loans, which reached more than 50% of the value of total loans in the Polish banking sector (Fig. 4).

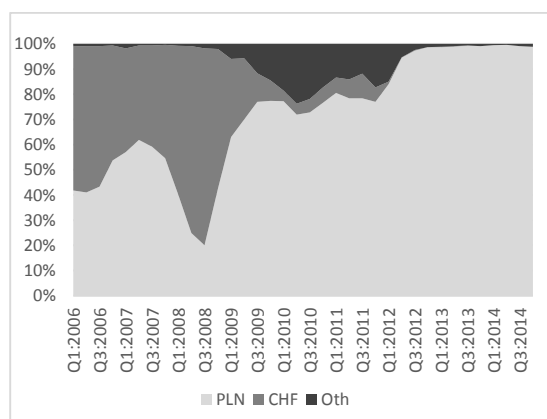


Fig 3. Currency structure of new mortgage loans in Poland (Q1:2006 - Q4:2014)

Source: own elaboration based on Raporty AMRON-SARFIN 2016

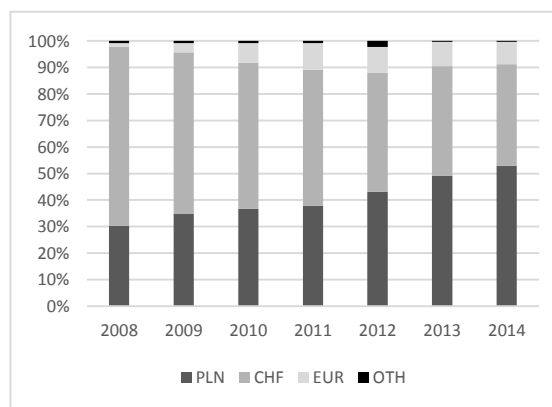


Fig. 4. Structure of mortgage loans in Polish banking sector (2008-2014)

Source: own elaboration based on Raport 2013, Raport 2014, Raport 2015

3.2. Swiss franc mortgage loans development

The most active period for crediting in Swiss currency remained in 2006 and 2008 (Tab. 1.), when the conditions of the economy and the banking sector were very favourable [Ocena 2013].

Table 1. New CHF-denominated mortgage loans development in Poland (2005-2014)

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
New CHF mortgage loans (mld zł)	10,5	23,6	31,4	52,6	5,5	2,9	3,3	0,2	0,1	0,1
Volume of new CHF mortgage loans (thousands)	83,1	115,5	97	162	19,2	8,3	9,7	0,4	0,1	0,1

Source: own elaboration based on PFSA data.

Lower rate of development of Swiss franc denominated loans was observed in 2007, what was mostly a consequence of implementation in July 2006 by Polish Financial Supervisory Authority the regulation called Recommendation S. Such recommendation was a first banking sector legal regulation limiting access to foreign currencies loans by higher requirement of creditworthiness and more detailed investigation of the financial situation of the borrower. One of the regulation of the Recommendation among the others was to investigate creditworthiness of the borrower with assumption that the loan value is increased by 20% and the interest rate is at the level equal to domestic currency (Polish zloty)¹. Until implementation of the Recommendation S Polish borrowers could more easily get Swiss franc loan than denominated in Polish zloty, what was directly a result of lower value of instalments of CHF denominated loans. The peak period for foreign loans crediting falls in 2008, when the appreciation of the Polish currency versus Swiss franc was the strongest. The increase of a value of loans adjusted by the exchange rate CHF/PLN was then even higher. Altogether with the starting of subprime crisis banks started to reduce crediting in Swiss currency and increased credit spread on new CHF denominated loans. Such policy was a consequence of the turmoil on the international interbank market, problems with CHF interbank financing as well as increase of interbank market real costs of capital (reflected e.g. in increase of CDS spreads). The another reason was

¹ The other regulations implemented by PFSA and Parliament related to foreign currency mortgage loans were Recommendation SII (2009), Recommendation SIII (2011) Recommendation T, and also „Anti-spread Act of 2011. The most crucial impact for the process of FCL development had Recommendation S.

increased volatility CHF/PLN and much stronger appreciation of Swiss franc than euro versus PLN (Fig 5 and 6).

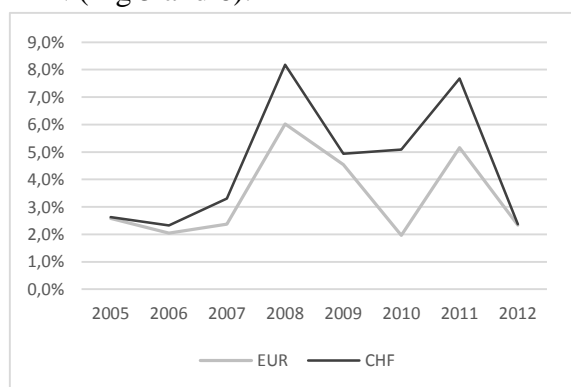


Fig. 5. Coefficient of variation for CHF/PLN and EUR/PLN rate (2005-2012)

Source: own elaboration based on NBP data



Fig. 6. Annual rate of change of CHF/PLN and EUR/PLN rate (2005-2012)

Source: own elaboration based on NBP data

Banks in Poland started then to offer euro as a currency of the first choice but from the beginning of 2009 ultimately Polish zloty has been dominating as a meaning of new mortgage loans in Poland. Until 2014 the total value of foreign currencies loans exceeded 50% of total mortgages in the banking sector. The overall evaluation of the foreign exchange mortgage loans versus denominated in PLN is presented in the table 2.

Table 2. Development of mortgage loans in Poland (2005-2014)

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CHF mortgage loans value (mld zł)	NA	NA	NA	NA	132,9	147,4	163,5	144,7	135,7	132,6
CHF mortgage loans volume (thousands)	NA	NA	NA	NA	NA	621,7	596,1	580,5	562,5	542,9
FC mortgage loans volume (thousands)	NA	NA	NA	NA	NA	717,9	712,4	699,7	677,6	654,4
PLN mortgage loans volume (thousands)	NA	NA	NA	NA	NA	798,7	866,1	980,3	1093,6	1207,8
Mortgage loans volume (thousands)	717,2	945,5	1078,1	1207,5	1374,1	1448,8	1630,7	1731,6	1819,8	1860,5
PLN mortgage loans value (mld zł)	18,5	28,2	49,9	59,1	75,6	98,2	115,6	138,7	161,9	183,9
FC mortgage loans value (mld zł)	32,2	50	65,1	136	142,1	169,3	197,8	178,3	166,9	162,9
Mortgage loans value (mld zł)	50,7	78,2	115	195,8	217,8	267,5	318,8	321,8	328,8	346,8
Households loans value (mld zł)	136,4	183,4	254,2	368,6	412,5	475,4	532	533,2	554,6	588,5
FC mortgage loans to total mortgage loans	63,5%	63,9%	56,6%	69,5%	65,2%	63,3%	62,1%	55,4%	50,8%	47,%
FC mortgage loans to total loans to HH	23,6%	27,3%	25,6%	36,9%	34,5%	35,6%	37,2%	33,4%	30,1%	27,7%

Source: own elaboration based on Raport 2011, Raport 2012, Raport 2013, Raport 2014, Raport 2015.

3.3. Risks of borrowings in Swiss franc

The major problem related to mortgage loans denominated in Swiss franc in Poland was servicing of such loans in domestic currency. As such servicing requires exchange of CHF into PLN and then vice versa, the borrowers are dependent on valuation of currencies on international market, bank pricing policies as well as costs of bid-asks spreads. The factor responsible for creating the highest risk of CHF-denominated loans in Poland was the historically low pricing of Helvetic currency toward Polish zloty when most of the loans were

taken (Fig 7). That exposed borrowers directly onto foreign exchange risk, which started to materialize visibly in the late 2008, and then in 2011 and 2015.

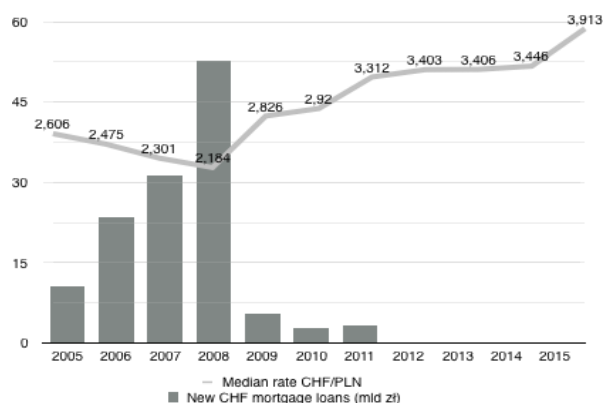


Fig. 7. Development of new Swiss franc mortgage loans versus CHF/PLN rate.
Source: own elaboration based on Ocena 2015 and NBP data

The foreign exchange risk of strong appreciation of CHF/PLN significantly raised the value of instalments of the loans repaid to the banks from CHF-denominated loans. Altogether with appreciation of CHF, the interest rate for Swiss currency was reduced from 3,25% in October 2008 to minimal level and ultimately to the negative value -0,96% in January 2015. Such a change reduced a value of the interest paid by the borrowers on the loans as banks in Poland used an algorithm to calculate interest rate on loans as reference rate (CHF LIBOR 3M) plus credit spread (fixed margin). The foreign currency mortgage loans in Poland included then variable interest rates which, on the one hand passed the interest rate risk onto borrowers, on the other, were automatic stabilizers of the financial condition of the borrowers. Very deep reduction of the interest rate of Swiss currency compensated in a large part the steep appreciation of CHF/PLN rate, keeping the non-performing loans share at a very low level.

Describing the FCL in Poland it is worth to note, that in general Swiss franc financing was granted as a rule to the high income borrowers (Fig 8). That was contrary to PLN-denominated mortgages. Also, the analysis of DtI ratio of borrowers confirms that FCL were used primarily by the persons obtaining relatively high incomes (Fig 9). Despite this rule, some part of the loans granted before implementation of Recommendation S can be in danger due to too low-incomes received by the borrowers. Until July 2006 borrowers of low creditworthiness could obtain just CHF-denominated loans.

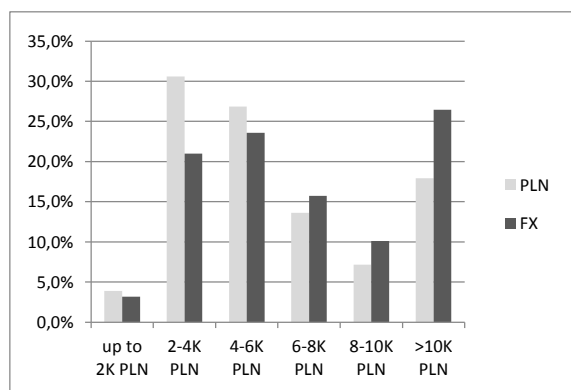


Fig. 8. Structure of mortgage loans according to incomes of borrowers Source: Buszko, Krupa 2015

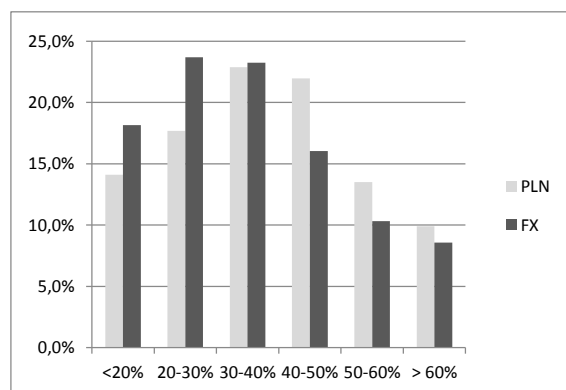


Fig. 9. Structure of mortgage loans according to DtI ratio

Source: Buszko, Krupa 2015

The most significant impact of increase of the CHF/PLN exchange rate on the financial safety and stability as well as a factor of a danger for the Swiss franc borrowers in Poland is the LtV ratio calculated as the current value of debt to the value of the real property. This ratio indicates the burden of debt to the assets and income of the borrower in case of his or her default. For the Swiss franc borrowers about 44% of the value of loans is characterized with LtV >100% (Fig. 10) while for Polish zloty denominated loans such share is about 10%. It is also worth noting that approx. 20% of CHF-denominated mortgage loans represent LtV >140%, what signifies substantial level of bankruptcy risk of borrowers if such loans are not returned on time.

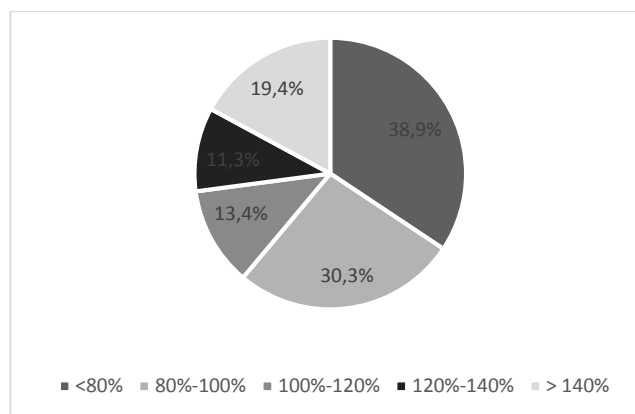


Fig. 10. Structure of LtV of Swiss franc mortgage loans in 2014.
Source: own elaboration based on Raport 2015.

Despite the strictly unfavourable foreign exchange conditions of repaying the CHF-denominated loans, expressed in strong appreciation of Swiss franc versus Polish zloty the quality of the loans remains quite high. In 2014 the NPL ratio was 2,7% (4% with adjustments for loans exchanged into PLN) of the value of all mortgages in Poland and 1,8% (2,7%) of their volume. Such results confirm their highest quality in the whole banking sector loans.

3.4. Instalments value and costs of Swiss franc loans in time

Taking mortgage loans in Swiss francs exposed Polish borrowers onto significant exchange and interest rate risk in a very long period of time. Based on the model of repayment of loans denominated in Francs and Polish zloty in monthly equal instalments, the author found the total value repaid by the borrowers from the moment of taking loan until 31.12.2015, the change of the value of instalments in time, the change of monthly benefits resulting from taking foreign currency loans, the change of monthly benefits of CHF loans in time as well as the value LtV for both types of loans as on 31.12.2015. The author examined model of repayment of a loan of 250.000 zł (approx. 57.000 euro), which is reflecting the average value of CHF-denominated mortgage in Poland. The investigation was conducted for two periods of repayment of loans, i.e. 240 and 360 months. The interest was calculated as CHF LIBOR 3M + fixed credit spread of 2,5% and PLN WIBOR 3M + fixed credit spread 1,5% in whole period of crediting. The Swiss franc loans instalments were exchange at the average exchange rate CHF/PLN from the first six days of each month adjusted with bid-ask spread 7%, what was reflecting real market conditions of foreign currency loans repayment in Poland.

After obtaining results of total value of repayment of CHF and PLN-denominated loans of a value 250.000 zł taken in period 12.2005-12.2011, one could observe the periods in which foreign currency loans were more beneficial for borrowers than mortgages denominated in Polish zloty (Fig. 11). For 20-years financing lower value repaid in total was noted for loans taken in months January-June 2009, June, August, November 2010 and later on until December

2011. For 30-years loans the beneficial periods were: December 2005 – September 2006 and from December 2009. In general, the 30-years loans are more beneficial than 20-years financing and more borrowers in time may take profits due to such loans. The worst period for taking the loan in Swiss franc is July 2008 for both 20 and 30-years loans. Borrowers taking 20-years mortgages in CHF repaid until the end of December 2015 totally 60.507 zł more than borrowers taking PLN-denominated loans, what equals 24,2% value of the real property. The 30-years loans in Swiss franc generated surplus of expenditures of 34.521 zł over PLN loans what amounted to 13,8% of the value of the real estate. On the other hand, the borrowers taking either 20 or 30-years loans denominated in Franc in February 2009 could take profits due to lower repayment amount in comparison to borrowers credited in PLN. For 20-years loans the savings were 16.395 zł (6,6%) and for 30-years 21.860 zł (8,7%). The positive effect of foreign currency loans is noted only in periods of crediting at elevated exchange rate of CHF/PLN. The CHF-denominated loans given for 30 years turned out to be more beneficial and less risky in terms of total amount repaid than 20-years loans. Such statement can be explained by the higher share of interest in the instalment and hence stronger effect of reduction of LIBOR rate in 30-years loans comparing to 20-years financing. The heaviest monthly financial burden of CHF-denominated loans is noted for loans taken in July 2008, what is expressed by the highest median of instalments (2.476 zł for 20-years loans and 1.852 zł for 30-years loans) (Fig. 12).

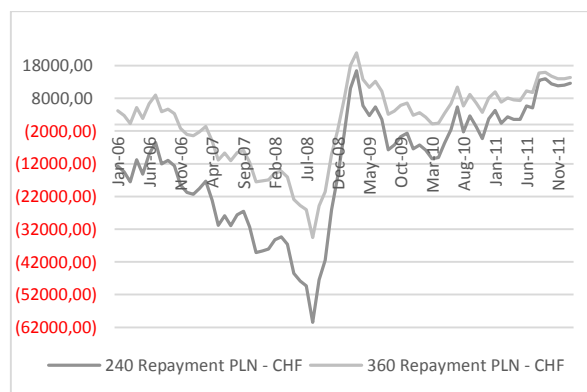


Fig. 11. Disparity in total repayment value of PLN and CHF-denominated loans on 31.12.2015.

Source: own elaboration

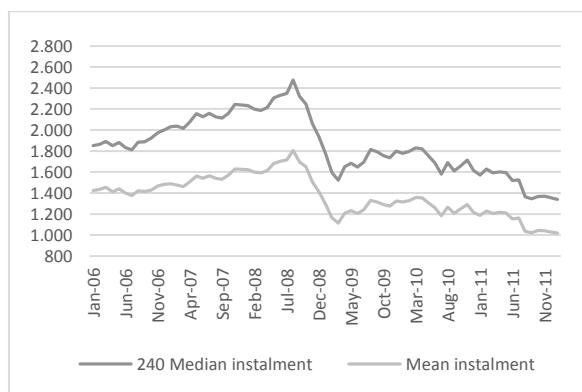


Fig. 12. Median value of instalments of Swiss franc mortgage loans

Source: own elaboration

The lowest instalments are paid by the borrowers taking loans in December 2011 (1.338 zł and 998 zł) what constitutes approx. 54% of the value of instalments from July 2008 loans. The low value of instalments is observed also in case of loans taken in February 2009. In both cases (December 2011 and February 2009) they were granted at elevated pricing of CHF.

According to the survey research [Raport na temat 2013] conducted in the group of borrowers taking loans in francs the most important factor determining decision of taking loans in foreign currency in Poland was the requirement of the lowest value of instalments. Fig. 13 presents initial relative disparity of instalments between PLN and CHF mortgages.

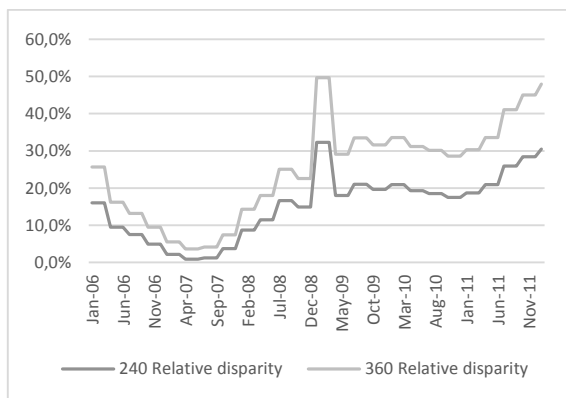


Fig. 13. Relative disparity of CHF and PLN mortgage loans instalments on taking the loan date.

Source: own elaboration

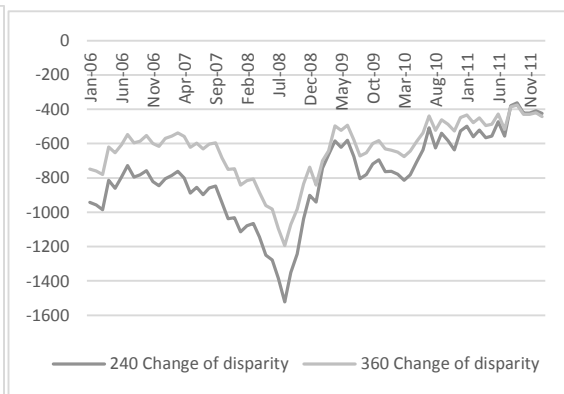


Fig. 14. Change of disparity between PLN and CHF mortgage loans instalments between taking the loan date and 31.12.2015

Source: own elaboration

The level of disparity is diversified and it is the lowest in 2007. Such phenomenon, altogether with Recommendation S, was determining a decrease of new CHF loans taken at that period. In the middle of the mentioned year the borrowers practically did not received benefits due to taking CHF loans. The disparity of at least 10% was noted in periods December 2005 – August 2006 and from December 2007 for 30-years loans and December 2005 – March 2006 and from March 2008. 30-years loans brought higher initial foreign currency crediting benefits than 20-years mortgages.

During the period of loan repayment, the disparity between value of instalments of the PLN-denominated loans and Swiss franc loans has been changing, what determined, and in fact reduced total value of benefits obtained from foreign currency borrowings (Fig. 14).

In case of all of the CHF-denominated loans the change of the disparity was negative, with special regard to loans taken in July 2008, where the loss of the value of disparity was the highest. The absolute change of the disparity of instalments was -1194 zł for 30-years loans and -1523 for 20-years loans. Considering various periods of crediting it is vital to present change of the disparity in time for two critical moments i.e. the July 2008 and February 2009, which are representing the worst and the best time to take CHF-denominated loans (Fig.15, Fig. 16). In case of loans taken in CHF in July 2008 the value of instalment become higher comparing to PLN-denominated loans just in November 2008. The borrowers could then obtain savings just for 3 months. In case of Swiss franc loans taken in February 2009 until October 2014 the instalments were lower comparing to loans in PLN (for 20-years loans) and until December 2014 (for 30-years loans).

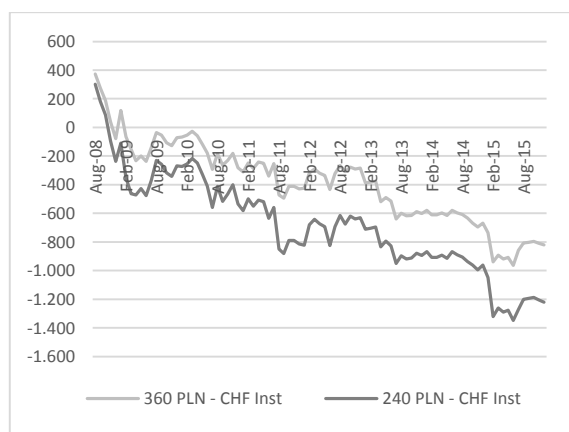


Fig. 15. Instalment value disparity for loans taken in July 2008.

Source: own elaboration

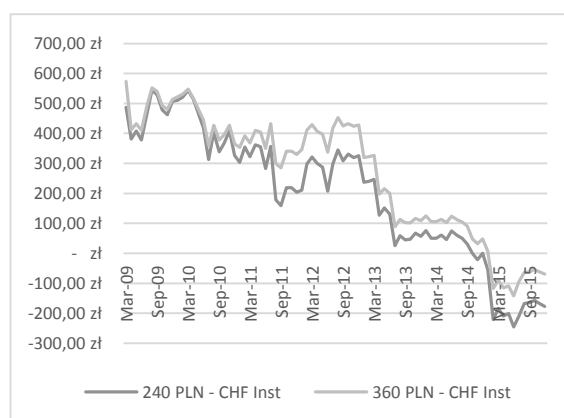


Fig. 16. Instalment value disparity for loans taken in February 2009.

Source: own elaboration

Fig. 17 presents the change of the value of instalments from the moment of taking the loan until 31.12.2015 for the loans taken between December 2005 and December 2011. The instalments value of the borrowers taking the CHF-denominated loan in July 2008 increased by 50% for 20-years loans and by 35,5% for 30-years loans taken in February 2006. Borrowers which took 20-years loans in August 2011 and 30-years loans starting from July 2011 paid at the end of 2015 lower instalments comparing to the period when the loan was taken. If one combines the value of instalments and its change with the increase of the average salaries in the sector of enterprises in Poland, the results indicate that the instalments were relatively cheaper for most borrowers on 31.12.2015 than on the date of taking of the loan (Fig. 18). The relative increase of the value of instalments for borrowers taking loans in the critical moment i.e. July 2008, was 5,2% despite strong appreciation of Franc between that date and 31.12.2015. The results confirm the increase of instalment's purchasing power of borrowers in time with the exception of periods May-July 2008, November 2009, February-March and November 2010 for 20-years loans as well as November 2009 and February 2010 for 30-years loans.



Fig. 17. Change of the value of instalments between taking the loan date and 31.12.2015.

Source: own elaboration

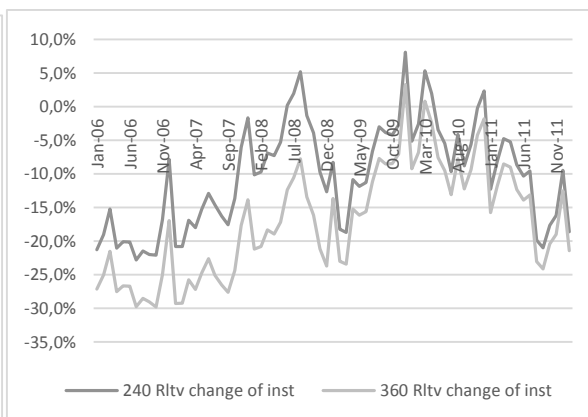


Fig. 18. Relative change of the value of instalments between taking the loan date and 31.12.2015

Source: own elaboration

The analysis of the coefficient of variation of the instalments of the CHF-denominated mortgage loans indicates that 20-years loans are more variable considering the instalments value than 30-years credits (Fig.19). The lowest variability has been noted in case of loans granted in 2011, what is a result of an appreciated but stable valuation of Swiss franc in Poland.

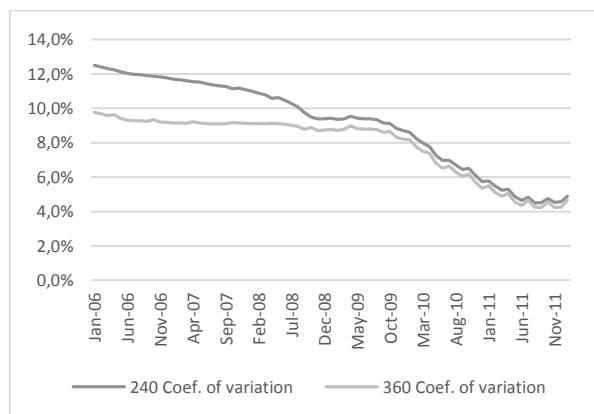


Fig. 19. Coefficient of variation for 20 and 30-years mortgage loans in Swiss franc.

Source: own elaboration

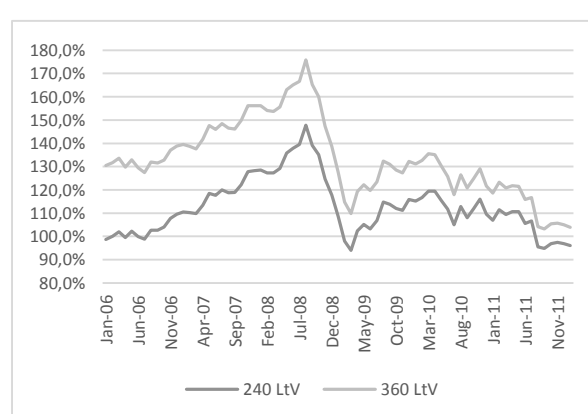


Fig. 20. LtV ratio for 20 and 30-years mortgage loans in Swiss franc.

Source: own elaboration

One of the most important conditions which should be taken into account during the analysis CHF-denominated loans from the perspective of borrowers is the ratio of LtV. Such ratio presents the current value of debt in relation to the value of purchased real property. In the

analysis the author assumed that 100% of the value of real property was financed with the mortgage loan. In opposite to loans in Polish zloty which would never have $LtV > 100\%$ under the condition that debt is not overdue and the initial value of the loan is 100% of the real estate, the CHF-denominated loans in majority are characterized by LtV ratio significantly higher than 100% (Fig. 20).

Just in case of 20-years loans taken in December 2005, March 2006, July 2006, January and February 2009 and from July 2011, the LtV ratio is below 100%. The highest risk is taken by the borrowers taking loans in July 2008, where the LtV is reaching 176% for 30-years crediting and 148% for 20-years loans. In case of failure with the mortgage repayment they would be economically and legally bankrupt as the value of debt significantly exceeds the collateral value, i.e. the value of apartment or house.

Conclusions

The investigation conducted by the author of the paper leads to several conclusions related to development of the Swiss franc loans in Poland. From the point of borrowers, the CHF-denominated loans seemed to be initially very attractive way of financing of the real property as the instalments of the foreign currency loans were significantly lower comparing to domestic financing. The premise to take loans in CHF was the perception of Swiss currency as very safe, stable and resistant for financial crises. Using of such perception for borrowings was incorrect as Swiss franc valuation in Poland was determined by depreciation of PLN and euro on international markets. Increase of CHF rate toward PLN would bring benefits to deponents but not to borrowers. The Swiss franc loans repayment conditions and financial condition of borrowers vary, depending on the date and hence CHF/PLN rate at which the loan was exchanged into PLN and afterwards at which the loans have been repaid. The consequence of such conditions is relatively high volatility of repayment expenditures for loans in CHF taken in various periods in time. The worst terms of the loans repayment and hence the highest LtV are representing loans taken around historical minimum pricing of the Swiss currency (July 2008). Loans taken after February 2009 in general are more beneficial for borrowers than mortgages in domestic currency. Due to variable situation of borrowers using Swiss franc loans, such type of financing should not be treated as a systemic problem and hence there is neither economic nor social reason behind its compulsory exchange onto PLN-denominated loans. When the high valuation of Swiss franc continues, foreign currency loans will be less profitable than Polish zloty mortgages but they should not affect substantially quality of the loans as there was no substantial increase of NPL ratio during long-term high valuation of Swiss currency. Moreover, due to increase of average salaries in Poland altogether with depreciation of PLN, the raise of instalments has been covered by the increased incomes of borrowers. As loans denominated in euro were granted mostly at the beginning of the subprime crisis and within next two years at appreciated value of euro, hence they do not create risk in a similar way like CHF loans. Due to legal requirements of PFSA from 2014 banks cannot grant anymore foreign currency loans to borrowers receiving incomes in Polish zloty, hence portfolio of foreign currency loans will be getting old and might be characterized by NPL ratio increasing in time. The first hypotheses put forward in the paper should be verified positively, the second partially positively due to generally higher costs of 20-years loans in CHF than in PLN but also as a rule more beneficial 30-years franc loans than PLN-denominated.

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Track 2

Entrepreneurship,
Tourism and Trade

Primal i dual problema LP-a: analiza osjetljivosti i višestruki optimumi

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Sažetak. U radu su prikazana rješenja niza praktičnih primjera iz područja linearnog programiranja dostupnih u literaturi s pomoću Excelovog alata Solver. Uz rješenja primala razmatrana su i rješenja duala odabranih problema. Izvršena je usporedba dobivenih rezultata. Temeljni cilj rada bio je utvrđivanje međusobne povezanosti podataka koje Solver nudi u svojim izvještajima *Answer Report* i *Sensitivity Report*: cijene u sjeni, odnosno marginalnog troška (*shadow prices*), oportunitetnog troška (*reduced costs*), koeficijenata funkcije cilja (*objective coefficients*) te desnih strana ograničenja (*constraints right hand sides*) za primal i za dual razmatranog problema. Posebno su analizirani problemi višestrukih optimumima (*multiple optima*) i mogućnosti njihove detekcije analizom podataka u izvještajima o osjetljivosti primala, odnosno duala razmatranih problema.

Ključne riječi: *linearno programiranje, primal i dual, Solver, analiza osjetljivosti, višestruki optimumi*

1. Uvod

U uvjetima žestoke konkurencije na tržištu, težnje ka smanjenju troškova i ostvarivanju maksimalne moguće dobiti, a zahvaljujući između ostalog i razvoju računala, modeli i metode operacijskih istraživanja postaju sve veća i sve snažnija potpora menadžerskom odlučivanju.

Linearno je programiranje svakako najpoznatija, najpopularnija i najčešće korištena metoda operacijskih istraživanja [1, 3].

Uz mnogobrojne prednosti, primjena ove metode ima i niz značajnih nedostataka koji se mogu svesti na sljedeće [7]:

- formuliranje linearne funkcije cilja u matematičkom obliku može biti vrlo složena zadaća, a i kada se ta funkcija definira teško je odrediti socijalna, institucijska, financijska i druga ograničenja,
- prikazivanje razmatranog problema baš u obliku linearnih jednadžba i nejednadžba može dovesti do odstupanja od realiteta samog problema (podrazumijevaju se idealni uvjeti i u procesu proizvodnje i na tržištu) koje se ne može zanemariti,
- vrlo je teško odrediti relevantne vrijednosti brojčanih parametara koji se pojavljuju u opisu problema, kako koeficijenata funkcije cilja tako i koeficijenata lijevih i desnih strana pojedinih ograničenja,
- rješenje problema optimuma u slučaju linearnog programiranja dobivaju se metodom pokušaja i pogreške i teško je ustvrditi stvarnu, realnu vrijednost optimuma različitih poslovnih situacija.

Navedeni se nedostaci ublažavaju, između ostalog, detaljnom analizom osjetljivosti rješenja. Ta je analiza, u slučaju linearnog programiranja, vrlo jednostavna i sadržajna, dijelom zahvaljujući i konceptu dualiteta.

Za rješavanje problema linearnog programiranja se koriste različiti programski paketi kao Lindo, Winqsb i slični, a dobro može poslužiti i Excelov alat Solver [6]. Svi oni koriste u rješavanju Simplex algoritam kojega je svijetu predstavio J. Dantzig još 1957. godine.

Korištenje Solvera ograničeno je na probleme do 200 varijabla odlučivanja i 500 ograničenja, a jedan je od ključnih nedostataka u tomu što kod problema s višestrukim optimumima Solver daje samo jedno bazično optimalno rješenje.

Sve navedeno je rezultiralo motivacijom za izradu ovog rada: utvrđivanje međusobne povezanosti podataka koje Solver nudi u svojim izvještajima *Answer Report* i *Sensitivity Report*: cijene u sjeni, odnosno marginalnog troška (*shadow prices*), oportunitetnog troška (*reduced costs*), koeficijenta funkcije cilja (*objective coefficients*) te desnih strana ograničenja (*constraints right hand sides*) za primal i za dual razmatranog problema [5].

Posebno je razmatrana mogućnost detekcije višestrukih optimuma temeljem podataka koje Solver nudi u svojim izvještajima o osjetljivosti rješenja.

2. Matematičke osnove

Svakom problemu linearnog programiranja (primalu), bilo da se radi o traženju maksimuma ili minimuma funkcije cilja, pripada odgovarajući problem traženja minimuma odnosno maksimuma koji se naziva dualom razmatranog problema [5].

Koncept dualiteta može se svrstati u jedno od najznačajnijih otkrića u razvoju teorije linearnog programiranja.

Uzajamni odnosi primala i duala od osobitog su značaja u analizi osjetljivosti problema linearnog programiranja.

2.1 Primal i dual u algebarskom zapisu [3]

Algebarski zapisi primala i duala problema linearnog programiranja, kada je problem primala standardni problem maksimuma, prikazani su u tablici 1.

Tablica 1 Primal standardnog problema maksimuma i njegov dual u algebarskom zapisu

PRIMAL	DUAL
<p>Odredi maksimum funkcije cilja:</p> $F_{CP} = c_1x_1 + c_2x_2 + \dots + c_ix_i + \dots + c_nx_n$ <p>uz ograničenja</p> $a_{11}x_1 + a_{12}x_2 + \dots + a_{1i}x_i + \dots + a_{1n}x_n \leq b_1$ $a_{21}x_1 + a_{22}x_2 + \dots + a_{2i}x_i + \dots + a_{2n}x_n \leq b_2$ <p style="text-align: center;">...</p> $a_{j1}x_1 + a_{j2}x_2 + \dots + a_{ji}x_i + \dots + a_{jn}x_n \leq b_j$ <p style="text-align: center;">...</p> $a_{m1}x_1 + a_{m2}x_2 + \dots + a_{mi}x_i + \dots + a_{mn}x_n \leq b_m$ <p>i nenegativne varijable odlučivanja</p> $x_1 \geq 0, x_2 \geq 0, \dots, x_i \geq 0, \dots, x_n \geq 0.$	<p>Odredi minimum funkcije cilja:</p> $F_{CD} = b_1y_1 + b_2y_2 + \dots + b_jy_j + \dots + b_my_m$ <p>uz ograničenja</p> $a_{11}y_1 + a_{21}y_2 + \dots + a_{j1}y_j + \dots + a_{m1}y_m \geq c_1$ $a_{12}y_1 + a_{22}y_2 + \dots + a_{j2}y_j + \dots + a_{m2}y_m \geq c_2$ <p style="text-align: center;">...</p> $a_{1i}y_1 + a_{2i}y_2 + \dots + a_{ji}y_j + \dots + a_{mi}y_m \geq c_i$ <p style="text-align: center;">...</p> $a_{1n}y_1 + a_{2n}y_2 + \dots + a_{jn}y_j + \dots + a_{mn}y_m \geq c_n$ <p>i nenegativne varijable odlučivanja</p> $y_1 \geq 0, y_2 \geq 0, \dots, y_j \geq 0, \dots, y_m \geq 0.$

Algebarski zapisi primala i duala problema linearnog programiranja, kada je problem primala standardni problem minimuma, prikazani su u tablici 2.

Tablica 2 Primal standardnog problema minimuma i njegov dual u algebarskom zapisu

PRIMAL	DUAL
<p>Odredi minimum funkcije cilja:</p> $F_{CP} = c_1x_1 + c_2x_2 + \dots + c_ix_i + \dots + c_nx_n$ <p>uz ograničenja</p> $a_{11}x_1 + a_{12}x_2 + \dots + a_{1i}x_i + \dots + a_{1n}x_n \geq b_1$ $a_{21}x_1 + a_{22}x_2 + \dots + a_{2i}x_i + \dots + a_{2n}x_n \geq b_2$ <p style="text-align: center;">...</p> $a_{j1}x_1 + a_{j2}x_2 + \dots + a_{ji}x_i + \dots + a_{jn}x_n \geq b_j$ <p style="text-align: center;">...</p> $a_{m1}x_1 + a_{m2}x_2 + \dots + a_{mi}x_i + \dots + a_{mn}x_n \geq b_m$ <p>i nenegativne varijable odlučivanja</p> $x_1 \geq 0, x_2 \geq 0, \dots, x_i \geq 0, \dots, x_n \geq 0.$	<p>Odredi maksimum funkcije cilja:</p> $F_{CD} = b_1y_1 + b_2y_2 + \dots + b_jy_j + \dots + b_my_m$ <p>uz ograničenja</p> $a_{11}y_1 + a_{21}y_2 + \dots + a_{j1}y_j + \dots + a_{m1}y_m \leq c_1$ $a_{12}y_1 + a_{22}y_2 + \dots + a_{j2}y_j + \dots + a_{m2}y_m \leq c_2$ <p style="text-align: center;">...</p> $a_{1i}y_1 + a_{2i}y_2 + \dots + a_{ji}y_j + \dots + a_{mi}y_m \leq c_i$ <p style="text-align: center;">...</p> $a_{1n}y_1 + a_{2n}y_2 + \dots + a_{jn}y_j + \dots + a_{mn}y_m \leq c_n$ <p>i nenegativne varijable odlučivanja</p> $y_1 \geq 0, y_2 \geq 0, \dots, y_j \geq 0, \dots, y_m \geq 0.$

Veličine prikazane u izrazima prikazanim u tablicama 1 i 2 su:

F_{CP} , F_{CD} - funkcija cilja primala, odnosno duala

x_i , $i = 1, 2, \dots, n$ - varijable odlučivanja primala

y_j , $j = 1, 2, \dots, m$ - varijable odlučivanja duala

a_{ij} , $i = 1, 2, \dots, n$; $j = 1, 2, \dots, m$ - koeficijenti lijevih strana ograničenja primala

a_{ji} , $j = 1, 2, \dots, m$; $i = 1, 2, \dots, n$ - koeficijenti lijevih strana ograničenja duala

c_i , $i = 1, 2, \dots, n$ - koeficijenti funkcije cilja primala, odnosno koeficijenti desne strane ograničenja duala

b_j , $j = 1, 2, \dots, m$ - koeficijenti desne strane ograničenja primala, odnosno koeficijenti funkcije cilja duala.

2.2 Primal i dual u matričnom zapisu [3]

Matrični zapisi primala i duala problema linearnog programiranja, kada je problem primala standardni problem maksimuma, prikazani su u tablici 3.

Tablica 3 Primal standardnog problema maksimuma i njegov dual u matričnom zapisu

PRIMAL	DUAL
<p>Odredi maksimum funkcije cilja:</p> $F_{CP} = \mathbf{c}^T \mathbf{x}$ <p>uz ograničenja</p> $\mathbf{A} \cdot \mathbf{x} \leq \mathbf{b}$ <p>i nenegativne varijable odlučivanja</p> $\mathbf{x} \geq \mathbf{0}.$	<p>Odredi minimum funkcije cilja:</p> $F_{CD} = \mathbf{b}^T \mathbf{y}$ <p>uz ograničenja</p> $\mathbf{A}^T \cdot \mathbf{y} \geq \mathbf{c}$ <p>i nenegativne varijable odlučivanja</p> $\mathbf{y} \geq \mathbf{0}.$

Matrični zapisi primala i duala problema linearnog programiranja, kada je problem primala standardni problem minimuma, prikazani su u tablici 4.

Tablica 4 Primal standardnog problema minimuma i njegov dual u matričnom zapisu

PRIMAL	DUAL
<p>Odredi minimum funkcije cilja:</p> $F_{CP} = \mathbf{c}^T \mathbf{x}$ <p>uz ograničenja</p> $\mathbf{A} \cdot \mathbf{x} \geq \mathbf{b}$ <p>i nenegativne varijable odlučivanja</p> $\mathbf{x} \geq \mathbf{0}.$	<p>Odredi maksimum funkcije cilja:</p> $F_{CD} = \mathbf{b}^T \mathbf{y}$ <p>uz ograničenja</p> $\mathbf{A}^T \cdot \mathbf{y} \leq \mathbf{c}$ <p>i nenegativne varijable odlučivanja</p> $\mathbf{y} \geq \mathbf{0}.$

U danim je izrazima:

$$\mathbf{x} = \begin{Bmatrix} x_1 \\ x_2 \\ \dots \\ x_i \\ \dots \\ x_n \end{Bmatrix}; \mathbf{c}^T = \{c_1, c_2, \dots, c_i, \dots, c_n\}, \mathbf{c} = \begin{Bmatrix} c_1 \\ c_2 \\ \dots \\ c_i \\ \dots \\ c_n \end{Bmatrix}; \mathbf{b} = \begin{Bmatrix} b_1 \\ b_2 \\ \dots \\ b_j \\ \dots \\ b_m \end{Bmatrix}, \mathbf{b}^T = \{b_1, b_2, \dots, b_j, \dots, b_m\}; \mathbf{y} = \begin{Bmatrix} y_1 \\ y_2 \\ \dots \\ y_j \\ \dots \\ y_m \end{Bmatrix}$$

gdje je \mathbf{x} – vektor varijabla odlučivanja primala, \mathbf{c}^T – vektor koeficijenata funkcije cilja primala, \mathbf{c} – vektor koeficijenata desne strane ograničenja duala, \mathbf{b} – vektor koeficijenata desne strane ograničenja primala, \mathbf{b}^T – vektor koeficijenata funkcije cilja duala, \mathbf{y} – vektor varijabla odlučivanja duala, dok je \mathbf{A} – matrica koeficijenata lijevih strana ograničenja primala, a \mathbf{A}^T – matrica koeficijenata lijevih strana ograničenja duala:

$$\mathbf{A} = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1i} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2i} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ a_{j1} & a_{j2} & \dots & a_{ji} & \dots & a_{jn} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ a_{m1} & a_{m2} & \dots & a_{mi} & \dots & a_{mn} \end{bmatrix}, \mathbf{A}^T = \begin{bmatrix} a_{11} & a_{21} & \dots & a_{j1} & \dots & a_{m1} \\ a_{12} & a_{22} & \dots & a_{j2} & \dots & a_{m2} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ a_{1i} & a_{2i} & \dots & a_{ji} & \dots & a_{jn} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ a_{1n} & a_{2n} & \dots & a_{jn} & \dots & a_{mn} \end{bmatrix}.$$

2.3 Višestruki optimumi

Donositelju odluke vrlo je važno znati postoji li uz dobiveno optimalno rješenje \mathbf{x}_{10} i neko drugo, alternativno optimalno rješenje \mathbf{x}_{20} , odnosno postoji li neka druga kombinacija vrijednosti varijabla odlučivanja za koju će funkcija cilja imati istu optimalnu vrijednost.

Ako razmatrani problem linearnog programiranja ima dva bazična optimalna rješenja \mathbf{x}_{10} i \mathbf{x}_{20} , tada su sve konveksne kombinacije ta dva optimalna rješenja

$$\mathbf{x}_O^* = \alpha \cdot \mathbf{x}_{10} + (1 - \alpha) \cdot \mathbf{x}_{20}, \quad \alpha \in [0, 1]$$

također optimalna rješenja tog problema.

Zaključuje se da u tom slučaju razmatrani problem ima beskonačno mnogo optimalnih rješenja.

3. Primjeri

Primjeri obrađeni u ovom radu su preuzeti iz udžbenika [2, 3]. Prvi je primjer [3] odabran za usporedbu rezultata rješenja i analize osjetljivosti primala i duala razmatranog problema, dok je u druga dva primjera, koji prema [2] imaju više od jednog optimalnog rješenja, prikazan način detekcije postojanja višestrukih optimuma kao i način određivanja barem još jednog bazičnog optimalnog rješenja s pomoću Excelovog alata Solver i duala razmatranog problema.

3.1 Primjer 1: Proizvodni problem, [3, str. 230]

Poduzeće proizvodi tri vrste proizvoda: P1, P2 i P3. U tablici 5 prikazano je vrijeme (u satima) koje je potrebno utrošiti na strojnu obradu, bojenje i kontrolu kvalitete svakog pojedinog proizvoda, sati kojima poduzeće tjedno raspolaže za izvršavanje tih operacija kao i dobit koja se ostvaruje po komadu svakog od proizvoda.

Tablica 5 Proizvodnja – ulazni podatci

Vrsta proizvoda	Strojna obrada u h	Bojenje u h	Kontrola kvalitete u h	Dobit po komadu u kn
Proizvod P1	0,4	0,3	0,3	150
Proizvod P2	0,7	0,5	0,3	160
Proizvod P3	0,5	0,3	0,4	140
Tjedno raspoloživo vrijeme	72	48	36	

Potrebno je odrediti plan tjedne proizvodnje koja će poduzeću donijeti najveću dobit.

3.1.1 Primal primjera 1

Ako se varijable odlučivanja (nenegativni brojevi) definiraju na sljedeći način: x_1 – broj komada proizvoda P1, x_2 – broj komada proizvoda P2, te x_3 – broj komada proizvoda P3, tada je funkcija cilja (ukupna dobit poduzeća)

$$F_{CP} = 150 \cdot x_1 + 160 \cdot x_2 + 140 \cdot x_3$$

koju treba maksimizirati uz sljedeća ograničenja:

- raspoloživo vrijeme za strojnu obradu
 $0,4 \cdot x_1 + 0,7 \cdot x_2 + 0,5 \cdot x_3 \leq 72 \quad (1)$
- raspoloživo vrijeme za bojenje
 $0,3 \cdot x_1 + 0,5 \cdot x_2 + 0,3 \cdot x_3 \leq 48 \quad (2)$
- raspoloživo vrijeme za kontrolu kvalitete
 $0,3 \cdot x_1 + 0,3 \cdot x_2 + 0,4 \cdot x_3 \leq 36 \quad (3)$

Na slici 1 prikazana je priprema podataka i rješenje primala s pomoću Solvera.

3		Varijable odlučivanja			Funkcija cilja			
4		x1	x2	x3	Dobit			
5		60,0	60,0	0,0	18.600,00 kn			
6	Koeficijenti Fc	150,0	160,0	140,0				
7								
8								
9	Opis ograničenja	Koeficijenti LSO			LSO	Operator	DSO	Br.
10	strojna obrada	0,4	0,7	0,5	66,0	<=	72,0	1
11	bojenje	0,3	0,5	0,3	48,0	<=	48,0	2
12	kontrola kval.	0,3	0,3	0,4	36,0	<=	36,0	3

Slika 1 Primjer 1: rješenje primala

Maksimalnu tjednu dobit od 18.600,00 kuna poduzeće će ostvariti proizvodnjom 60 komada proizvoda P1 i P2, pri čemu se proizvod P3 neće proizvoditi.

3.1.2 Dual primjera 1

Funkcija cilja duala (prema izrazima danim u tablici 1), minimalni trošak (vrijednost) raspoloživih resursa za zadanu razinu dobiti, glasi

$$F_{CD} = 72 \cdot y_1 + 48 \cdot y_2 + 36 \cdot y_3$$

i treba je minimizirati uz sljedeća ograničenja:

$$0,4 \cdot y_1 + 0,3 \cdot y_2 + 0,3 \cdot y_3 \geq 150 \quad (1)$$

$$0,7 \cdot y_1 + 0,5 \cdot y_2 + 0,3 \cdot y_3 \geq 160 \quad (2)$$

$$0,5 \cdot y_1 + 0,3 \cdot y_2 + 0,4 \cdot y_3 \geq 140 \quad (3).$$

Varijable odlučivanja su jedinični interni (marginalni) troškovi resursa s kojima poduzeće raspolaže: y_1 – jedinična interna vrijednost strojne obrade (po satu), y_2 – jedinična interna vrijednost bojenja, te y_3 – jedinična interna vrijednost kontrole kvalitete.

Prvo ograničenje duala znači vrijednost pripisanu proizvodnji jedne jedinice proizvoda P1 (0,4 h strojne obrade, 0,3 h bojenja i 0,3 sati kontrole kvalitete) koja ne može biti manja od dobiti po jedinici tog proizvoda (150 kuna). Na isti se način mogu opisati ograničenja (2) i (3) duala.

Na slici 2 prikazana je priprema podataka i rješenje duala s pomoću Solvera.

3		Varijable odlučivanja			Funkcija cilja			
4		y1	y2	y3	Trošak			
5		0,0	50,0	450,0	18.600,00 kn			
6	Koeficijenti Fc	72,0	48,0	36,0				
7								
8								
9	Opis ograničenja	Koeficijenti LSO			LSO	Operator	DSO	Br.
10	jed. vrijednost proizvodnje P1	0,4	0,3	0,3	150,0	>=	150,0	1
11	jed. vrijednost proizvodnje P2	0,7	0,5	0,3	160,0	>=	160,0	2
12	jed. vrijednost proizvodnje P3	0,5	0,3	0,4	195,0	>=	140,0	3

Slika 2 Primjer 1: rješenje duala

Minimalni trošak resursa koji će poduzeće ostvariti je 18.600,00 kuna uz interne vrijednosti od 50 kuna po satu bojenja i 450 kuna po satu kontrole kvalitete.

3.1.3 Usporedba podataka analize osjetljivosti primala i duala primjera 1.

Podaci o analizi osjetljivosti primjera 1. dobiveni s pomoću Solvera dani su na slici 3.

Iz prikazanih podataka slijedi da je (sukladno brojevima označenim na slici 3):

- **1:** optimalne vrijednosti varijabla odlučivanja primala jednake su cijenama u sjeni (marginalnim troškovima) duala,
- **2:** optimalne vrijednosti varijabla odlučivanja duala jednake su cijenama u sjeni (marginalnim troškovima) primala
- **3:** koeficijenti funkcije cilja primala kao i raspon njihove moguće promjene (najveće moguće povećanje odnosno smanjenje) jednaki su desnim stranama odgovarajućih ograničenja duala kao i rasponima mogućih promjena tih desnih strana,
- **4:** koeficijenti funkcije cilja duala kao i raspon njihove moguće promjene (najveće moguće povećanje odnosno smanjenje) jednaki su desnim stranama odgovarajućih ograničenja primala kao i rasponima mogućih promjena tih desnih strana,
- **5:** oportunitetni trošak (reducirani trošak), tj. smanjenje funkcije cilja primala za svaki proizvedeni komad P3 (kojega nema u optimalnom planu proizvodnje) jednak je razlici desne strane odgovarajućeg ograničenja duala i konačne vrijednosti lijeve

strane tog ograničenja duala, odnosno negativnoj vrijednosti dopuštenog povećanja desne strane tog ograničenja,

- **6:** oportunitetni trošak (reducirani trošak), tj. povećanje funkcije cilja za svaki dodani sat resursa strojne obrade (čija je interna vrijednost jednaka nuli) jednak je razlici desne strane odgovarajućeg ograničenja primala i konačne vrijednosti lijeve strane tog ograničenja primala, odnosno vrijednosti dopuštenog smanjenja desne strane tog ograničenja.

6	Variable Cells						a)
7			Final	Reduced	Objective	Allowable	
8	Cell	Name	Value	Cost	Coefficient	Increase	Decrease
9	\$B\$5	x1	60	0	150	10	30
10	\$C\$5	x2	60	0	160	90	10
11	\$D\$5	x3	0	-55	140	55	1E+30
12			1	5			3
13	Constraints						
14			Final	Shadow	Constraint	Allowable	Allowable
15	Cell	Name	Value	Price	R.H. Side	Increase	Decrease
16	\$E\$10	strojna obrada LSO	66	0	72	1E+30	6
17	\$E\$11	bojenje LSO	48	50	48	4	12
18	\$E\$12	kontrola kval. LSO	36	450	36	12	7,2
12			2				6
6	Variable Cells						b)
7			Final	Reduced	Objective	Allowable	Allowable
8	Cell	Name	Value	Cost	Coefficient	Increase	Decrease
9	\$B\$5	y1	0	6	72	1E+30	6
10	\$C\$5	y2	50	0	48	4	12
11	\$D\$5	y3	450	0	36	12	7,2
12			2				4
13	Constraints						
14			Final	Shadow	Constraint	Allowable	Allowable
15	Cell	Name	Value	Price	R.H. Side	Increase	Decrease
16	\$E\$10	jed. vrijednost proizvodnje P1 LSO	150	60	150	10	30
17	\$E\$11	jed. vrijednost proizvodnje P2 LSO	160	60	160	90	10
18	\$E\$12	jed. vrijednost proizvodnje P3 LSO	195	0	140	55	1E+30
12			1				5

Slika 3 Podatci o analizi osjetljivost: a) primala, b) duala, i njihova povezanost

Iz podataka o analizi osjetljivosti rješenja primala razmatranog primjera (sl. 3.a) može se zaključiti sljedeće:

- bazično rješenje problema osjetljivo je na promjenu razine dobiti po pojedinom proizvodu: dopušteno povećanje dobiti po proizvodu P1 je 10 kuna (6,7%), a dopušteno smanjenje 30 kuna (20%), dok je dopušteno smanjenje dobiti po proizvodu P2 10 kuna (6,3%),
- raspoloživi sati za bojenje i za kontrolu kvalitete uska su grla proizvodnje; povećanje raspoloživog vremena za kontrolu kvalitete za 1 sat povećalo bi optimalnu funkciju cilja (maksimalnu dobit) za 450 kuna,
- ako se poduzeće ipak odluči proizvesti određenu količinu proizvoda P3 maksimalna dobit će se smanjiti za 55 kuna po svakom tom proizvodu.

3.2 Primjer 2: Raspodjela radnog vremena – Hitna pomoć, [2, str. 186]

U stanici hitne pomoći raspored radnog vremena (dežurstava) zahtijeva brojno stanje medicinskog osoblja koje je prikazano u tablici 6.

Stupanje medicinskog osoblja na posao je svakoga dana u 0, 4, 8, 12, 16 i 20 sati, a radi se 8 sati neprekidno.

Kako izgleda raspored dežurstava koji će značiti najmanje troškove za ustanovu?

Tablica 6 Hitna pomoć – ulazni podatci

Vremenski interval	0-4	4-8	8-12	12-16	16-20	20-24
Potreban broj medicinskog osoblja	10	6	20	18	12	16
troškovi dežurstva po osobi i satu u kn	495	396	330	330	330	396

3.2.1 Primal primjera 2

Ako se s x_i označi broj osoba koje dolaze na posao na početku i -tog intervala vremena (a takvih intervala ima 6) i ako te osobe ostaju na poslu sljedećih 8 sati, bit će varijable odlučivanja: x_1 - broj osoba koje dolaze u 0:00 sati i rade do 8:00, x_2 - broj osoba koje dolaze u 4:00 sati i rade do 12:00, x_3 - broj osoba koje dolaze u 8:00 sati i rade do 16:00, x_4 - broj osoba koje dolaze u 12:00 sati i rade do 20:00, x_5 - broj osoba koje dolaze u 16:00 sati i rade do 24:00, te x_6 - broj osoba koje dolaze u 20:00 sati i rade do 4:00 idućeg dana.

Troškovi dežurstava su sljedeći: osoba koja dolazi u 0:00 sati (njih x_1) radi 4 sata uz cijenu sata 495 kuna i 4 sata uz cijenu sata od 396 kuna pa je trošak dežurstva te osobe $4 \cdot 495 + 4 \cdot 396 = 3564$ kune; osoba koja dolazi u 4:00 sati (njih x_2) radi uz ukupni trošak dežurstva $4 \cdot 396 + 4 \cdot 330 = 2904$ kuna; osoba koja dolazi u 8:00 sati (njih x_3) kao i osoba koja dolazi u 12:00 sati (njih x_4) radi svih 8 sati uz cijenu sata 330 kuna pa je ukupni trošak dežurstva te osobe $8 \cdot 330 = 2640$ kuna; osoba koje dolazi u 16:00 sati (njih x_5) radi 4 sata uz cijenu sata 330 kuna, te 4 sata uz cijenu sata od 396 kuna pa je cijena dežurstva te osobe 2904 kune; te konačno, osoba koja dolazi u 20:00 sati (njih x_6) radi 4 sata uz cijenu sata 396 kuna, a 4 sata uz cijenu sata od 495 kuna pa je cijena dežurstva te osobe 3564 kune.

Prema tome, funkcija cilja primala (ukupni troškovi dežurstava) je

$$F_{CP} = 3564 \cdot x_1 + 2904 \cdot x_2 + 2640 \cdot x_3 + 2640 \cdot x_4 + 2904 \cdot x_5 + 3564 \cdot x_6$$

a ograničenja koja slijede iz potrebnog brojnog stanja osoblja u pojedinim intervalima su

$$\begin{aligned} x_1 + x_2 &\geq 6 & (1), & \quad x_2 + x_3 \geq 20 & (2), & \quad x_3 + x_4 \geq 18 & (3) \\ x_4 + x_5 &\geq 12 & (4), & \quad x_5 + x_6 \geq 16 & (5), & \quad x_6 + x_1 \geq 10 & (6). \end{aligned}$$

Na slici 4 prikazana je priprema podataka i rješenje s pomoću Solvera.

3		Varijable odlučivanja						Funkcija cilja			
4		x1	x2	x3	x4	x5	x6	Trošak dežurstva			
5		6	0	20	0	12	4	123.288,00 kn			
6	Koeficijenti Fc	3564	2904	2640	2640	2904	3564				
7											
8											
9	Opis ograničenja	Koeficijenti LSO						LSO	Operator	DSO	Br.
10	osoblje 0-4	1	1					6	>=	6	1
11	osoblje 4-8		1	1				20	>=	20	2
12	osoblje 8-12			1	1			20	>=	18	3
13	osoblje 12-16				1	1		12	>=	12	4
14	osoblje 16-20					1	1	16	>=	16	5
15	osoblje 20-24	1					1	10	>=	10	6

Slika 4 Primjer 2: rješenje primala

6	Variable Cells						
7			Final	Reduced	Objective	Allowable	Allowable
8	Cell	Name	Value	Cost	Coefficient	Increase	Decrease
9	\$B\$5	x1	6	0	3564	0	2640
10	\$C\$5	x2	0	0	2904	2640	0
11	\$D\$5	x3	20	0	2640	0	2640
12	\$E\$5	x4	0	0	2640	1E+30	0
13	\$F\$5	x5	12	0	2904	0	2640
14	\$G\$5	x6	4	0	3564	2640	0

Slika 5 Primjer 2: podatci o analizi osjetljivosti koeficijenata funkcije cilja primala

Dakle, najmanji trošak dežurstava u iznosu od 123.288,00 kuna Hitna će pomoć imati uz varijable odlučivanja $x_1^o = 6$, $x_2^o = 0$, $x_3^o = 20$, $x_4^o = 0$, $x_5^o = 12$, te $x_6^o = 4$.

Međutim, iz podataka o analizi osjetljivosti koeficijenata funkcije cilja primala (slika 5) može se vidjeti da je oportunitetni trošak uz varijable x_2 i x_4 , čija je vrijednost u optimalnom rješenju jednaka nuli, također jednaka nuli. Proizlazi da se funkcija cilja neće promijeniti niti ako te varijable poprimu neku vrijednost različitu od nule. Budući da se u tom slučaju moraju promijeniti vrijednosti i nekih drugih varijabla odlučivanja to upućuje na postojanje barem još jednog optimalnog rješenja.

Kod korištenja Solvera može se pokazati da cijene u sjeni (marginalni troškovi) duala razmatranog problema jesu varijable odlučivanja drugog bazičnog optimalnog rješenja. Ovo se može objasniti algoritmom koji se koristi u Simpleks metodi i „putanjom“ kojom se dolazi do optimuma u slučaju traženja maksimuma funkcije cilja primala, odnosno minimuma funkcije cilja duala.

3.2.2 Dual primjera 2

Funkcija cilja duala prema tablici 1 glasi

$$F_{CD} = 6 \cdot y_1 + 20 \cdot y_2 + 18 \cdot y_3 + 12 \cdot y_4 + 16 \cdot y_5 + 10 \cdot y_6$$

i treba je maksimizirati uz sljedeća ograničenja:

$$y_1 + y_2 \leq 3564 \quad (1), \quad y_1 + y_2 \leq 2904 \quad (2), \quad y_2 + y_3 \leq 2640 \quad (3)$$

$$y_3 + y_4 \leq 2640 \quad (4), \quad y_4 + y_5 \leq 2904 \quad (5), \quad y_5 + y_6 \leq 3564 \quad (6).$$

Na slici 2 prikazana je priprema podataka i rješenje duala s pomoću Solvera.

3		Varijable odlučivanja						Funkcija cilja			
4		y1	y2	y3	y4	y5	y6	Dobit ili Trošak ili			
5		264	2640	0	2640	264	3300	123.288,00 kn			
6	Koeficijenti Fc	6	20	18	12	16	10				
7											
8											
9	Opis ograničenja	Koeficijenti LSO						LSO	Operator	DSO	Br.
10	trošak smjene (0:00)	1					1	3564	<=	3564	1
11	trošak smjene (4:00)	1	1					2904	<=	2904	2
12	trošak smjene (8:00)		1	1				2640	<=	2640	3
13	trošak smjene (12:00)			1	1			2640	<=	2640	4
14	trošak smjene (16:00)				1	1		2904	<=	2904	5
15	trošak smjene (20:00)					1	1	3564	<=	3564	6

Slika 6 Primjer 2: rješenje duala

Drugo bazično optimalno rješenje primala razmatranog primjera je ono za koje varijable odlučivanja primala poprimaju vrijednost odgovarajućih marginalnih troškova (cijena u sjeni, *shadow price*) njegovoga duala, dakle: $x_1^{o2} = 0$, $x_2^{o2} = 6$, $x_3^{o2} = 16$, $x_4^{o2} = x_5^{o2} = 6$, te $x_6^{o2} = 10$, što se može vidjeti iz podataka o analizi osjetljivosti ograničenja duala (sl. 7).

16	Constraints						
17			Final	Shadow	Constraint	Allowable	Allowable
18	Cell	Name	Value	Price	R.H. Side	Increase	Decrease
19	\$H\$10	trošak smjene (0:00) LSO	3564	0	3564	1E+30	0
20	\$H\$11	trošak smjene (4:00) LSO	2904	6	2904	0	264
21	\$H\$12	trošak smjene (8:00) LSO	2640	14	2640	264	0
22	\$H\$13	trošak smjene (12:00) LSO	2640	6	2640	0	2640
23	\$H\$14	trošak smjene (16:00) LSO	2904	6	2904	3300	0
24	\$H\$15	trošak smjene (20:00) LSO	3564	10	3564	0	3300

Slika 7 Primjer 2: podatci o analizi osjetljivosti ograničenja duala

Rješenje se poklapa s odgovarajućim drugim optimalnim rješenjem dobivenim s pomoću programa Winqsb [2, str. 188].

3.3 Primjer 3: Proizvodnja viskija, [2, str. 208]

Proizvođač viskija uvozi 3 vrste sirovina (A, B i C) različitih gradacija i miješa ih zavisno o receptima koji specificiraju maksimalni i minimalni postotak tih sirovina u svakoj od vrsta viskija koje proizvodi (Blue Dot, Highland Fling i Old Frenzy). Receptura i cijene viskija po litri dana je u tablici 7.

Tablica 7 Proizvodnja viskija – specifikacija i cijene

Vrsta viskija	Specifikacija	Cijena po litri u €
Blue Dot	ne manje od 60% sirovine A ne više od 20% sirovine C	6,80
Highland Fling	ne manje od 15% sirovine A ne više od 20% sirovine C	5,70
Old Frenzy	ne više od 50% sirovine C	6,00

Raspoložive dnevne količine sirovina A, B i C, kao i njihove nabavne cijene prikazane su u tablici 8.

Tablica 8 Proizvodnja viskija – sirovine

Sirovina	Dnevna količina u l	Cijena po litri u €
A	2000	7
B	2500	5
C	1200	4

Zbog ugovorne klauzule proizvođač mora dnevno proizvesti najmanje 1000 litara Highland Flinga. Odrediti plan proizvodnje koji će maksimizirati dnevno ostvarenu dobit.

3.3.1 Primal primjera 3

Ako se s x_1 označi dnevno proizvedena količina Blue Doda, s x_2 - dnevno proizvedena količina Highland Flinga, a s x_3 - dnevno proizvedena količina Old Frenzyja, tada se mogu uvesti sljedeće varijable odlučivanja: x_{1A} - količina sirovine A upotrijebljene za piće x_1 , x_{2A} - količina sirovine A upotrijebljene za piće x_2 , x_{3A} - količina sirovine A upotrijebljene za piće x_3 , x_{1B} - količina sirovine B upotrijebljene za piće x_1 , x_{2B} - količina sirovine B upotrijebljene za piće x_2 , x_{3B} - količina sirovine B upotrijebljene za piće x_3 , x_{1C} - količina sirovine C upotrijebljene za piće x_1 , x_{2C} - količina sirovine C upotrijebljene za piće x_2 , te x_{3C} - količina sirovine C upotrijebljene za piće x_3 .

Ukupna količina dnevno proizvedenog viskija Blue Dot jednaka je zbroju količina sirovina A, B i C umiješanih u taj viski

$$x_1 = x_{1A} + x_{1B} + x_{1C}$$

pa je dnevni prihod od prodaje viskija Blue Dot

$$TR_1 = 6,8 \cdot x_1 = 6,8 \cdot (x_{1A} + x_{1B} + x_{1C})$$

Analogno vrijedi i za ostale dvije vrste viskija:

$$x_2 = x_{2A} + x_{2B} + x_{2C}, \quad TR_2 = 5,7 \cdot x_2 = 5,7 \cdot (x_{2A} + x_{2B} + x_{2C})$$

$$x_3 = x_{3A} + x_{3B} + x_{3C}, \quad TR_3 = 6 \cdot x_3 = 6 \cdot (x_{3A} + x_{3B} + x_{3C}).$$

Ukupni dnevni prihod je

$$TR = TR_1 + TR_2 + TR_3 = 6,8 \cdot (x_{1A} + x_{1B} + x_{1C}) + 5,7 \cdot (x_{2A} + x_{2B} + x_{2C}) + 6 \cdot (x_{3A} + x_{3B} + x_{3C})$$

Dnevno se potroši $(x_{1A} + x_{2A} + x_{3A})$ litara sirovine A po jediničnoj cijeni od 7 kuna, $(x_{1B} + x_{2B} + x_{3B})$ litara sirovine B po jediničnoj cijeni od 5 kuna, te $(x_{1C} + x_{2C} + x_{3C})$ litara sirovine C po jediničnoj cijeni od 4 kune. Slijede ukupni troškovi upotrijebljenih sirovina:

$$TC = 7 \cdot (x_{1A} + x_{2A} + x_{3A}) + 5 \cdot (x_{1B} + x_{2B} + x_{3B}) + 4 \cdot (x_{1C} + x_{2C} + x_{3C}).$$

Oduzimanjem ukupnih troškova od ukupnog prihoda i sređivanjem se dobije funkcija cilja primala (dnevna dobit proizvođača viskija) koju treba maksimizirati:

$$\pi = -0,2 \cdot x_{1A} + 1,8 \cdot x_{1B} + 2,8 \cdot x_{1C} - 1,3 \cdot x_{2A} + 0,7 \cdot x_{2B} + 1,7 \cdot x_{2C} - x_{3A} + x_{3B} + 2 \cdot x_{3C}.$$

Ograničenja slijede iz raspoložive količine sirovina, recepture te ugovorne obveze vezane uz količinu viskija Highland Fling [2, str. 211] su (uz sve nejednakosti oblika \leq):

$$x_{1A} + x_{2A} + x_{3A} \leq 2000 \quad (1)$$

$$x_{1B} + x_{2B} + x_{3B} \leq 2500 \quad (2)$$

$$x_{1C} + x_{2C} + x_{3C} \leq 1200 \quad (3)$$

$$-0,4 \cdot x_{1A} + 0,6 \cdot x_{1B} + 0,6 \cdot x_{1C} \leq 0 \quad (4)$$

$$-0,2 \cdot x_{1A} - 0,2 \cdot x_{1B} + 0,8 \cdot x_{1C} \leq 0 \quad (5)$$

$$-0,6 \cdot x_{2A} - 0,6 \cdot x_{2B} + 0,4 \cdot x_{2C} \leq 0 \quad (6)$$

$$-0,85 \cdot x_{2A} + 0,15 \cdot x_{2B} + 0,15 \cdot x_{2C} \leq 0 \quad (7)$$

$$-0,5 \cdot x_{3A} - 0,5 \cdot x_{3B} + 0,5 \cdot x_{3C} \leq 0 \quad (8)$$

$$-x_{2A} - x_{2B} - x_{2C} \leq -1000. \quad (9)$$

Podrazumijeva se da su varijable odlučivanja nenegativne.

Na slici 8 prikazana je priprema podataka i rješenje s pomoću Solvera odakle slijedi da će najveću dnevnu dobit u iznosu od 5.066,67 € proizvođač viskija ostvariti za vrijednosti varijabla odlučivanja $x_{1A}^o = 1850$, $x_{2A}^o = 616,7$, $x_{3A}^o = 616,7$, $x_{1B}^o = 150$, $x_{2B}^o = 266,7$, $x_{3B}^o = 583,3$, $x_{1C}^o = 0$, $x_{2C}^o = 1616,7$, te $x_{3C}^o = 0$. Ovo nadalje znači da će se dnevno proizvesti $1850 + 616,7 + 616,7 = 3083,3$ litara viskija vrste Blue Dot, $150 + 266,7 + 583,4 = 1000$ litara viskija Highland Fling i $0 + 1616,7 + 0 = 1616,7$ litara viskija Old Frenzy.

Međutim, iz podataka o analizi osjetljivosti (slika 9) može se vidjeti da je oportunitetni trošak (*reduced cost*) uz varijablu x_{3C} , čije je vrijednost u optimalnom rješenju jednaka nuli, također jednaka nuli.

3		Varijable odlučivanja									Funkcija cilja			
4		x1A	x2A	x3A	x1B	x2B	x3B	x1C	x2C	x3C	dnevna dobit			
5		1850,0	616,7	616,7	150,0	266,7	583,3	0,0	1616,7	0,0	5.066,67 €			
6	Koeficijenti Fc	-0,2	1,8	2,8	-1,3	0,7	1,7	-1,0	1,0	2,0				
7														
8														
9	Opis ograničenja	Koeficijenti LSO									LSO	Operator	DSO	Br.
10	količina sirovine A	1,00			1,00			1,00			2000,0	<=	2000,0	1
11	količina sirovine A		1,00			1,00			1,00		2500,0	<=	2500,0	2
12	količina sirovine A			1,00			1,00			1,00	1200,0	<=	1200,0	3
13	recepture 1	-0,40	0,60	0,60							0,0	<=	0,0	4
14	recepture 2	-0,20	-0,20	0,80							0,0	<=	0,0	5
15	recepture 3				-0,60	-0,60	0,40				-16,7	<=	0,0	6
16	recepture 4				-0,85	0,15	0,15				0,0	<=	0,0	7
17	recepture 5							-0,50	-0,50	0,50	-808,3	<=	0,0	8
18	ugovorna obveza				-1,00	-1,00	-1,00				-1000,0	<=	-1000,0	9

Slika 8 Primjer 3: rješenje primala

6	Variable Cells							
7								
8	Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease	
9	\$B\$5	x1A	1850	0	-0,2	1E+30	0,33333333	
10	\$C\$5	x2A	616,6666667	0	1,8	2,2204E-16	1	
11	\$D\$5	x3A	616,6666667	0	2,8	1E+30	2,2204E-16	
12	\$E\$5	x1B	150	0	-1,3	1,33333333	1E+30	
13	\$F\$5	x2B	266,6666667	0	0,7	0	2,2204E-16	
14	\$G\$5	x3B	583,3333333	0	1,7	2,2204E-16	0	
15	\$H\$5	x1C	0	-1,33333333	-1	1,33333333	1E+30	
16	\$I\$5	x2C	1616,666667	0	1	0,5	0	
17	\$J\$5	x3C	0	0	2	0	1E+30	

Slika 9 Primjer 3: podatci o analizi osjetljivosti koeficijenata funkcije cilja primala

Proizlazi da se funkcija cilja neće promijeniti niti ako ta varijabla poprimi neku vrijednost različitu od nule. Budući da se u tom slučaju moraju promijeniti vrijednosti i nekih drugih varijabla odlučivanja to upućuje na postojanje barem još jednog optimalnog rješenja.

Prema [3] postoje ukupno 3 bazična optimalna rješenja, a jedno od njih će se ovdje odrediti analizom podataka o analizi osjetljivosti duala opisanog primjera.

3.3.2 Dual primjera 3

Funkcija cilja duala prema tablici 1 glasi

$$F_{CD} = 2000 \cdot y_1 + 2500 \cdot y_2 + 1200 \cdot y_3 - 1000 \cdot y_9$$

i treba je maksimizirati uz sljedeća ograničenja:

$$y_1 - 0,4 \cdot y_4 - 0,2 \cdot y_5 \geq -0,2 \quad (1)$$

$$y_2 + 0,6 \cdot y_4 - 0,2 \cdot y_5 \geq 1,8 \quad (2)$$

$$y_3 + 0,6 \cdot y_4 + 0,8 \cdot y_5 \geq 2,8 \quad (3)$$

$$y_1 - 0,6 \cdot y_6 - 0,85 \cdot y_7 - y_9 \geq -1,3 \quad (4)$$

$$y_2 - 0,6 \cdot y_6 + 0,15 \cdot y_7 - y_9 \geq 0,7 \quad (5)$$

$$y_3 + 0,4 \cdot y_6 + 0,15 \cdot y_7 - y_9 \geq 1,7 \quad (6)$$

$$y_1 - 0,5 \cdot y_8 \geq -1,0 \quad (7)$$

$$y_2 - 0,5 \cdot y_8 \geq 1,0 \quad (8)$$

$$y_3 + 0,5 \cdot y_8 \geq 2,0 \quad (9)$$

Na slici 10 prikazana je priprema podataka i rješenje duala s pomoću Solvera.

3		Variable odlučivanja									Funkcija cilja			
4		y1	y2	y3	y4	y5	y6	y7	y8	y9	Trošak			
5		0,3	1,0	2,0	1,3	0,0	0,0	1,3	0,0	0,5	5.066,67 €			
6	Koeficijenti Fc	2000	2500	1200	0	0	0	0	0	-1000				
7														
8														
9	Opis ograničenja	Koeficijenti LSO									LSO	Operator	DSO	Br.
10	resurs 1	1,00			-0,40	-0,20					-0,2	>=	-0,2	1
11	resurs 2		1,00		0,60	-0,20					1,8	>=	1,8	2
12	resurs 3			1,00	0,60	0,80					2,8	>=	2,8	3
13	resurs 4	1,00					-0,60	-0,85		-1,00	-1,3	>=	-1,3	4
14	resurs 5		1,00				-0,60	0,15		-1,00	0,7	>=	0,7	5
15	resurs 6			1,00			0,40	0,15		-1,00	1,7	>=	1,7	6
16	resurs 7	1,00							-0,50		0,3	>=	-1,0	7
17	resurs 8		1,00						-0,50		1,0	>=	1,0	8
18	resurs 9			1,00					0,50		2,0	>=	2,0	9

Slika 10 Primjer 3: rješenje duala

Jedno od preostalih bazičnih optimalnih rješenje primala razmatranog primjera je ono za koje varijable odlučivanja primala poprimaju vrijednost odgovarajućih marginalnih troškova (cijena u sjeni, *shadow price*) njegovoga duala, dakle: $x_{1A}^{o2} = 1850$, $x_{2A}^{o2} = 1233,3$, $x_{3A}^{o2} = 0$, $x_{1B}^{o2} = 150$, $x_{2B}^{o2} = 458,3$, $x_{3B}^{o2} = 391,7$, $x_{1C}^{o2} = 0$, $x_{2C}^{o2} = 808,3$, te $x_{3C}^{o2} = 808,3$, što se može vidjeti iz podataka o analizi osjetljivosti ograničenja duala (slika 11).

19	Constraints						
20							
21	Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
22	\$K\$10	resurs 1 LSO	-0,2	1850	-0,2	1E+30	0,33333333
23	\$K\$11	resurs 2 LSO	1,8	1233,33333	1,8	1E+30	2,2204E-16
24	\$K\$12	resurs 3 LSO	2,8	0	2,8	2,2204E-16	1E+30
25	\$K\$13	resurs 4 LSO	-1,3	150	-1,3	1,33333333	1E+30
26	\$K\$14	resurs 5 LSO	0,7	458,33333	0,7	2,2204E-16	3,3307E-16
27	\$K\$15	resurs 6 LSO	1,7	391,66667	1,7	3,3307E-16	2,2204E-16
28	\$K\$16	resurs 7 LSO	0,33333333	0	-1	1,33333333	1E+30
29	\$K\$17	resurs 8 LSO	1	808,33333	1	3,3307E-16	1,33333333
30	\$K\$18	resurs 9 LSO	2	808,33333	2	1	3,3307E-16

Slika 11 Primjer 3: podatci o analizi osjetljivosti ograničenja duala

- Rješenje se poklapa s odgovarajućim trećim bazičnim optimalnim rješenjem dobivenim s pomoću programa Winqsb [2, str. 214].

Drugi način iznalaženja alternativnih optimalnih rješenja sastoji se u sljedećem:

- razmatranom se problemu dodaje novo ograničenje prema kojem je vrijednost odabrane i -te varijable jednaka njenoj optimalnoj vrijednosti ($x_i = x_i^o$),
- riješi se tako postavljeni problem pa se u izvještaju o analizi osjetljivosti analizira moguća promjena desne strane dodanog ograničenja; ako se desna strana dodanog ograničenja može mijenjati za neki iznos $\Delta x_i \neq 0$ pri čemu je cijena u sjeni tog ograničenja jednaka nuli, to znači da se vrijednost i -te varijable može mijenjati u dobivenim granicama bez promjene optimalne vrijednosti funkcije cilja,
- novo bazično optimalno rješenje tada se dobije rješavanjem razmatranog problema uz dodatno ograničenje $x_i = x_i^o + \Delta x_i$.

4. Zaključak

U radu je, na nekoliko primjera dostupnih u literaturi, prikazana mogućnost primjene Excelovog alata Solver u rješavanju problema linearnog programiranja i analizi osjetljivosti tih rješenja sa svrhom eliminiranja/ublažavanja temeljnih nedostataka linearnog programiranja. Dana je usporedba podataka o mogućim promjenama koeficijenata funkcije cilja i desnih strana ograničenja, marginalnim i oportunitetnim troškovima, koje u izvještajima o analizi osjetljivosti daje Solver za primal i za dual razmatranih problema.

Pojašnjen je način utvrđivanja eventualne egzistencije većeg broja optimalnih rješenja te određivanja drugog bazičnog optimalnog rješenja (ako je riječ o problemu s 2 bazična optimuma), odnosno barem još jednog bazičnog optimalnog rješenja (ako je riječ o problemu s više od dva bazična optimuma) i to s pomoću cijena u sjeni duala razmatranog problema.

Pokazano je da u granicama svojih mogućnosti (do 200 varijabla odlučivanja i do 500 ograničenja) Solver može poslužiti kao jednostavan i učinkovit alat pri rješavanju problema linearnog programiranja i analizi osjetljivosti dobivenih rješenja.

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Primal and dual LP problem: sensitivity analysis and multiple optima

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Abstract. Several linear programming problems available in the literature are solved by using Excel Solver. The solution of both the primal and the dual of the selected examples is considered. The obtained results have been compared. The aim of this paper is to determine the interconnection of data provided in Solver Answer and Sensitivity reports: shadow prices, reduced costs, objective coefficients and constraints right hand sides both for the primal and the dual of the presented problems. In particular, the problems of multiple optima and possibilities of their detection by analyzing data in the sensitivity reports for the primal and dual solutions of the selected problems were considered.

Key words: linear programming, primal and dual, Solver, sensitivity analysis, multiple optima

Potencijali za razvoj novih proizvoda i usluga u turizmu baziranih na novim ICT tehnologijama

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Sažetak. U svijetu ICT-a (Information and Communication Technologies) 2020. godina se smatra prekretnicom jer se očekuje komercijalizacija 5G mobilnih mreža pa će telekomunikacijski operateri (s posebnim naglaskom na mobilne operatere) u narednom periodu žurno morati mijenjati kompletan pristup poslovanju odnosno filozofiju poslovanja i pristupa korisniku. Uz to cijeli niz novih pojmova (5G, SDN, NVF, HetNet ...) odnosno sustava baziranih na ovim novim tehnologijama, postat će stvarnost i sadašnjost te budućnost u svakodnevnom životu. Definiran je i pojam koji to sve objedinjuje – „Vizija 2020“. U turizmu ne postoji precizno definiran pojam „Vizija 2020“, ali postoji određeni broj analiza i stručnih te znanstvenih radova u kojima su analizirana očekivanja do 2020. godine te perioda nakon 2020. godine. U ovom radu biti će analizirani preduvjeti za usklađivanje i prilagođavanje pristupa u turizmu i „Vizije 2020“ u ICT-u te će biti analizirani potencijali i dani prijedlozi za razvoj novih integriranih usluga u turizmu. Bit će analizirani zajednički interesi gospodarskih sektora ICT-a i turizma u cilju provođenja i implementacije „Vizije 2020“ te kreiranje usluga u turističkim objektima i turizmu u Republici Hrvatskoj baziranih na novim tehnologijama. Na kraju će biti dan načelni prijedlog standardizacije i kategorizacije turističkih objekata obzirom na nove predložene usluge bazirane na novim tehnologijama čime bi se u turizmu dodijelila dodatna vrijednost za turističke objekte koji su opremljeni i koji nude usluge bazirane na novim tehnologijama.

Ključne riječi: ICT, 5G, IoT/IIoT, Vizija 2020, turizam.

1. Uvod

Današnje poimanje ICT sektora značajno će se promijeniti u narednih par godina. Od 2020. godine (okvirno je ova godina uzeta kao polazna) prelazimo na potpuno drugi način poimanja ICT-a te moramo napraviti „pomak u načinu razmišljanja“. Te promjene koje slijede i koje neki nazivaju i „četvrtom industrijskom revolucijom“ što samo po sebi govori o veličini i značaju promjena koje slijede odrazit će se na sve grane gospodarstva pa samim time i na turizam. U biti, bolje reći turizam će biti jedna od grana gospodarstva na koju će se promjene koje slijede možda i najviše odraziti.

Promjene koje slijede u ICT sektoru bit će analizirane u ovom radu, a sve je sadržano pod zajedničkim nazivom „Vizija 2020“. Neke turističke zajednice, organizacije i države (ili regije pojedinih država) su već objavili svoje smjernice, vizije i strategije razvitka turizma do 2020-e i poslije ove godine (moguće ponukani i pojmom „Vizije 2020“ u ICT sektoru napravili su svoje vizije i strategije u turizmu). U ovom radu, autori će analizirati promjene koje slijede u ICT sektoru i u turizmu u svijetu te kako se to odražava prema pojmu i poimanju turizma u Republici Hrvatskoj.

2. Vizija 2020 u ICT sektoru – što je to

Postoji cijeli niz tvrtki proizvođača ICT opreme, organizacija, telekom operatera i znanstvenih institucija koje se bave problematikom „Vizije 2020“ i svemu vezanom uz nju. Malo je prostora za nabrojati sve njih, ali mogu se navesti samo neki od njih da se shvati kolika je važnost koja se u svijetu pridaje ovom pojmu i razvitku svega što je vezano uz „Viziju 2020“. Najpoznatiji i najvažniji su svakako:

- **Telekom operateri: AT&T, Deutsche Telekom, DoCoMo, Orange, Telefonica, Telenor, Telstra, Verizon Wireless, Vodafone i cijeli niz drugih telekom operatera**
- **Proizvođači opreme: Alcatel-Lucent, Nokia, Ericsson, Qualcomm, Huawei, Intel, Samsung, i cijeli niz drugih poznatih proizvođača opreme**
- **Međunarodne organizacije: 5G PPP, 5G MF, METIS i METIS II, IEEE, GSMA, WWRF i cijeli niz drugih međunarodnih organizacija**

Već samo spomenuti popis koji predstavlja tek manji dio proizvođača ICT opreme, telekom operatera i međunarodnih organizacija ukazuje na to da se ovoj problematici pristupa ozbiljno, da se investira značajan novac, a sasvim sigurno je da oni koji budu izvan ovih tokova i ne budu se posvećivali ovoj problematici će početi zastoјati i može se lako dogoditi da propadnu. U biti, najbolje je reći da svaki telekom operater i proizvođač opreme koji želi opstati na tržištu bavi se ovom problematikom.

Uz to, sve konzultantske tvrtke, međunarodne organizacije za standardizaciju, znanstvene ustanove i svučilišta ako žele nakon 2020. godine predstavljati važnu kariku u budućoj zajednici moraju se baviti ovom problematikom jer će inače biti gurnuti na margine poslovanja, vrijednosti i značaja koju predstavljaju za društvo i vrijednosti i značaja u znanstvenoj zajednici. Prethodno navedene činjenice su općeprihvaćene i predstavljaju osnovu razmišljanja stručnjaka i znanstvenika koji se bave ovom problematikom.

2.1. Osnovne značajke „Vizije 2020“

Pojam „Vizija 2020“ u tehnološkom smislu ima određene definirane postavke kojih se trebaju pridržavati svi sudionici (proizvođači opreme, telekom operateri, međunarodne organizacije, znanstvene institucije ...) koji rade na implementaciji ove vizije. Osnovne ili bolje reći glavne postavke „Vizije 2020“ su:

- podržavanje i do 1000 puta većeg kapaciteta prijenosa u cilju podržavanja povećanih zahtjeva za prijenosom podataka,
- smanjenje kašnjenja u prijenosu do maksimalno 1 ms u cilju podrške razvoju novih budućih aplikacija,
- brzina korisničkog pristupa od 1 Gb/s i više od toga,
- standardizacija: jedinstveni unificirani standard mobilne mreže 5G (za razliku od dosadašnjih iskustava sa standardizacijom mreža 2G – 4G)
- maksimalna automatizacija mreže u cilju jednostavnog upravljanja i održavanja (mreža postaje “svjesna sebe”),
- proučavanje i prilagodba mrežnog iskustva kako bi se omogućilo uvođenje poslovnih modela budućnosti,
- dinamički pristup informacijama od strane uređaja sa svojstvima umjetne inteligencije (AI – artificial intelligence),
- jedinstvena IP mreža (zasnovana na IPv6 adresiranja) sa kombinacijom “bešavnog”

pristupa putem mobilnih mreža, te mreža LAN/WAN/PAN/WLAN i www (uvodi se potpuno novi pojam “wireless world wide web”)

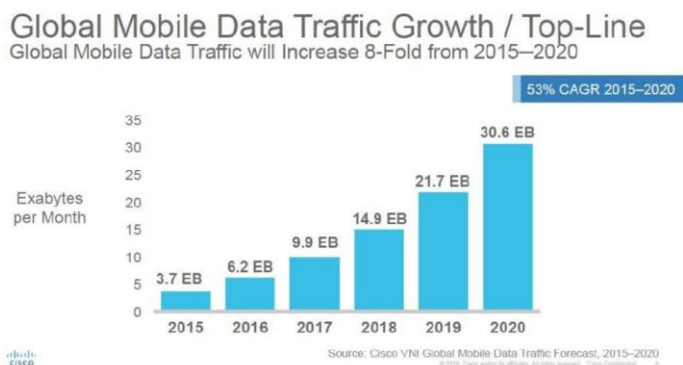
- prilagodba telekom operatera budućnosti za “rješenja u oblaku” kako bi se kreirale “mreže na zahtjev” koje postaju prilagodljive potrebama,
- zadržavanje (ili čak smanjivanje) ukupne potrošnje energije, unatoč ubrzanom rastu prijenosa prometa.

Iz prethodno pobrojanih osnovnih postavki jasno je da se u pojmu „Vizija 2020“ krije potpuno novi pristup telekomunikacijama i informatici (tj. potpuno novi pristup ICT-u). Promjene koje slijede uzrokovat će promjene u svim segmentima ICT-a, ali ono što je posebno značajno i važno, podrazumijeva potpuno novi pristup kreiranju tarifnih paketa i usluga unutar tih tarifnih paketa, tj. potpuno novi pristup u „načinu razmišljanja“ prilikom organizacije mobilnih telekom operatera njihovih unutarnjih procesa u cilju kreiranja potpuno novog korisničkog pristupa. Osim potpuno novog korisničkog pristupa i novog načina kreiranja tarifnih modela, ponude će morati biti i personalizirane za privatne i poslovne segmente uz napomenu i posebne segmentacije i „personalizacije“ za posebne gospodarske grane pa tako i za turizam, tj. za turističke djelatnosti.

2.2. Sastavni dijelovi „Vizije 2020“

Sastavni dijelovi „Vizije 2020“ su prije svega peta generacija mobilnih mreža (5G) te razvoj dijela ICT-a koji podrazumijeva razvoj Internet stvari/uređaja (IoT) i Internet stvari/uređaja u gospodarstvu (IIoT) ili bolje reći novi pristup ovoj problematici – pristup „internet svega“ (IoE). Naravno „Vizija 2020“ je mnogo širi pojam i predstavlja osnovu za poslovni razvoj i usmjeravanje ICT sektora u cilju podrške svim gospodarskim granama, ali temelj počiva na razvoju 5G mreže te pristup razvitku internet uređaja (stvari) ili bolje reći pristup korisničkim mrežama uređaja baziranim na pristupu IoE – internet svega. Razvoj, standardizacija i komercijalizacija pete generacije mobilnih sustava je ključ za što bržu implementaciju „Vizije 2020“. Zašto je 5G mreža ključna za „Viziju 2020“ najbolje se može zaključiti ako se analiziraju podaci koji su prikazani na slici 1.

Sa slike je vidljivo da procjena porasta podatkovnog prometa iznosi blizu deset puta od 2015. godine do 2020. godine (dakle u narednih pet godina) – sa 3,7 EB (eksabajta) na čak 30,6 EB (eksabajta). Ako se podaci sa slike malo dublje analiziraju, onda se vidi da je procjena porasta (u apsolutnom iznosu) najveća upravo u razdoblju 2018. – 2020. godine, tj. u razdoblju kada se očekuje komercijalizacija prvih mobilnih mreža pete generacije. O ovomu će detaljnije biti pisano u narednom dijelu rada.

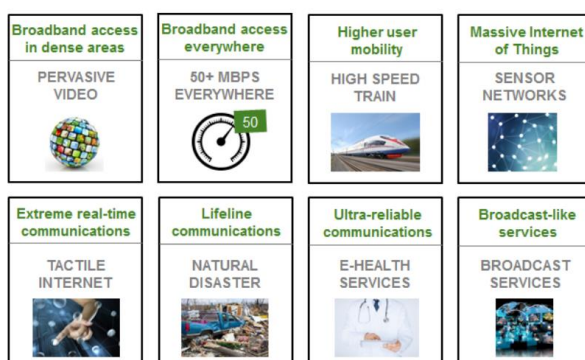


Slika 1 Prikaz procjene porasta mobilnog prometa za period 2015 – 2020. godine
(Preuzeto od Cisco VN Group Mobile data Traffic Forecast 2015 – 2020)

2.3. Poslovni modeli temeljeni na „Viziji 2020“

Za sami početak razdoblja iza 2020. godine, poslovni modeli bazirani na „Viziji 2020“ mogu se podrazumijevati kao poslovni modeli bazirani na petoj generaciji mobilnih mreža i primjeni internet stvari (uređaja).

Gdje se sve ove promjene mogu događati i kakav je potencijal za primjenu u stvarnom svakodnevnom životu? Možda najbolje se sve može vidjeti i iščitati sa sljedeće slike (slika 2) koja je pruzeta iz dokumenta *5G White Paper* izdanog od strane NGMN Alliance u veljači 2015. godine. Ono što sa slike 2 nije izravno vidljivo jeste i primjena novih tehnologija u turizmu koja će donijeti dosta noviteta te mogućnost za razvoj potpuno novih proizvoda i usluga, a koje će turističkim djelatnicima donijeti sasvim novi dodatni (i značajan) prihod. Ili bolje reći, onaj tko ne bude pratio trendove, moći će gotovo sigurno računati s laganim gubljenjem posla i stagnacijom.



Slika 2 Prikaz primjene 5G mreže i IoT-a u „Viziji 2020“

(Preuzeto od 5G White Paper, NGMN 5G Initiative, NGMN Alliance)

3. Peta generacija mobilnih sustava (5G)

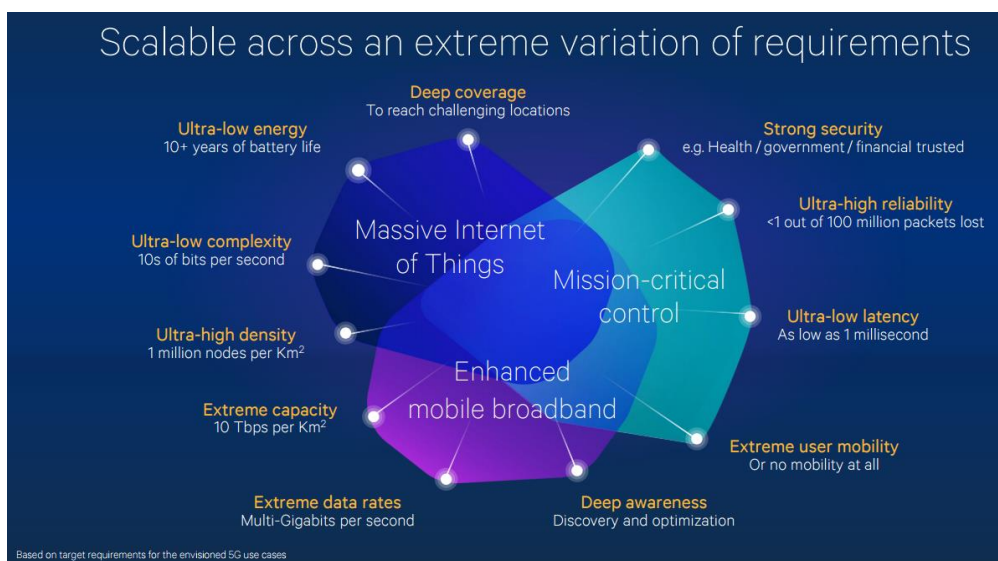
Peta generacija mobilnih sustava (5G) neće samo biti nova generacija mobilnih sustava već i nova vrsta sustava (White Paper, Qualcomm), tj. sustav s potpuno novom filozofijom pristupa tehnologiji i poslovanju koje je na nju naslonjeno. Peta generacija mobilnih sustava bit će svakako podloga za implementaciju „Vizije 2020“ i svih eventualnih kasnijih „vizija“ ili sličnih dokumenata koji će biti razvijani i pisani za razdoblje koje slijedi nakon 2020. godine.

3.1. Osnovne značajke pete generacije (5G) mobilnih sustava

Glavni cilj razvitka i standardizacije pete generacije mobilnih sustava (5G) jeste podrška i omogućavanje razvoja potpuno novih proizvoda i usluga, uvezivanje postojećih i novih gospodarskih grana te osnaživanje i poboljšanje korisničkih iskustava (Qualcomm's 5G Vision, Qualcomm).

Glavne značajke koje 5G sustavi moraju podržati već su navedeni u dijelu rada u kojem su navedene osnovne postavke za „Viziju 2020“ – jer 5G je osnovna podloga za primjenu „Vizije 2020“. Sa slike 3 je dijelom vidljivo ono što je prije bilo navedeno – da 5G sustav nije samo pomak u generaciji mobilnih sustava već je to pomak u potpuno novom pristupu razvoju proizvoda i usluga ili bolje reći „pomak u načinu razmišljanja“.

Naime, ono što se traži od 5G mobilnih sustava kao podloge za implementaciju „Vizije 2020“ jesu i sljedeće stavke: jako dobra i kvalitetna pokrivenost signalom, izuzetno mala potrošnja energije, visoka sigurnost, ekstra velika brzina širokopojasnog prijenosa, izuzetno nisko kašnjenje (kao preduvjet za razvoj potpuno novih proizvoda i usluga u stvarnom vremenu gdje ova komponenta dolazi do punog izražaja).



Slika 3. Osnovne značajke 5G sustava
(Preuzeto iz rada Qualcomm's 5G Vision, Qualcomm)

3.2. Sastavni dijelovi pete generacije (5G) mobilnih sustava

Peta generacija mobilnih sustava još nije standardizirana, ali proces standardizacije je u tijeku. Pretpostavka je da će se ovaj proces završiti tijekom ove i iduće godine, a da bi prvi testni (moguće i komercijalni sustavi) trebali biti pušteni u rad već 2018. godine (očekuju se prve komercijalne 5G mreže u Sočiju, Rusiji tijekom zimskih OI te u Južnoj Koreji).

Prateći literature te brojne dokumente koji se objavljuju, vidljiva je želja i pokušaj nekih mobilnih operatera da već krajem ove godine i početkom iduće kao prvi komercijalno u rad puste (neku vrstu) 5G mobilnih sustava te tako zauzmu vodeće pozicije u novom poretku u telekomunikacijama.

Što je ključ uspjeha koji se očekuje od 5G mobilnih sustava? Prije svega pristup korisnicima neće biti baziran samo na sadašnjem klasičnom pristupu putem baznih stanica (kao što je to slučaj sa sadašnjim 2G/3G/4G mobilnim sustavima) već se pretpostavlja (standardizacija 5G sustava je još u tijeku!) da će kroz standardizaciju 5G mobilnih sustava biti omogućena kombinacija korištenja standardnih baznih stanica (jasno s novim modelima kodiranja i korištenjem novog frekvencijskog spektra čime će se omogućiti veća brzina pristupa putem klasičnih baznih stanica) i korištenja wi-fi baznih stanica.

Jasno, prekapčanje ili preuzimanje između klasičnih baznih stanica i wi-fi korisničkog pristupa mora biti "bešavno", a korisnik ne smije osjetiti prijelaz između različitih tehnologija pristupa prilikom korištenja određene usluge.

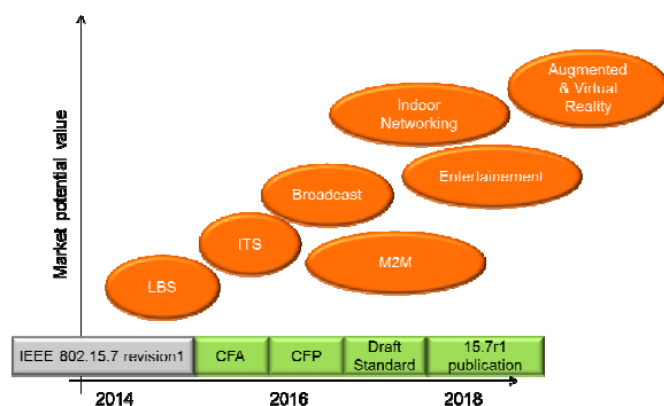
3.3. Li-fi (Light Fidelity) tehnologija

Pojam „Optičke bežične komunikacije“ (*Optical Wireless Communications* - OWC) ili *Light Fidelity* (Li-Fi) odnosi se na komunikaciju zasnovanu na propagaciji elektromagnetnih valova na frekvencijama iznad 30 THz.

Osnovne karakteristike ovih sustava (udaljenost, pokrivenost ...) je takva da je dostupnost pokrivenosti zasnovana na zatvorenom prostoru sa značajno većom propusnošću i brzinom prijenosa. Dakle, ograničena je pokrivenost s jednim Li-Fi konektorom, ali omogućava značajno veće brzine prijenosa i propusnost nego sadašnje komercijalne tehnologije.

Ova tehnologija je tek u fazi razvoja i standardizacije, ali nije nemoguće da bude sastavni dio 5G ili nekih budućih 5G+ ili čak 6G mobilnih sustava. Naime, kako se očekuje da će do 2020. godine na internet biti spojeno preko 50 milijardi uređaja, a prema nekim procjenama (kao što je to procjena WWRF-a) taj broj bi mogao biti i značajno veći. Na slici 4. je prikazan planirani vremenski tijek razvoja ove tehnologije do komercijalizacije.

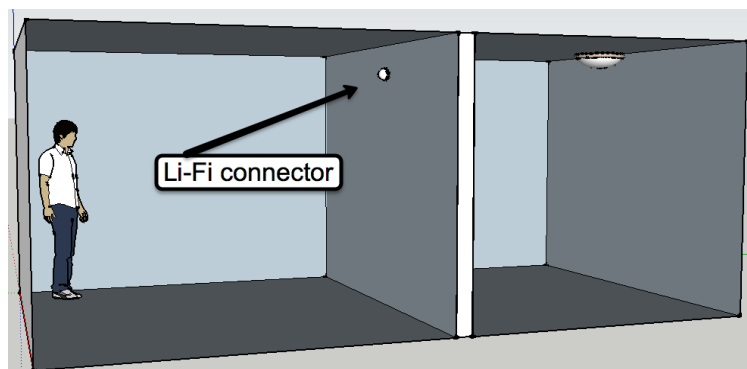
Prema analizama Ericssona i Cisco-a slobodni spektar koji će biti dostupan za primjenu ove tehnologije je preko 700.000 GHz što predstavlja ogroman frekvencijski spektar za sve buduće aplikacije te uređaje koji će biti spojeni na internet i svakako će podržati sve veće zahtjeve za prijenosom podataka, a što je prikazano već ranije u ovom radu na slici 1. Da velike tvrtke vjeruju u ovakvo što najbolje pokazuje primjer da su Cisco i Ericsson napravili zajednički tim koji će raditi na razvitku ove tehnologij, a već se i mnogi telekom operateri u svojim istraživačkim laboratorijima bave ovom problematikom i istražuju potencijale koje ova tehnologija može pružiti (npr. Mobilni operater Orange iz Francuske).



Slika 4. Li-Fi roadmap

(Preuzeto iz rada Light Fidelity – The New wireless communication system, ICWMC 2015, The eleventh International Conference of Wireless and Mobile Communications)

Ono što je posebno dobro jeste činjenica da svjetlosni signal ne prodire kroz zidove prostorije (soba, ureda i slično) te ne postoji mogućnost za interferenciju i ometanje signala koji će biti u različitim prostorijama, a bazirani na Li-Fi tehnologiji (slika 5.). Ova karakteritika (nekada je smatrana nedostatkom s obzirom na ograničenost pokrivanja signalom unutar samo jedne prostorije) je u biti velika prednost jer omogućava pokrivanje pojedinih prostora bežičnim signalom velike brzine i propusnosti, a s druge strane ne postoji mogućnost ometanja signala u drugim prostorijama.

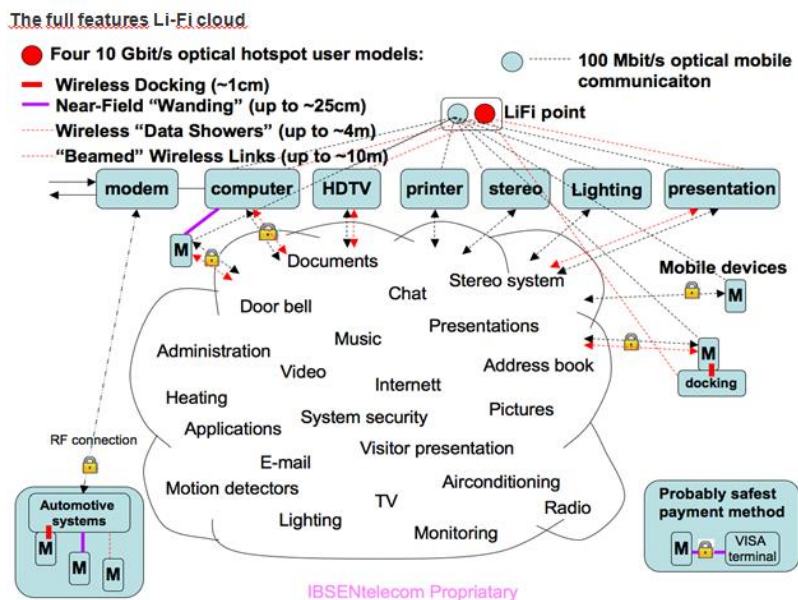


Slika 5. Princip rada Li-Fi tehnologije

(Preuzeto sa <http://www.lificonsortium.org/tech6.html>)

Što ovakva tehnologija omogućava u budućnosti. Kažu da “slika govori više od tisuću riječi” pa je najbolje to prikazati i pojasniti slikom (slika 6.).

U svakom slučaju Li-Fi tehnologija se razvija i standardizira paralelno s 5G mobilnim sustavima i nije nemoguće da jednog dana ovakva tehnologija bude sastavni dio pete generacije ili neke kasnije i novije generacije mobilnih sustava – ali svakako granice brzine prijenosa, propusnost i kapaciteti sustava se pomiču prema neslućenim karakteristikama.



Slika 6. Mogućnosti primjene Li-Fi tehnologije

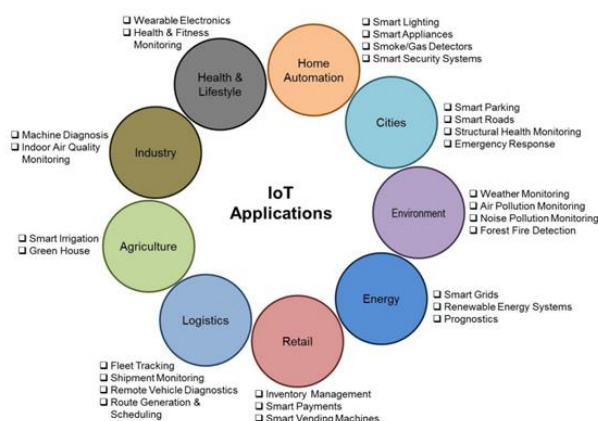
(Preuzeto sa <http://www.lificonsortium.org/tech6.html>)

4. Internet stvari, Internet stvari u gospodarstvu (IIoT) i Internet svega (IoT/IoE)

Postoji nekoliko definicija za pojmove Internet stvari/uređaja (IoT), Internet stvari/uređaja u gospodarstvu (IIoT) i Internet svega (IoE). Sve su slične i podrazumijevaju isti opis pojmova, a možda najbolje definicije, tj. one koje najbolje opisuju ove nove pojmove, su sljedeće:

- **Internet of Things, IoT (Internet uređaja/stvari)** je mreža fizičkih objekata (uređaja) spojenih preko interneta. Ovi objekti (uređaji) sadržavaju ugrađenu tehnologiju za međusobno djelovanje s unutarnjim stanjima i vanjskim okruženjem. (Ahmed Banafa: „What is next for IoT and IIoT”, Enterprise Mobility Summit, Australia 2015)
- **Gospodarski (industrijski) Internet uređaja (stvari)** je mreža fizičkih objekata sustava, platformi i aplikacija koje sadržavaju ugrađenu tehnologiju za međusobnu komunikaciju i dijeljenje inteligencije jednih uređaja s drugima, s vanjskim okruženjem i s ljudima. (Ahmed Banafa: „What is next for IoT and IIoT”, Enterprise Mobility Summit, Australia 2015)
- **Internet svega (Internet of Everything, IoE)** donosi zajedno ljude, procese, podatke i uređaje (stvari) što čini umrežene veze (spojeve) važnijim i vrijednijim nego ikada prije – pretvarajući informaciju u akcije što stvara nove mogućnosti, bogatije iskustvo i stvara jedinstvene (i potpuno nove) ekonomske mogućnosti za gospodarstvo, pojedince i države. (Definicija prema tvrtki CISCO; <http://www.slideshare.net/CiscoIBSG/internet-of-everything>)

Na ovim pojmovima odnosno na primjeni Interneta stvari u privatnom okruženju i u gospodarstvu ili bolje rečeno na primjeni koncepta Interneta svega, temeljit će se budućnost novih aplikacija koje će u „Viziji 2020“ ljudima olakšati svakodnevni život, a mobilnim operaterima, proizvođačima opreme i tvrtkama koje se bave određenim djelatnostima (npr. u turizmu) donijeti dodatne prihode i olakšati i pojednostaviti svakodnevno poslovanje. Ovo možemo nazvati i „win-win-win-win“ situacijom gdje svi dobivaju. U biti, ako „Viziju 2020“ usporedimo sa željeznicom onda je najbolje za usporedbu reći da 5G mobilnih sustava predstavlja tračnice za buduće usluge, a IoT/IoE je lokomotiva vlaka koji prometuje po tim tračnicama. Koje su sve moguće primjene IoT/IoE koncepta u budućnosti najbolje je prikazano na slici 7.

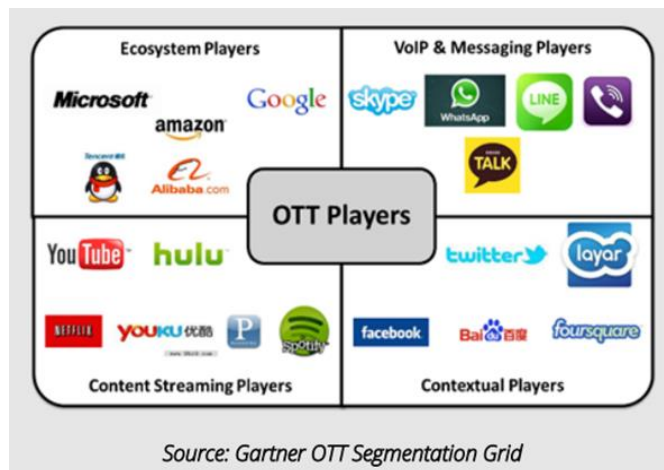


Slika 7. Mogućnosti primjene IoT/IoE tehnologije

(Preuzeto od Ahmed Banafa: „What is next for IoT and IIoT“, Enterprise Mobility Summit, Australia 2015)

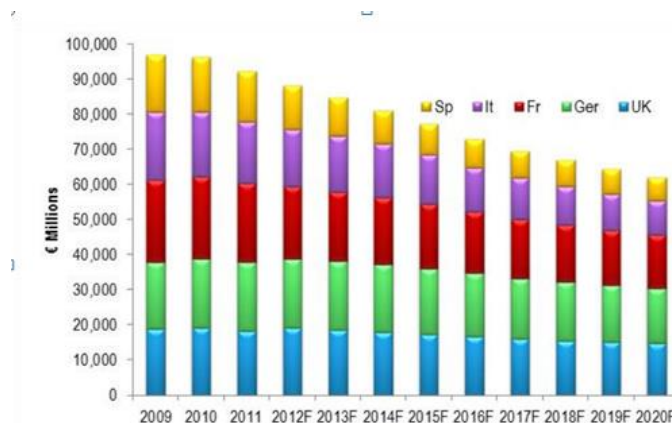
5. Over the Top usluge (OTT)

OTT aplikacije popularno nazivaju i „ubojicama modernih mobilnih telekom operatera“. Aplikacije kao što su Viber, Skype, WhatsApp ... danas su prisutne skoro na svakom „pametnom telefonu“ jer korisnici sve više postaju svjesni mogućnosti primjene ovakvih usluga i smanjenja svojih korisničkih troškova. Pored toga i Netflix se sve više probija i na naše tržište i postaje prijetnja modernim mobilnim telekom operaterima. Podjela OTT aplikacija (prema Gartneru) prikazana je na slici 7.



Slika 8. Segmetacija OTT aplikacije prema Gartneru

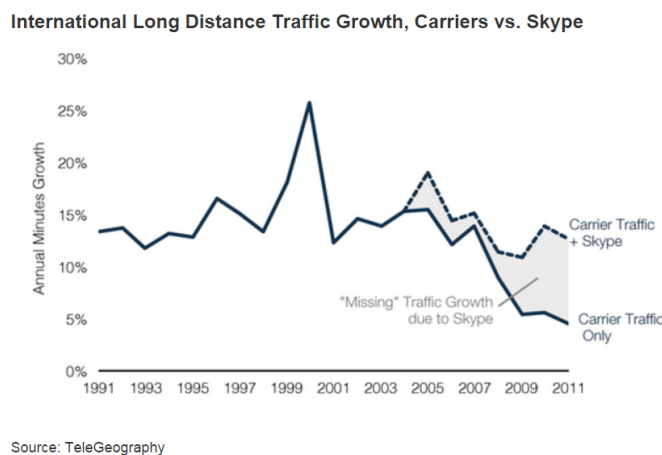
OTT aplikacije predstavljaju ozbiljnu prijetnju za sve moderne mobilne telekom operatere. Ta prijetnja nije izražena samo u operaterima u državama u razvoju već je izražena i u razvijenim državama – čak je u tim državama i izraženija. Prateći ponašanje telekom tržišta u razvijenim državama i u državama u razvoju može se zaključiti da ono što se događa u razvijenim državama može uskoro biti značajnije izraženo i u državama u razvoju – u taj trend se praktički već možemo uvjeriti prateći situaciju u BiH i Hrvatskoj.



Slika 9. Procjena pada prihoda uslijed korištenja OTT aplikacija u razvijenim državama

(Preuzeto sa: <https://www.cgi.com/files/white-papers/CSPs-Communication-Service-providers-Next-Decade-e.pdf>)

Skype je bila prva i još je vjerojatno najpoznatija OTT aplikacija. Koliki je utjecaj Skype-a bio na smanjenje međunarodnog prometa početkom i sredinom prošlog desetljeća, vidljivo je sa slike 9.

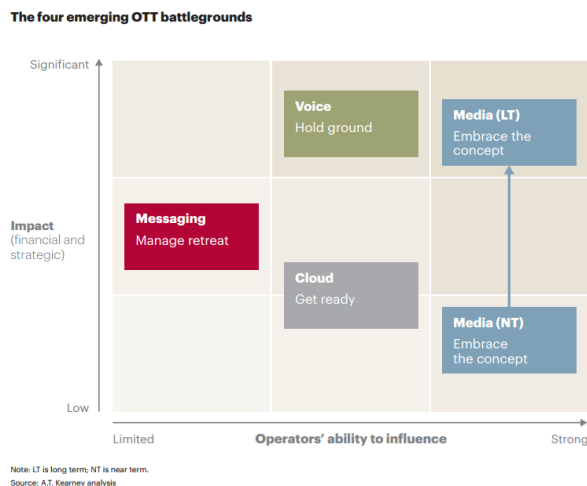


Slika 10. Utjecaj Skype-a na pad međunarodnog prometa

(Preuzeto sa: <https://www.telegeography.com/press/press-releases/2012/01/09/international-call-traffic-growth-slows-as-skypes-volumes-soar/index.html>)

Prema „Viziji 2020“ imat ćemo još brži mobilni pristup internetu što otvara mnogo mogućnosti za primjene i usavršavanje postojećih, ali i kreiranje novih aplikacije. Ako se kod mobilnih operatera ne promjeni strateški pristup tj. ako ne dođe do „promjene načina razmišljanja“ lako je moguće da prihod kod mobilnih i fiksnih telekom operatera nastavi kontinuirano padati. A to u konačnici može dovesti do smanjenja broja mobilnih operatera tj. udruživanja postojećih ili jednostavno gašenje pojedinih operatera.

Prema analizi konzultantske kuće AT Kerney postojat će četiri osnovna polja na kojem će mobilni telekom operatori moći i morati se suprotstaviti OTT aplikacijama. U pojedinim poljima će mobilni operatori moći imati veću mogućnost „obrane” od OTT aplikacija, a na nekim poljima će imati veći utjecaj i mogućnost obrane prihoda. Pojašnjenje je vidljivo na slici 10.



Slika 11. Područja “sukoba” OTT aplikacija i modernih mobilnih operatera

(Preuzeto sa:

https://www.atkearney.de/documents/856314/1214712/BIP_Winning_the_OTT_War_Strategies_for_Sustainable_Growth.pdf/44d5842d-a806-479d-aa9f-4b9555f5b3a9)

6. Potencijalne usluge u turizmu bazirane na „Viziji 2020“

U današnje vrijeme sve je više znanstvenih i stručnih (profesionalnih) radova pa i čitavih simpozija ili seminara koji se bave problematikom i pitanjima vezanima uz ICT i primjenu novih tehnologija u turizmu. Tako je npr. u Dublinu u Irskoj u siječnju 2014. godine održan *Information and Communications Technologies in Tourism 2015*, eProceedings of the ENTER 2014, PhD workshop. Na tom “worskopu” objavljeno je 18 znanstvenih i stručnih radova sa tematikom primjene ICT i novih tehnologija u turizmu.

Radovi koje su predstavili stručnjaci i znanstvenici bili su iz cijelog svijeta - iz Australije, Novog Zelanda, Kine, Hong Konga, SAD-a, Južnoafričke Republike, Malezije, Indije, Velike Britanije, Irske, Portugala i Austrije. Već sam popis država iz kojih dolaze znanstvenici i stručnjaci iz poslovnog svijeta koji se bave ovom problematikom jasno ukazuje na činjenicu koliko je ova tema prisutna u svijetu i koliki broj znanstvenika i stručnjaka se njome danas bave.

U ovom radu se nećemo posebno baviti pojedinim uslugama koje se mogu primjenjivati kroz primjenu novih ICT aplikacija i usluga u turizmu. Za takvo što nema prostora, a nije ni cilj ovdje predlagati konkretne usluge ili proizvode koji bi se mogli primjeniti u turizmu, a bazirane su na ICT tehnologijama.

Ono što je bitno navesti jest sljedeća činjenica – ICT u „Viziji 2020“ donosi praktično neograničene mogućnosti pružanja novih usluga kroz različite aplikacije. Modernom turistu je moguće ponuditi kroz pristup internetu gotovo neograničen spektar usluga – od toga da besplatno komunicira putem telefona pa do toga da u svojoj sobi u nekom hotelu u Hrvatskoj gleda serije ili filmove ili bilo koje druge emisije koje gleda i u svom domu bez obzira iz kojeg dijela svijeta dolazio. A zadovoljan i sretan turist potrošit će i više novca, a moguće i dulje ostati na nekom mjestu i u nekom hotelu nego da nema takve usluge. Sve što mu treba jest ultra brzi pristup mobilnom internetu bilo gdje i bilo kada.

Svjetska turistička organizacija (WTO; www.world-tourism.org) sa sjedištem u Madridu u Španjolskoj objavila je i „Viziju 2020“ za turizam i to po područjima – Europa, Istočna Azija i Pacific i drugo. Sličan dokument postoji i u Australiji gdje je razrađena „Vizija 2020“ za turizam za područje sjevernog teritorija u Australiji (a vjerojatno ima i mnogo drugih sličnih dokumenata u različitim državama i regijama na svijetu).

U dokumentu „Vizija 2020“ za Europu, WTO predviđa da će deset država na Balkanu u 2020. godini posjetiti oko 79 milijuna međunarodnih turista (u ovu brojku se ne računaju domicilni turisti). Prema toj istoj analizi pet vodećih turističkih destinacija – Grčka, Turska, Bugarska, Rumunjska i Hrvatska će zadržati primat u turističkim posjetama – procjena je da će preko 92% od ovog broja posjetiti i boraviti u ovih pet vodećih turističkih destinacija. A 92% od 79 milijuna jest preko 72,5 milijuna turista. Za ovu brojku se vrijedi boriti, a nije svejedno hoće li u Hrvatskoj završiti pet, deset, petnaest ili i značajno više milijuna turista. Za ove brojke se vrijedi pripremiti i boriti i aktivnom implementacijom novih usluga baziranih na ICT tehnologijama. A te usluge mogu imati neograničen spektar – **bitno je samo imati infrastrukturu kao podlogu i kreativnost u razvoju novih turističkih proizvoda i usluga baziranih na ICT tehnologijama.**

7. Prijedlog za poticanje implementacije novih usluga u turizmu u Republici Hrvatskoj

U „Viziji 2020“ koja je osnova razvoja novih usluga u ICT sektoru postoji puno pretpostavki i zahtjeva koji se standardiziraju i rješavaju. Standardizacija je u tijeku i očekuje se da će (kako je već u radu i navedeno) do 2017. godine biti dovršena, a da će se prvi sustavi 5G mobilnih mreža u komercijalni rad pustiti 2018. godine dok se veća ekspanzija očekuje 2020. godine.

Ali u podlozi svega stoji podloga – super brzi mobilni internet. Super ili bolje reći ultra brzi mobilni internet na prijenosnoj razini, ali i super brzi internet po pitanju korsničkog pristupa. Brzine korisničkog pristupa od 100 Mb/s pa čak i do 1 Gb/s postaju veoma skoro stvarnost.

Međutim, za takvo što je neophodna kvalitetna prijenosna infrastruktura. Prije svega svjetlovodna (optička) prijenosna infrastruktura. U tu svrhu u radu je rađena analiza o broju hotela na području Makarske rivijere (Republika Hrvatska) i turističkog primorja u Crnoj Gori - koliko hotela ima spojenu optičku prijenosnu infrastrukturu te koliko ih ima razvedenu optičku infrastrukturu unutar hotela (do soba, restorana, kafića ...). Rezultati će biti prezentirani u sljedećem poglavlju.

Prije prikaza samih rezultata, bit će navedena preporuka za kreiranje nove oznake za hotele koji su se spremili za implementacije novih usluga baziranih na ICT tehnologijama.

Ono što će u narednom razdoblju biti neophodno jest brzi internet svugdje i u svakom treunutku. U tu svrhu, autori nakon detaljnih analiza turističkog i ICT sektora predlažu uvođenje turističke oznake “Hrvatska 2020+” (*Croatia 2020+*). Za zadovoljiti uvjete za dobivanje ovakve oznake, hoteli, apartmanska naselja i svi drugi turistički objekti trebaju zadovoljiti sljedeće minimalne preduvjete:

- Povezanost objekta svjetlovodnom infrastrukturom (svjetlovodni kabel).
- Razvedenost svjetlovodne (optičke) infrastrukture unutar objekta do svih soba, restorana, kafića, teretane ... i svih drugih dijelova u i oko objekta gdje gosti borave ili mogu boraviti.
- Pokrivenost baznim stanicama za wi-fi signal (do tih lokacija treba biti proveden svjetlovodni kabel) na način da na svakom mjestu u hotelu i oko hotela ili apartmanskog naselja, tj. gdje god borave turisti, signal treba biti minimalne razine jakosti od – 75 dBm na korisničkoj strani.

Turistički objekti koji ovo zadovoljavaju dobili bi oznaku “Hrvatska 2020+” odnosno *Croatia 2020+* koja bi trebala biti promovirana kao dodatna vrijednost za turiste koji borave u tom hotelu ili turističkom naselju.

Zašto bi vlasnici hotela investirali u svjetlovodnu infrastrukturu? Tu na scenu treba stupiti država na način da hotelima ili turističkim naseljima koji ispunjavaju ovaj minimum preduvjeta za dobivanje oznake “Hrvatska 2020+” omogući određene beneficije: od toga da se takvim hotelima ili turističkim naseljima umanji porez do toga da ih se (besplatno) promovira na različitim turističkim sajmovima u inozemstvu gdje Republika Hrvatska, tj. Hrvatska turistička zajednica ili Ministarstvo turizma RH ima svoje standove i gdje budu imali nastupe. Kroz ove, ali i druge mjere, vlasnici hotela i turističkih ili apartmantskih naselja imat će i razlog uložiti u infrastrukturu koja bi u budućnosti (ali veoma bliskoj budućnosti) i njima i državi, ali i telekom operaterima donijela dodatne vrijednosti i zaradu (naravno bilo bi veoma poželjno da se u cijelu priču uključe i telekom operateri).

8. Rezultati istraživanja o potencijalima primjene usluga u turizmu baziranih na novim tehnologijama

U okviru rada provedeno je malo istraživanje vezano uz hotele i hotelska naselja u Makarskoj i na Makarskoj rivijeri (Baška Voda, Brela, Igrane, Podgora i Živogošće) te u turističkim središtima u Crnoj Gori (Bar, Budva, Herceg Novi, Kotor, Ulcinj). Ili bolje reći istraživanje je pokušano biti provedeno, ali odaziv na anketu je bio jako loš. A možda je istraživanje ipak uspjelo jer i takav odaziv ili bolje reći neodaziv govori za sebe i za osvješćenost turističkih djelatnika po pitanju mogućnosti uvođenja novih proizvoda i usluga u turizmu baziranih na novim tehnologijama iz „Vizije 2020“.

Upitnik je bio veoma kratak (5 pitanja s odgovorima DA ili NE) i veoma jednostavan za popuniti (slika 12.). Tako da ne može biti razlog slabog odaziva to što je upitnik složen ili dugačak za odgovaranje ili da bi onima koji ga popunjavaju to moglo oduzeti mnogo vremena.

Upiti (anketni upitnici) su poslani putem e-adresa hotelima (uzeti su u obzir hoteli i hoteli/apartmani u privatnom smještaju – svi oni koji na svojim web stranicama ili na stranicama turističke zajednice imaju kontakt e-adrese) u navedenim naseljima, a nakon 7 - 9 dana poslani su podsjetnici (tj. ponovljeni upiti). Broj poslanih upita prema hotelima u određenim gradovima i naseljima su navedeni kako sljedeći (6 turističkih naselja u Hrvatskoj i 5 turističkih naselja u Crnoj Gori):

Hrvatska:

- Baška Voda: 15
- Brela: 25
- Igrane: 16
- Makarska: 16
- Podgora: 25
- Živogošće: 28

Crna Gora:

- Bar: 45
- Budva i pripadajuća rivijera: 88
- Herceg Novi: 29
- Kotor: 21
- Ulcinj: 24

UPITNIK

Općeniti podaci

1. Naziv hotela:.....

2. Mjesto/lokacija:.....

3. Broj soba/apartmana:.....

Tehnički podaci

1. Postoji li fiksni Internet priključak u sobama hotela (bez obzira na tehnologiju pristupa Internetu):	DA	NE
2. Postoji li bežična Internet veza unutar hotela (bilo gdje):	DA	NE
3. Postoje li bežične Internet veze u sobama hotela:	DA	NE
4. Postoji li optički telekomunikacijski kabel spojen do hotela:	DA	NE
5. Postoji li potpuno razvedena optička telekomunikacijska infrastruktura unutar hotela (do soba, restorana, kafića, konferencijskih sala,...):	DA	NE

Podatke popunio/la:.....

Funkcija osobe koja je popunila formular:.....

Slika 12. Izgled anketnog upitnika s pitanjima

Broj odgovora koji je dobiven (bez obzira je li poslan popunjen upitnik natrag ili samo informacija da se radi o privatnoj kući s apartmanima – dakle pretpostavlja se da im ne trebaju nove tehnologije):

Hrvatska:

- Baška Voda: 3 (od 15)
- Brela: 2 (od 25)
- Igrane: 0 (od 16)
- Makarska: 0 (od 16)
- Podgora: 0 (od 25)
- Živogošće: 1 (od 28)

Crna Gora:

- Bar: 2 (od 45)
- Budva i pripadajuća rivijera: 3 (od 88)
- Herceg Novi: 1 (od 29)
- Kotor: 1 (od 21)
- Ulcinj: 0 (od 24)

Jasno je da nema smisla raditi neku posebnu analizu jer broj pristiglih odgovora je zanemariv. Međutim, predstavnici hotela koji su odgovorili i poslali autorima popunjen anketni upitnik uglavnom imaju dovedenu svjetlovodnu (optičku) infrastrukturu do hotela kao i razvedenu svjetlovodnu (optičku) infrastrukturu do soba, restorana, kafića, hotelskog predvorja i konferencijskih sala u hotelu. Konkretno od sedam odgovora primljenih od hotela iz Crne Gore, šest hotela ima spojen svjetlovodni (optički) kabel do hotela, a četiri ih imaju potpuno

razvedenu svjetlovodnu optičku infrastrukturu unutar hotela (jedan hotel ima djelomično razvedenu infrastrukturu do soba, ali ne i do restorana, kafića i drugih prostora unutar hotela). Iz Hrvatske (Makarske i Makarske rivijere) stiglo je samo šest odgovora. Četiri su odgovora osoba koji imaju apartmane ili kuću s apartmanima tako da nisu odgovorili na anketni upitnik, a pretpostavlja se da nemaju niti svjetlovodni kabel doveden do kuće niti razveden do apartmana. Bez obzira radilo se o pet ili šest apartmana bilo bi dobro da razmisle o ovoj opciji jer će turist u budućnosti tražiti ovakve pogodnosti bez obzira bili smješteni u hotelima visoke kategorije ili u privatnim apartmanima. Od dvaju odgovora predstavnika hotela iz Makarske i s Makarske rivijere, jedan hotel ima spojenu svjetlovodnu infrastrukturu do telekom operatera i razvedenu svjetlovodnu infrastrukturu po hotelu dok drugi to nema. Malo za napraviti kvalitetnu analizu.

Znači li to da predstavnici hotela koji nisu odgovorili na upitnik u hotelima koje predstavljaju nemaju instaliranu svjetlovodnu infrastrukturu ili je u pitanju samo lijenost i određena doza neodgovornosti? To se ne može sa sigurnošću tvrditi, ali barem je za nadati se da je potaknuto razmišljanje vodećih ljudi tih hotela o potrebi uvođenja svjetlovodne (optičke) infrastrukture unutar objekta (ili objekata) kao i povezivanje tih objekata s telekomunikacijskom infrastrukturom telekomunikacijskih operatera. U interesu i hotela i telekom operatera i države, a u konačnici u interesu i građana Republike Hrvatske jer turizam predstavlja jednu od ključnih gospodarskih grana za razvitak Republike Hrvatske.

9. Zaključak

Zaključak ovog rada je veoma kratak. Potencijal koji se kroz implementacije novih potencijalnih usluga baziranih na novim tehnologijama koje se planiraju uvesti i koje su osnova „Vizije 2020“ je doista velik. Međutim, isto tako, velika šteta može nastati ako se naredno razdoblje i razdoblje koji slijedi iza 2020. godine dočeka nespreman u turizmu. Jer „četvrta industrijska revolucija“ donosi mnogo potencijala za nove usluge i nove prihode, ali isto tako ako turistički djelatnici i turističke zajednice u drugim državama ovo prepoznaju, a u Hrvatskoj se o ovome ne bude vodilo računa šteta može biti ogromna tim prije jer udio turističkog prihoda u ukupnom BDP-u Republike Hrvatske je viši nego u ostalih država koje imaju izrazitu turističku orijentaciju.

Na potezu su turistički djelatnici koji moraju imati više osjećaja za vrijeme koje dolazi, turističke zajednice na općinskim, županijskim razinama i na razini Republike Hrvatske te svakako Vlada Republike Hrvatske koje mora pokrenuti i poticati razmišljanja o implementaciji novih tehnologija kroz koje će se moći razvijati novi proizvodi i usluge u svim gospodarskim granama, a posebice u turizmu.

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New products and services in tourism based on new technologies

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Summary: In the world of ICT (Information and Communication Technologies) 2020 is considered a milestone because it is expected commercialization 5G mobile networks and the telecommunications operators in the coming period urgent need to change the entire approach to business and business philosophy and user access. In addition, a number of new concepts and systems based on these new technologies, will become a reality and the present and the future in our daily lives. It is defined and the notion that it all together - Vision 2020. In tourism there is no precisely defined concept of "Vision 2020" but there are a number of analysis and professional and scientific papers in which they analyzed the expectations to 2020 and the period after 2020. This paper will analyze the requirements for harmonizing and adapting the approach to tourism and Vision 2020 in ICT and will be analyzed potentials and give suggestions for the development of new integrated services in tourism. It will be analyzed common interests of economic sectors of ICT, construction and tourism course in order to carry out the implementation of the "Vision 2020" and the creation of services in tourist facilities and tourism in the Republic of Croatia based on new technologies. It will be given to the proposal in principle of standardization and categorization of tourist facilities due to the proposed new services based on new technologies which would be awarded in tourism added value for tourism facilities that are equipped and offering services based on new technologies.

Keywords: *ICT, 5G, IoT/IoE, Vision 2020, tourism.*

Schengenski sporazum

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Sažetak. Europska unija garantira svojim građanima slobodu kretanja. To je jedno od osnovne četiri slobode koje osigurava Europska unija, pored slobode kretanja dobara, usluga i kapitala. Upravo je Schengenski sporazum taj koji osigurava jednu od tih sloboda – slobodu kretanja ljudi. 1985. g. šest je europskih država potpisalo Schengenski sporazum. Pet godina nakon toga Schengenskom je konvencijom utvrđen način na koji će biti provedeno ukidanje provjere na unutarnjim granicama. Utvrđeno je i niz mjera za pojačavanje kontrole na vanjskim granicama, definirani su postupci za izdavanje jedinstvenih viza te uveden Schengenski informacijski sustav, koji je naknadno 2013. godine zamijenjen novom generacijom sustava SIS II. Potpisnici Schengenskog sporazuma izbrisali su međusobne granice na kopnu, moru i u zračnim lukama zbog čega je i postao sinonim otvorenih granica unutar Europske unije. Protokolom uz Ugovor iz Amsterdama, Schengenski sporazum i ostali elementi schengenske pravne stečevine, uvršteni su u institucionalni i pravni okvir Europske unije i dio su njezinog pravnog poretka. Ukidanje granične kontrole u praksi započinje 1995. Usvajanje schengenske pravne stečevine do pristupanja u Europsku uniju je obaveza za svaku državu kandidatkinju za članstvo u Uniji. Hrvatska, kao punopravna članica Europske unije od 01. srpnja. 2013. godine ima mogućnost aplicirati za pristup schengenskom prostoru. Cilj ovog rada je definirati elementarne odrednice schengenskog prostora, prikazati način na koji je organiziran, te navesti uvjete koji moraju biti ostvareni da bi neka država ostvarila pravo schengenskog prostora.

Ključne riječi: schengenski prostor, EU, vanjske granice, unutarnje granice

1. Uvod

Europska unija gospodarsko je i političko partnerstvo 28 europskih država. Osnovana je nakon Drugog svjetskog rata zbog poticanja gospodarske suradnje, ali i sa namjerom da zemlje koje međusobno trguju postanu ekonomski ovisne jedna o drugoj te se na taj način izbjegnu i budući sukobi. Od tada se stvara ogromno tržište koje teži dostizanju svojega punog potencijala.

Europska unija garantira svojim građanima slobodu kretanja osoba. To je jedno od osnovne četiri slobode koje osigurava Europska unija. Tu spadaju i pravo kretanja dobara, usluga i kapitala. Upravo je Schengenski sporazum taj koji osigurava jednu od tih sloboda – slobodu kretanja ljudi.

Temeljni pravni akti koji uređuju schengensku pravnu stečevinu su Konvencija o provedbi schengenskog sporazuma, Odluka Vijeća 2007/533/PUP o uspostavi, djelovanju i korištenju druge generacije Schengenskog informacijskog sustava SIS II, te Uredba br. 1987/2006 Europskog parlamenta i Vijeća o uspostavi, djelovanju i korištenju druge generacije Schengenskog informacijskog sustava SIS II (Pravo i publikacije EU-a, 2015).

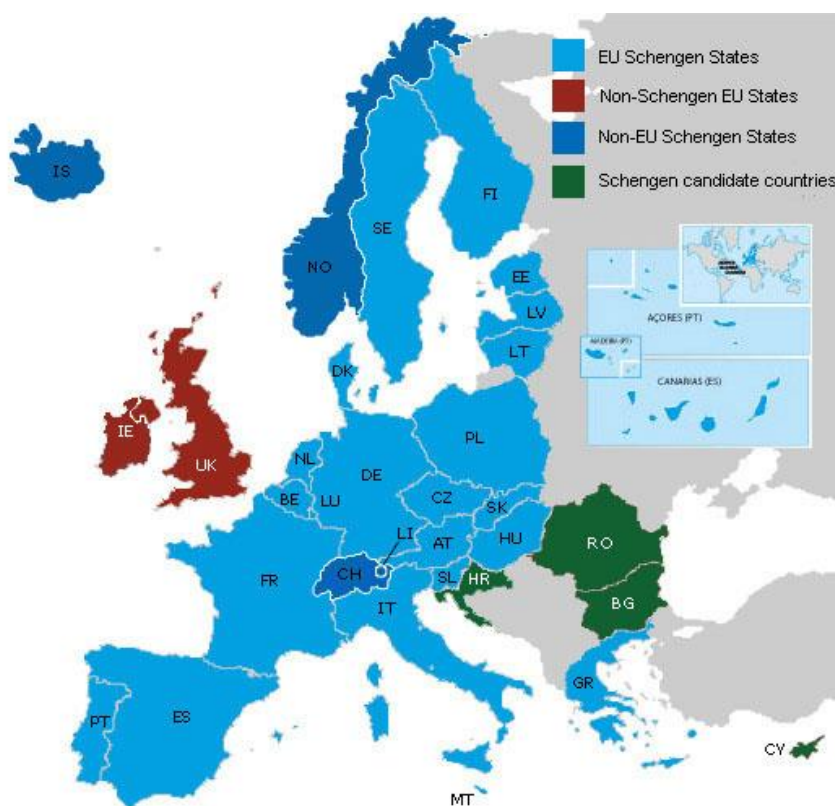
Idejni koncept Europske unije ujedinjuje u sebi tri elementa: slobodu, sigurnost i pravičnost. Da bi se ostvarili ti ideali te osigurala sloboda kretanja ljudi, Schengenski sporazum treba osigurati (Šegvić, 2011):

- ukidanje unutarnjih granica između država članica,
- uvođenje jedinstvene vizne politike za državljane trećih država čime im se omogućava maksimalno tromjesečni boravak na području država članica,
- borbu protiv ilegalnih emigranata,
- uvođenje zajedničke vanjske granice,
- uvođenje mjera koje će nadoknaditi pravnu prazninu nastalu ukidanjem unutarnjih granica država članica.

S obzirom da su u posljednje vrijeme izbili teroristički napadi (op. Pariz), Europska unija priprema niz mjera za borbu protiv terorizma, što uključuje pojačani nadzor nad vanjskim granicama i za građane Europske unije, što do sada nije bio slučaj. RH se po tom pitanju nalazi u dosta nepovoljnom položaju. RH ima najdužu vanjsku granicu Europske unije. To može imati za posljedicu produljenje roka koji će Europska komisija odrediti Hrvatskoj za pristupanje Schengenskom prostoru.

2. Schengenski prostor

Osnova za uspostavljanje unutarnjeg tržišta sa slobodnim kretanjem osoba bilo je zaključivanje dvaju schengenskih sporazuma: Prvi se odnosi na mjerodavni Schengenski sporazum od 14. lipnja 1985., a drugi je Konvencija o provedbi Schengenskog sporazuma, koji je potpisan 19. lipnja 1990., a stavljen u upotrebu 26. ožujka 1995. (Europski parlament, 2015).



Slika 1: Schengenski prostor

Na početku se Konvencijom o provedbi Schengenskog sporazuma (koju su potpisali samo Belgija, Francuska, Njemačka, Luksemburg i Nizozemska) uređivala suradnja među državama potpisnicama, području pravosuđa i unutarnjih poslova. Protokolom priloženim Ugovoru iz Amsterdama utvrđen je prijenos schengenske pravne stečevine u Ugovore. Danas schengenska pravna stečevina, zajedno sa Ugovorom iz Lisabona¹ podliježe parlamentarnom i sudskom nadzoru. Budući da je većina schengenskih propisa sada dio pravne stečevine EU-a, od proširenja EU-a 1. svibnja 2004. države pristupnice sukladno članku 8. Schengenskog protokola više nemaju mogućnost propusta primjene određenih odredbi (Službeni list Europske Unije, 2013).

Zemlje članice schengenskog prostora su: Švedska, Finska, Estonija, Letonija, Litva, Danska, Poljska, Slovačka, Mađarska, Češka, Njemačka, Austrija, Slovenija, Lichtenstein, Luxemburg, Nizozemska, Belgija, Francuska, Italija, Malta, Španjolska, Portugal i Grčka.

Zemlje članice Europske unije koje nisu u schengenskom prostoru: Ujedinjeno Kraljevstvo i Irska. Zemlje članice schengenskog prostora koje nisu članice Europske unije: Island, Norveška i Švicarska. Zemlje kandidatkinje za ulazak u schengenski prostor: Hrvatska, Rumunjska, Bugarska i Cipar (Vaša Europa, 2016).

2.1 Povijest Schengenskog sporazuma

Cijeli proces počinje nezadovoljstvom cestovnih prijevoznika 1984. g. zbog dugog čekanja uslijed graničnih formalnosti. Iste je godine potpisan i francusko-njemački sporazum o postupnom ukidanju kontrole osoba i pojednostavljenoj graničnoj kontroli državljana Europske zajednice (Rošić, 2008).

Godine 1985. kao posljedice suradnje vlada zemalja osnivačica došlo je do potpisivanja sporazuma o ukidanju provjera na zajedničkim granicama. Potpisivanje sporazuma dogodilo se u mjestu Schengen koje se nalazi u neposrednoj blizini tromeđe Francuske, Luxemburga i Njemačke. Sporazum je zapravo potpisan na brodu MS Princesse Marie – Astrid na rijeci Moselle koja onuda protiče.

Od 1995. g. sedam je zemalja članica: Španjolska, Portugal, Njemačka, Francuska, Nizozemska, Belgija i Luksemburg. Zatim se 1997. godine pridružuju Italija i Grčka te nakon toga Austrija. Godine 2001. Schengenu pristupaju Danska, Island, Norveška, Finska i Švedska. U prosincu 2007. Schengenskoj zoni pristupaju Latvija, Litva, Estonija, Slovačka, Slovenija, Mađarska, Češka Republika, Poljska i Malta. 2008. priključuje se i Švicarska.

U periodu kada se schengenski režim počeo primjenjivati bilo je razdoblje velikih promjena: došlo je do ujedinjenja Njemačke, povećao se broj tražitelja azila, povećao se broj ilegalnih useljenika iz Afrike i Azije, pojačane su terorističke aktivnosti u Europi. U takvim uvjetima pojavio se problem mogućeg pretvaranja schengenske granice u utvrdu, odnosno mogućnosti da schengenski prostor postane područje zatvoreno za strance.

Međutim, s druge strane jedan dio analitičara tvrdio je da su vanjske granice EU vrlo slabo nadzirane. U posljednjem desetljeću poteškoće za Schengenski sustav predstavljaju i susjedne države u Europskoj uniji jer ih strogi nadzor vanjskih granica EU odvaja od toga „elitnog

¹ Op. Lisabonski ugovor, punim nazivom Ugovor iz Lisabona o izmjenama i dopunama Ugovora o Europskoj uniji i Ugovora o osnivanju Europske zajednice, međunarodni je ugovor koji je potpisan u Lisabonu 13. prosinca 2007. godine s ciljem rješavanja pitanja daljnjeg institucionalnog funkcioniranja Europske unije. Dopunjuje postojeće ugovore o Europskoj uniji i Europskoj zajednici, ne zamjenjujući ih. Ugovor je stupio na snagu 01. prosinca 2009., nakon što je prošao proces ratifikacije u svim tadašnjim državama članicama EU.

kluba“. Nama blizak primjer je odnos Slovenije i Hrvatske prije ulaska u Europsku uniju (Šegvić, 2011).

2.2 Integriranje u pravni poredak EU-a

Godine 1997., kada je dogovoren Ugovor iz Amsterdama², odlučeno je kako bi bilo poželjno integrirati mjere u okviru schengenskog sporazuma u pravni poredak EU-a. To je učinjeno pomoću Protokola u prilogu Ugovora, što je omogućilo Vijeću detaljno usvajanje mjera. Mjere koje je Vijeće usvojilo su Odluke koje definiraju schengensku pravnu stečevinu, i Odluke koje raspodjeljuju schengensku pravnu stečevinu na ‘pravne baze’ (tj. ovlasti za djelovanje Europske zajednice ili Europske unije), iznesene u Ugovoru (Peers, 2013.).

Od tog trenutka, Odluke o pristupanju schengenske pravne stečevine su usvojene od strane Vijeća, s jednoglasnom odlukom postojećih schengenskih država i država koje žele sudjelovati u schengenskim pravilima. Nadalje, udruživanje zemalja nečlanica sa schengenskom pravnom stečevinom iziskivalo je nekakav oblik ugovora između EZ/EU i trećih zainteresiranih država. Stoga je Vijeće odlučilo proširiti schengenski prostor na Grčku, 1999. godine, te na Švedsku, Dansku i Finsku 2001. godine (Ivanda, 2001.). Istovremeno, na snagu stupa i ugovor između EZ/EU i Norveške i Islanda, proširujući tako schengensku pravnu stečevinu na zemlje nečlanice.

Međutim, za države koje su EU pristupile od 1999. (među kojima je i Republika Hrvatska), utvrđen je proces dvofaznog ulaska u schengenski sustav.

Prvo, ugovori koji reguliraju ulazak novih država u EU odredili su određene preduvjete, odnosno odredbe schengenske pravne stečevine (pravila na vanjskim granicama, zajedničke liste viza, kao i aspekte policijske i pravosudne suradnje) koji se počinju primjenjivati na dan pristupanja tih država Uniji.

Drugo, primjena osnovnih pravila Schengena (ukidanje unutarnjih graničnih kontrola, sloboda putovanja, jedinstvena politika viza, te uporaba Schengenskog informacijskog sustava SIS o kojem će se govoriti nešto kasnije), odgođeno je za nekoliko godina, dok postojeće schengenske članice jednoglasno odluču da zainteresirane zemlje mogu početi primjenjivati pravila Schengena (iako im je pristup SIS-u omogućen i ranije) (Peers, 2013.).

2.3 Područja primjene schengenskog sustava

Područja primjene schengenskog sustava odnose se na (Europski parlament-Vama na usluzi, 2015):

- Ukidanje graničnih kontrola na unutarnjim granicama za sve osobe.
- Osnaživanje i usklađivanje granične kontrole na vanjskim granicama - svi građani Europske unije imaju pravo ulaska u schengenski prostor u bilo kojem trenutku samo uz predodjenje osobnih dokumenata - osobne iskaznice ili putovnice.
- Državljanima zemalja nečlanica koje se nalaze na zajedničkom popisu država nečlanica čijim je državljanima potrebna viza za ulazak u Schengenski prostor, imaju pravo na jedinstvenu vizu koja vrijedi na cijelom schengenskom prostoru.

² Op. Amsterdamski ugovor iz 1999. godine unio je proširenje nadležnosti Europskog suda u području drugog i trećeg stupa. Donijet je na temelju konferencije vlada u Torinu, Italija, u kojem su sudjelovali i zastupnici Komisije i Europskog parlamenta. Ugovorom iz Amsterdama uvedene su promjene u Maastrichtski UEU kao i u osnivačke ugovore triju zajednice. Ugovor iz Amsterdama predviđa pažljive reforme u području zajedničke vanjske i sigurnosne politike. Politika viza, azila i useljavanja kao i druge politike vezane uz slobodu kretanja osoba iz trećih država premještene su iz područja policijske i pravosudne suradnje u kaznenim stvarima u drugi stup.

- Suradnju policije država članica na otkrivanju i sprečavanju kaznenih djela, također imaju pravo na kazneni progon počinitelja kaznenih djela na državnom području susjedne schengenske države; konstruiran je sustav brzog izručenja i uzajamno priznavanje kaznenih presuda.
- Uspostavu i razvoj SIS-a (Schengenski informacijski sustav).
- Slobodu kretanja građana Europske unije i članova njihovih obitelji (uređeno Direktivom 2004/38/EZ).

Svaka novoprimljena država članica dužna je implementirati pravila Schengenskog sporazuma, koji je Amsterdamskim ugovorom postao dio pravne stečevine EU-a.

Pristupanje Schengenu nije samo politička odluka. Zemlje koje pristupaju imaju listu preduvjeta koje moraju ispuniti, a koji obuhvaćaju (Ivanda, 2001.):

- preuzimanje odgovornosti za kontrolu vanjskih granica i traženje standardnih Schengenskih viza a da pri tome ne štete ostalim zemljama članicama
- odgovarajuće propise o vatrenom oružju
- rad nadležnih tijela koja primjenjuju schengensku pravnu stečevinu,
- efikasnu suradnju sa sigurnosnim agencijama u drugim zemljama Schengena u cilju održavanja visokog nivoa sigurnosti
- primjenu uobičajenih schengenskih pravila kao što su kontrola na zemlji, moru i aerodromima, traženje viza, suradnja policije i zaštita osobnih podataka
- spajanje i korištenje sa SIS-om.

Zemlje koje potencijalno pristupaju schengenskom prostoru prije toga moraju proći schengensku evaluaciju. Nakon pristupanja zemlje prolaze mehanizme kontrole u kojima se periodično kontrolira da li dovoljno efikasno primjenjuju schengenska pravila. Terenskim provjerama prethodi analiza rizika Europske agencije za upravljanje operativnom suradnjom na vanjskim granicama EU (Frontex), Europske agencije za temeljna ljudska prava te po potrebi nekih drugih tijela i agencija npr. Europol.

Prilikom sastavljanja izvješća članovi evaluacijskog tima (predstavnici zemalja članica i Europske komisije) sastavljaju preporuke za korektivne mjere kojima bi se uklonili eventualni nedostaci utvrđeni tijekom evaluacije. U tri mjeseca od donošenja takve preporuke evaluirana zemlja mora Europskoj komisiji i Vijeću europske unije predložiti akcijski plan za uklanjanje tih nedostataka (Službeni list Europske Unije, 2013.).

3. Sloboda kretanja osoba

Sloboda kretanja osoba dijeli se na slobodu kretanja radnika i slobodu poslovnog nastana za poduzetnike. Opća sloboda kretanja građana Unije je neovisna od gospodarske djelatnosti (Večernji list, Specijal: EU učionica, 2012.).

Sloboda kretanja radnika znači slobodnu alokaciju čimbenika proizvodnje rada. Njome se jamči mobilnost, no osim ekonomske ova sloboda ima i socijalnu i društveno-političku važnost (npr. pitanje socijalne sigurnosti, politike zapošljavanja, ostanka u toj državi i sl.).

Europska unija osigurava slobodno kretanje radnika što podrazumijeva zabranu svake diskriminacije na temelju nacionalnosti između radnika država članica u odnosu na zapošljavanje, plaću i druge uvjete rada i zaposlenja (EUR-Lex, 2015.). Ta sloboda može se ograničiti samo radi zaštite javne politike, javne sigurnosti ili javnog zdravlja, a obuhvaća pravo prihvatiti stvarnu ponudu za zaposlenje, kretati se slobodno unutar područja država članica za te svrhe, ostati u državi članici u svrhu zaposlenja u skladu s odredbama zakona, uredbi ili upravnih akta koje se odnose na zapošljavanje državljana te države, ostati na području države

članice nakon zapošljavanja u toj državi, prema uvjetima koje određuje u svojim uredbama Komisija.

Ugovor o funkcioniranju Europske unije (UFEU) ne sadrži pojam radnika pa je sudska praksa taj pojam definirala široko. U svakom slučaju, radnik se u smislu prava Unije, definira kao osoba koja obavlja nesamostalnu djelatnost te za svoj rad prima plaću. U odnosu na obitelj radnika Unija je priznala prava obitelji radnika na zajednički život, pravo na školovanje i pravo na zaposlenje. Propisi prava Unije o slobodi kretanja ne zabranjuju obrnuto diskriminiranje, tj. diskriminiranje vlastitih državljana u potpuno unutarnjim situacijama. Naime, postojeće zabrane diskriminacije u okviru tržišnih sloboda pretpostavljaju prekogranični element.

Sloboda kretanja osoba je pravo zagarantirano ne samo za više od pola milijarde europskih građana nego i državljanima trećih zemalja koji se zakonito nalaze na schengenskom području. Slobodno kretanje podrazumijeva: bez čekanja u zračnim lukama, na morskim ili kopnenim granicama, bez unutarnjih graničnih kontrola. Kontrolna infrastruktura npr. kućice za graničnu policiju i ostale fizičke barijere su uklonjene. Države članice imaju pravo provjere osoba te carinske provjere unutar svog državnog područja kao dio uobičajene policijske, carinske i imigracijske kontrole (Međunarodna trgovina i carina, 2015).

Bogata sudska praksa koja se odnosi na slobodno kretanje osoba obuhvaćena je Direktivom 2004/38/EZ Europskog parlamenta i Vijeća o pravu građana Unije i članova njihovih obitelji na slobodu kretanja i boravište na području neke države članice. Direktiva je uspostavljena s ciljem poticanja građana na ostvarivanje svojih prava slobode kretanja i boravka u članicama, smanjenja administracije, kao i preciznog definiranja statusa članova obitelji (Europski parlament, 2015.). Pa se tako prema Direktivi 2004/38/EZ kao članovi obitelji navode: bračni partner; registrirani partner, ako je po zakonodavstvu države članice domaćina registrirana zajednica izjednačena s bračnom zajednicom; izravni potomci koji nisu navršili 21. godinu ili su uzdržavanici, kao i oni bračnog druga ili registriranog partnera te izravni srodnici u uzlaznoj liniji koji su uzdržavanici, kao i oni bračnoga druga ili registriranog partnera (EUR-Lex - 32004L0038 - EN, 2015.).

3.1 Vanjske granice

Vanjska granica schengenskog područja duga je preko 50 000 km (oko 80 % more i 20 % kopno) te uključuje stotine zračnih i morskih luka, kao i granične prijelaze na kopnenim granicama (Poslovni dnevnik, 2015.).

Svaka schengenska država odgovorna je za kontrolu svojih vanjskih granica. Standardi i razina kontrole jednaki su na svim graničnim prijelazima na vanjskim granicama u schengenskom području bez obzira na njihovu lokaciju. Zajednička pravila utvrđena su u „Zakoniku o schengenskim granicama” (Sintić Toić, 2012.).

Granična policija jedne države može biti premještena u drugu državu kako bi sudjelovala u zajedničkim operacijama i pružila potporu državama članicama koje proživljavaju osobite pritiske. U skladu s pravilima EU-a o lokalnom graničnom prometu na vanjskim granicama mnoge schengenske države sklopile su bilateralne aranžmane sa susjednim trećim zemljama, uključujući dozvolu za lokalni granični promet, kako bi omogućile lokalni granični promet, trgovinu, socijalnu i kulturnu razmjenu i regionalnu suradnju.

3.1.1 Europska agencija za upravljanje operativnom suradnjom na vanjskim granicama (Frontex)

Europska agencija za upravljanje operativnom suradnjom na vanjskim granicama (FRONTEX) nastala je i počela s radom 2005. godine.

Prije svega, svrha Frontexa olakšati je i učiniti učinkovitijim primjenu mjera EU-a u pogledu upravljanja vanjskim granicama, priznajući pri tom državama članicama pravo zadržavanja primarne odgovornost za stvarnu kontrolu i nadzor nad granicama. Frontex mora obavljati svoje zadatke „u potpunom skladu“ s pravom EU-a, uključujući Povelje o temeljnim pravima, Ženevske konvencije o statusu izbjeglica i „obveze koje se odnose na međunarodnu zaštitu, a osobito načelo zabrane protjerivanja“, odnosno da se osobu ne vrati natrag u zemlju stalnog boravišta (Peers, 2013.).

Frontex ima niz zadataka (Peers, 2013.):

- koordinaciju operativne suradnje između država članica u području upravljanja vanjskim granicama
- pomoć državama članicama u obuci nacionalnih graničara, uključujući osnutak zajedničkih standarda obuke
- sudjelovanje u razvoju istraživanja relevantnih za kontrolu i nadzor vanjskih granica
- pomoć državama članicama u okolnostima koje zahtijevaju povećanu tehničku i operativnu pomoć na vanjskim granicama; raspoređivanje europskih graničnih postrojbi (timova) tijekom zajedničke operacije, pilot projekata i brzih intervencija
- pruža državama članicama potrebnu potporu, uključujući i koordinaciju ili organizaciju, zajedničkih operacija povratka i dr.

Države članice i dalje mogu sudjelovati u operativnoj suradnji s drugim državama članicama ili trećim zemljama na vanjskim granicama, ako takva suradnja upotpunjuje aktivnosti Frontexa i ako je Frontex o njima pravovremeno obaviješten (FRONTEX, FRONTEX financial regulation, 2015.). Države članice se također moraju suzdržati od poduzimanja aktivnosti koje mogu dovesti u pitanje, odnosno ugroziti ciljeve Frontexa.

Frontex Uredba također navodi da „nitko ne smije biti protjeran, ili na drugi način predan vlastima, zemlje u suprotnosti s načelom zabrane protjerivanja, ili iz koje postoji opasnost od povratka u drugu zemlju, protivno tom načelu“. Također, posebne potrebe djece, žrtava trgovanja ljudima, osoba kojima je potrebna medicinska pomoć, osoba kojima je potrebna međunarodna zaštita i drugih ranjivih osoba će se rješavati u skladu s EU i međunarodnim zakonima. U tu svrhu, Frontex mora povući Kodeks ponašanja kako bi se osiguralo da Frontex operacije poštuju načela vladavine prava i temeljnih prava, s posebnim naglaskom na maloljetnike bez pratnje i ugrožene osobe, kao i osobe koje traže međunarodnu zaštitu (FRONTEX, FRONTEX financial regulation, 2015.).

3.1.2 Nadzor vanjskih granica

Da bi osigurala provođenje Schengenskog sporazuma svaka država članica schengenskog sustava mora uskladiti niz propisa s pravom Europske unije. Na primjer, Zakon o nadzoru državne granice, Zakon o strancima, Zakon o azilu, Zakon o policiji, Zakon o zaštiti tajnosti osobnih podataka. Posljedica Schengenskog sporazuma je i zaključivanje brojnih bilateralnih sporazuma i dogovora. Kako sa državama potpisnicama Schengenskog sporazuma tako i sa susjednim državama koje su izvan schengenskog prostora.

Funkcija schengenske vanjske granice trebala bi spriječiti ulaz osobama koje ne ispunjavaju propisane uvjete. Također bi na svim graničnim prijelazima trebali biti precizno regulirani te ujednačeni uvjeti za prijelaz preko njih.

Da bi državljani treće zemlje prešao granicu Europske unije potrebni su mu (Rošić, 2008.):

- važeća putna isprava

- važeća viza (ukoliko se radi o državljanima trećih država s kojima postoji vizni režim)³
- isprave koje dokazuju razlog ulaska i dovoljna novčana sredstva te sve to ako pojedincu nije zabranjen ulazak te ako ne predstavlja opasnost za javni red, nacionalnu sigurnost ili međunarodne odnose država članica.

Granični nadzor obuhvaća nadzor zelene (kopnene) granice i plave (morske) granice te uključuje pregled osoba, ukradenih vozila, dokumenata, isprava, ukradenog oružja te provjeru ispunjavanja uvjeta za ulaz u schengenski prostor. Kako Schengenski sporazum teži ukidanju unutarnjih granica i uspostavu zajedničkih vanjskih granica to podrazumijeva snažniji nadzor vanjskih granica jer ukidanje unutarnjih granica ne smije smanjiti sigurnost državljana Europske unije već im treba zajamčiti viši stupanj sigurnosti.

4. Republika Hrvatska i schengenski prostor

Hrvatska je postala članica Europske unije 01. 07. 2013. g., međutim, nije članica schengenskog prostora. Hrvatska vlada najavila je da će Hrvatska 01. srpnja 2015. formalno aplicirati za članstvo u schengenskoj zoni te time omogućiti hrvatskim građanima da se unutar nje kreću slobodno i gotovo bez ikakvog nadzora. Od tog trenutka Hrvatska će biti izravno podvrgnuta evaluaciji odnosno provjeri EU-a da li je za to spremna ili ne. Da bi je Odbor za koordinaciju i nadzor schengenskih instrumenata procijenio spremnom treba ispuniti niz ozbiljnih tehničkih kriterija. Očekivanja su da će odluka o ocjeni spremnosti Hrvatske biti donijeta u roku pola godine od apliciranja (Poslovni, 2013.).

Za pristupanje Hrvatske potrebna je jednoglasna odluka Vijeća Europske unije o uklanjanju kontrola na unutarnjim granicama (nakon konzultacija sa Europskim parlamentom). Provjera spremnosti Republike Hrvatske uključuje primjenu schengenske pravne stečevine u područjima: vanjskih granica, policijske suradnje, vizne politike, sudjelovanje u SIS-u te zaštiti osobnih podataka. Također uključuje i pravosudnu suradnju u građanskim i kaznenim postupcima.

U državama članicama do sada je trebalo između tri i osam godina nakon pristupanja Uniji da pristupe schengenskom području. EU je Republici Hrvatskoj stavila na raspolaganje 120 milijuna eura iz privremenog Schengenskog instrumenta i to isplaćujući 40 milijuna eura u 2013. i 80 milijuna eura u 2014. koje Hrvatska mora iskoristiti za poboljšanje nadzora i kontrole buduće vanjske granice EU (financiranje izgradnje i opremanje graničnih prijelaza, infrastrukture za potrebe policije, nabavka tehničke opreme za nadzor granice, ulaganje u informatičke sustave itd).

Primjeri Rumunjske i Bugarske pokazuju da ulazak u schengensko područje nije samo tehničko već i političko pitanje, naročito u ocjeni borbe protiv korupcije i organiziranog kriminala te efikasnosti pravosuđa, što povećava značaj EU antikorupcijskog izvješća.

S „novim mehanizmima“ nadzora učinkovitosti pravosuđa i borbe protiv korupcije koje uvodi EU, Republika Hrvatska će i nakon pristupanja imati obvezu određenog vida izvješćivanja o stanju pravosuđa i borbi protiv korupcije i organiziranog kriminala, ali pod istim uvjetima kao i ostale države članice. Prvo Izvješće o suzbijanju korupcije (engl. *EU Anti-Corruption Report*) objavljeno je početkom prosinca 2015. i uključuje svih 28 država članica, a sadrži također i preporuke, na razini EU i za svaku državu članicu te su utvrđena područja na kojima će biti potrebno osigurati buduća djelovanja s razine EU. Kao i ostale države članice i Hrvatska će biti

³ Op. Amsterdamski ugovor razvrstava države nečlanice u tri skupine: države negativne liste (čiji državljani moraju imati vizu za ulaz u sve države Schengenskog sporazuma), države sive liste (prema kojima svaka od članica mora uvesti vizni režim) i države pozitivne liste (čiji državljani ne trebaju posjedovati vizu za ulaz u schengenski prostor)

obuhvaćena pravosudnom rang listom - *Justice Scoreboard* - mehanizmom evaluacije pravosudnih sustava država članica kao alatom za promicanje učinkovitog pravosuđa (Pristupanje RH Schengenskom sustavu, 2015).

5. Zaključak

Schengenski ugovor dio je pravne stečevine EU-a koji uklanja unutarnje granice u EU-u te jača kontrolu vanjskih granica EU-a. Danas, preko 400 milijuna ljudi živi u schengenskoj zoni, koja se sastoji od 22 države članice i 3 države koje nisu članice Europske unije: Island, Norveška i Švicarska. Irska i Velika Britanija nisu dio područja Schengena jer su odlučile zadržati kontrolu na svojim granicama, iako redovito surađuju u rješavanju pitanja iz područja sudstva i policije. Cipar, Bugarska i Rumunjska još nisu uvršteni u schengensku zonu, iako su članice Europske unije već dugi niz godina, s obzirom na to da ne ispunjavaju potrebne uvjete i nisu uspjeli dosegnuti propisane standarde.

Uvjet za pristup je provedba schengenskih standarda u četiri područja: kontrola zračnih, kopnenih i pomorskih granica, vizni režim, policijska suradnja i zaštita osobnih podataka. Za Hrvatsku to znači nadzor 2.374,9 km kopnene granice i 948 km morske granice, obuku postojećih i zapošljavanje novih policijskih snaga, nabavu opreme za nadzor granice, kao i implementaciju nacionalnog informacijskog sustava na graničnim prijelazima buduće vanjske granice EU-a koji ima tehničke pretpostavke za priključenje SIS-u (Schengenskom Informacijskom Sustavu). Pristupanje Schengenu znači učinkovitu koordinaciju policije, carine i pravosuđa na nacionalnoj razini, odnosno suradnju tih službi na razini EU-a.

Primjena Schengenskog sporazuma za članice EU-a ima veliki značaj na više područja: sloboda kretanja osoba, roba i kapitala, jačanje ideje građanstva i temeljnih ljudskih prava, jačanje europskog zakona i pravde, kontinuiran i koordiniran rad na razvoju mehanizama koji služe održavanju unutarnje i vanjske sigurnosti. Schengenski prostor također predstavlja područje odgovornosti, solidarnosti i partnerstva članica u pitanjima azilanata i emigranata. Sve to stavlja pred države članice nove izazove u kojima će svakako svoj prostor i mjesto naći i Hrvatska.

Ulazak u Schengen Hrvatskoj donosi niz pogodnosti kao što su: povećanje potražnje za inozemnim dobrima, ali i još bolja mogućnost plasiranja vlastitih proizvoda i usluga na inozemno tržište, zatim podizanje svijesti o jeftinijim proizvođačima u inozemstvu, smanjenje rizika vezanih za kupnju i prodaju izvan zemlje, jačanje turizma i mnoge druge.

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The Schengen agreement

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Abstract. In the town called Schengen, in the south Luxembourg, in 1985, six European countries signed the Schengen Agreement. Five years after the Schengen Convention the abolition of checks at internal borders was determined. A series of measures to increase control at external borders were established. Procedures for issuing uniform visas were introduced including the Schengen Information System, which was replaced by a new generation of SIS II in 2013. The signatories of the Schengen Agreement erased their boundaries on land, sea and airports, and opened borders within the European Union. The Protocol to the Treaty of Amsterdam, the Schengen Agreement and other elements of Schengen acquis, are included in the institutional and legal framework of the European Union and are a part of its legal system. The abolition of border controls started in 1995. In the following years, the Schengen area slowly expands and soon, with accession of Bulgaria and Romania, it will cover 28 European countries. The abolition of internal borders between Member States serves to ensure free movement of goods, people, services and capital. In addition to the economic importance, the abolition of internal borders has freedom of movement within the European Union, which contributes to greater homogeneity and cohesion of European countries; the basic idea of the European Union. An adoption of the Schengen acquis by accession to the European Union is an obligation for each candidate country for EU membership. Croatia, as a full member of the European Union from July 1 2013 will soon have the option to apply for access the Schengen area.

Keywords: *the Schengen area, EU external borders, internal borders, visas*

Stjecanje dobara između država članica Europske unije

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Sažetak. Europska unija je jedinstveno gospodarsko i političko partnerstvo 28 europskih država. Jedinstveno ili „unutarnje“ tržište omogućilo je slobodno kretanje roba, usluga i osoba te postalo glavni gospodarski pokretač EU-a. Uspostavom jedinstvenog tržišta uklonjena je većina trgovinskih barijera. S obzirom na to da između država članica Europske unije nema graničnih crta niti carinske kontrole, više ne možemo govoriti o uvozu i izvozu dobara kad se radi o razmjeni i kretanju dobara na području Europske unije, već se izraz „uvoz“ zamjenjuje izrazom „stjecanje“, a izraz „izvoz“ izrazom „isporuka dobara u drugu državu članicu“. Ti izrazi se koriste kako bi mogli razlikovati te transakcije od „uvoza i izvoza“ koji se i dalje primjenjuju prilikom razmjene dobara sa državama koje nisu članice Europske unije, tj. prema trećima. Nakon ulaska u EU i Republika Hrvatska je prihvatila sve elemente trgovinske politike EU. Jedinstveno unutarnje tržište donijelo je razne pogodnosti kako za proizvođače/dobavljače tako i za krajnje potrošače. Zajedničko tržište je najveće postignuće EU-a. Da bi se ostvarilo jamstvo slobodnog kretanja roba, usluga, ljudi i kapitala, zakonodavci su morali donijeti stotine direktiva koje su potrebne za uklanjanje tehničkih, kulturnih, pravnih i regulatornih poteškoća unutar same Unije koje je morala prihvatiti i Hrvatska.

Ključne riječi: Europska unija, trgovina, stjecanje dobara

1. Uvod

Sa svojim udjelom od 16.5 % u ukupnom svjetskom uvozu i izvozu, EU se smatra najvećim svjetskim trgovcem. Slobodna trgovina je jedno od temeljnih načela EU-a, koja je omogućila europskim potrošačima i proizvođačima jednostavniji pristup i lakšu razmjenu dobara, usluga i protok novca (EU, 2015.).

Cjelokupni proces europskog ujedinjenja započeo je nakon Drugog svjetskog rata kada je potpisivanjem Pariških i Rimskih ugovora nastala „prva“ integracija. Od pedesetih godina pa sve do danas dogodile su se brojne promjene na europskom području. EU je tijekom svog djelovanja doživjela nekoliko „valova proširenja“ i danas broji 28 zemalja članica. U samoj jezgri procesa ujedinjenja europskih država nalazi se trgovinska politika jer je jedan od prvih ciljeva bio povezan sa postupnim ukidanjem carina i ostalih ograničenja koji su utjecali na međusobnu trgovinu (Kersan-Škabić, 2012.).

Temelj Europske unije, koji je ujedno i ugrađen i u ugovor o Europskoj uniji, sačinjavaju tzv. „četiri slobode“, slobodno kretanje: robe, ljudi, kapitala i usluga. Ono u praktičnom dijelu znači za potrošače širi izbor proizvoda po konkurentnijoj cijeni te veću zaštitu, dok proizvođačima pojednostavljuje proces globalnog natjecanja i prekograničnog poslovanja. To jedinstveno tržište i postoji radi 500 milijuna potrošača koji imaju pravo kupovati proizvode i usluge po istim kriterijima i ugovornim obvezama, dok je svakom proizvođaču u Europskoj uniji omogućen pristup svakom od tih potrošača.

Jedna od najvećih prednosti jedinstvenog tržišta za proizvođače je ekonomija razmjera i konkurentnost, dok je malim tvrtkama i proizvođačima omogućen lakši pristup novim tržištima.

2. Trgovinska politika Europske unije

Cjelokupna trgovinska politika Europske unije uređena je člankom 207 Ugovora o funkcioniranju Europske unije (Lisabonski ugovor) te je samim time u njezinoj isključivoj nadležnosti.

EU tržište je ključnu ulogu imalo i u osnivanju Svjetske trgovinske organizacije (WTO). EU je 2012. bila glavni trgovinski partner s više od 100 zemalja, a čak 10 % stanovništva EU-a ovisilo je o vanjskoj trgovini što govori o značaju vanjske trgovine za njeno stanovništvo. Također trgovina je značajno pridonijela i povećanju BDP-a i životnog standarda kako u Uniji tako i drugdje (Europa, EU, 2015.).

Međutim, svjetska trgovina se u posljednje vrijeme bitno promijenila. Razvojem tehnologije kao i dolaskom na tržište nekih novih gospodarskih supersila (op. zemlje BRIC-a, Brazil, Rusija, Indija i Kina), svjetska trgovina je u velikoj mjeri doživjela promjene te se počelo trgovati robom i uslugama kojima se do sada nije moglo trgovati. Svojim ujedinjenjem države članice su sva važnija pitanja vezana za međunarodnu trgovinu prepustila Europskoj komisiji koja zastupa Europsku uniju u pregovorima o međunarodnim trgovinskim sporazumima i pitanjima vezanim za trgovinu (Europski parlament, 2015.).

Ciljevi trgovinske politike Europske unije su (Kersan-Škabić, 2012.):

- smanjenje carinskih barijera
- harmonizirani razvoj svjetske trgovine
- progresivno ukidanje ograničenja u međunarodnoj trgovini.

Ključnu ulogu u stvaranju integriranog unutarnjeg tržišta i zajedničke gospodarske politike imaju trgovinska i carinska politika koje su temelj Europske unije. Zajednička trgovinska politika temelji se na jedinstvenim načelima, osobito u pogledu primjene carinskih stopa i kvota, inozemnih izravnih ulaganja, zaključivanja bilateralnih i multilateralnih carinskih i trgovinskih sporazuma koji se odnose na trgovinu robom i uslugama, postizanje ujednačenosti mjera liberalizacije te izvozne politike i zaštitnih mjera.

Trgovinska politika Europske unije regulira trgovinske odnose sa zemljama nečlanicama i u potpunoj je nadležnosti Europske unije, što znači da države članice ne mogu samostalno sklapati trgovinske sporazume ili donositi nove propise. Za vođenje pregovora sa trgovinskim partnerima zadužena je Europska komisija, dok Vijeće Europske unije i Europski parlament imaju zakonodavne ovlasti.

Europska unija je jedno od najvećih carinskih područja na svijetu sa 28 carinskih uprava koje primjenjuju zajedničke carinske standarde. Zajednička carinska tarifa, kao jedna od glavnih značajki carinske politike Europske unije, propisuje carinske pristojbe koje se naplaćuju na uvoz robe u Europsku uniju i idu u proračun Europske unije, a ne zemljama članicama (carine obuhvaćaju oko 13 % proračunskih prihoda Europske unije). Neke od zemalja europskog gospodarskog prostora poput Norveške, Islanda, Švicarske, kao i zemlje u razvoju, najčešće imaju povlaštene carinske stope ili slobodan uvoz robe bez ograničenja po pitanju carine, osim carinske kontrole. Puna primjena Zajedničke carinske tarife očituje se, primjerice, u trgovini s državama poput Kanade, SAD-a i Japana.

Europska unija uz zajedničku trgovinsku politiku također provodi trgovinsku i carinsku politiku kroz niz mehanizama za zaštitu trgovine i to mjerama zaštite od subvencioniranog izvoza iz zemalja izvan Unije, provedbu bilateralnih i multilateralnih sporazuma, mjere anti-dampinga te dijaloga s relevantnim dionicama iz javnog i privatnog sektora.

3. Carinska politika EU

S obzirom na to da temelj Europske unije čine zajedničko tržište i carinska unija, jako je bitno naglasiti značajke svake posebno. Zajedničko tržište obilježavaju zajednička trgovinska i poljoprivredna politika te slobodno kretanje roba, a carinsku uniju obilježavaju bescarinska trgovina između zemalja članica i zajednički carinski propisi koji se primjenjuju prema trećim zemljama (Ministarstvo financija RH, Carinska uprava, 2015.).

Carinska unija je jedno od najvećih postignuća Europske unije i ključni je čimbenik u globalnom okruženju 21. stoljeća. Europska unija je po svom određenju carinska unija koja primjenjuje brojna pravila na uvoz i izvoz robe sa trećima, no u potpunosti su uklonjene sve kontrole između zemalja članica. Carinska unija okružuje unutarnje tržište Europske unije i omogućuje slobodno kretanje roba unutar tog područja te nadzire uvoz i izvoz proizvoda iz trećih zemalja. Carinskom unijom upravlja 28 nacionalnih carinskih službi zemalja članica koje djeluju zajednički. Oni nadziru kretanje proizvoda na vanjskim granicama Europske unije koje uključuju granične prijelaze u zračnim lukama, trajektnim lukama i na kopnenim graničnim prijelazima kao i unutarnje područje Europske unije.

Europska unija je isključivo odgovorna za funkcioniranje carinske unije, međutim da bi se to provelo ona se mora zasnivati na partnerstvu sa zemljama članicama i između njih. Ključnu ulogu u svemu ima Europska komisija koja predlaže carinske zakone i prati primjenu istih. Ona također nastoji osigurati da carinska unija ima moderne, učinkovite i međusobno povezane carinske ustanove koje se mogu nositi sa postojećim i budućim izazovima (Politike Europske Unije, 2015.).

Carinski propisi koji se primjenjuju su (Ministarstvo financija, Carinska uprava RH, 2015.):

- Carinski zakonik Zajednice (CZZ)-Uredba Vijeća (EZZ) br. 2913/92 od 12. listopada 1992., kojom se donosi CZZ sa svim izmjenama i dopunama.
- Zakon o provedbi carinskih propisa Europske unije.
- Uredba za provedbu Carinskog zakonika Zajednice (UPCZZ) – Uredba Komisije (EZZ) br. 2454/93 od 2. srpnja 1993., o odredbama za provedbu Uredbe Vijeća kojom se donosi CZZ, sa svim izmjenama i dopunama.
- Razni provedbeni propisi (pravilnici) kojima se detaljnije reguliraju carinska postupanja čije je donošenje u nadležnosti pojedinih zemalja članica.

Za provedbu carinskih postupaka za određenu robu prvenstveno je potrebno utvrditi carinski status robe. Sukladno odredbama koje propisuje CZZ moguća su dva carinska statusa robe: prvi se odnosi na status robe Zajednice, a drugi na robu koja nema status Zajednice.

„Roba Zajednice“ je roba koja je (Carinska uprava RH, 2015.):

- U cijelosti dobivena na carinskom području Zajednice prema uvjetima iz članka 23. CZZ-a i koja ne sadrži robu uvezenu sa teritorija koji nije dio carinskog područja Zajednice.
- Dobivenu ili proizvedenu u carinskom području Zajednice – bilo od robe koja je u cijelosti dobivena na carinskom području Zajednice, bilo od robe prethodno uvezene i puštene u slobodan promet.
- Uvezene iz trećih zemalja koje nisu dio carinskog područja Zajednice i puštene u slobodan promet.

„Roba koja nema status Zajednice“ je (Carinska uprava RH, 2015):

- Roba unesena u carinsko područje Zajednice u skladu sa člankom 37. CZZ-a.
- Roba privremeno smještena ili u slobodnoj zoni kontrolnog tipa 1. ili u slobodnom skladištu.

- Roba stavljena u postupak s odgodom ili u slobodnu zonu kontrolnog tipa 2.

Zajednička carinska tarifa je carinska tarifa koja se na vanjskim granicama Unije primjenjuje na uvoz robe iz trećih zemalja u Uniju, a čija je visina i klasifikacija zajednička svim državama članicama i jedna je od najvažnijih propisa Europske unije. Zakonska osnova sadržana je u članku 20. Uredbe Vijeća (EEZ) 2913/92 o uspostavi Carinskog zakonika Zajednice.

Prema navedenom članku sastoji se od (Zajednička carinska tarifa EU, 2015) :

- kombinirane nomenklature
- bilo koje druge nomenklature koja se u potpunosti ili djelomično bazira na kombiniranoj nomenklaturi ili uvodi daljnju podjelu kombinirane nomenklature zbog potrebe provedbe tarifnih mjera Zajednice u specifičnim područjima u trgovini robom
- stopa carine i drugih elementa davanja koje se primjenjuje na robu obuhvaćenu kombiniranim nomenklaturom
- preferencijalnih tarifnih mjera sadržanih u ugovorima koje je Zajednica sklopila s pojedinim zemljama ili grupama zemalja, temeljem kojih se osigurava preferencijalni tarifni tretman
- preferencijalnih tarifnih mjera uvedenih jednostrano od Zajednice u odnosu na određene zemlje, grupe zemalja ili teritorije
- autonomnih suspenzija kojima se snižavaju ili ukidaju carine za određenu robu
- drugih tarifnih mjera koje se temelje na zakonodavstvu Zajednice (na primjer, antidampinške i kompenzacijske carine, zaštitne carine, dodatne carine).

Svi mehanizmi koji se primjenjuju u Europskoj uniji, posebice carinski propisi i zakoni temelje se prvenstveno na zaštiti i poticaju domaće proizvodnje te regulaciji tržišta.

3.1. Kombinirana nomenklatura

Kombinirana nomenklatura bazirana je na Međunarodnoj konvenciji o Harmoniziranom sustavu nazivlja i bročnanog označavanja te uključuje daljnje podjele zbog trgovinskih, statističkih i carinskih potreba Europske unije. Sam naziv „kombinirana nomenklatura“ je nastao kombinacijom bivše carinske (engl. *Common customs tariff*) i statističke trgovinske (Nimex) nomenklature Europske unije.

U primjeni je na području Europske unije od 1988. godine. Ona je sastavni dio Zajedničke carinske tarife, čija zakonska osnova je sadržana u članku 20. Uredbe Vijeća (EEZ) 2913/92 (Ministarstvo financija RH, Carinska uprava, 2015.).

Utvrđeno je da će se tako uspostavljena nomenklatura sastojati od (Ministarstvo financija RH, Carinska uprava, 2015.):

- nomenklature Harmoniziranog sustava (HS)
- daljnje podjele nomenklature HS-a za potrebe Zajednice, koju se naziva KN podbrojevi
- uvodnih odredbi, dodatnih napomena uz odsjeke i poglavlje vezanih uz KN podbrojeve.

Klasifikacija (nomenklatura) robe definirana je člankom 3. Uredbe. Podbrojevi Kombinirane nomenklature imaju osmeroznamenkastu tarifnu oznaku, od kojih (Ministarstvo financija RH, Carinska uprava, 2015.):

- prvih šest znamenki predstavljaju tarifne brojeve i podbrojeve iz Harmoniziranog sustava
- sedma i osma znamenka identificiraju podbrojeve Kombinirane nomenklature.

Ako tarifni broj ili podbroj Harmoniziranog sustava nije dalje podijeljen za potrebe Zajednice, na mjestu sedme i osme znamenke bit će oznaka „00“. Zbog specifičnih mjera koje se provede pri uvozu (npr. ugovori o povlaštenim trgovinskim režimima, zajedničke trgovinske i druge politike itd.), podbrojevi Kombinirane nomenklature mogu biti dalje podijeljeni na TARIC podbrojeve. Oni zajedno s osmeroznamenkastom KN oznakom čine TARIC oznaku. U slučaju da ne postoji daljnja TARIC podjela, deveta i deseta znamenka biti će „00“ (Carinska uprava RH, 2015).

3.2. TARIC sustav

S obzirom na svakodnevne promjene u Zajedničkoj carinskoj tarifi istom nije moguće upravljati u papirnatom obliku, stoga je tiskano izdanje carinske tarife prestalo postojati. Kao zamjena za nju kreiran je TARIC sustav (akronim od francuskog naziva za „integriranu tarifu Zajednice“ - *Tarif Intégrée Communautaire*) (Carinska uprava RH, Taric, 2015.).

Člankom 2. Uredbe 2658/87 o tarifnoj i statističkoj nomenklaturi i zajedničkoj carinskoj tarifi, TARIC sustav predstavlja bazu podataka u kojoj se nalaze sve mjere zajedničke trgovinske politike Europske unije. Zajedničke mjere primjenjuju se u trgovini s trećim zemljama te pokrivaju vanjskotrgovinske, statističke, trgovinske i druge politike.

Za funkcioniranje TARIC sustava zadužena je Europska komisija te je time osigurana jedinstvena primjena mjera od svih država članica. Također TARIC sustav omogućuje svim gospodarskim subjektima pravovremen prikaz svih transparentnih mjera kako u uvozu tako i u izvozu (Carinska uprava RH, Taric, 2015.).

TARIC predstavlja informatičku verziju Zajedničke carinske tarife (elektroničku bazu podataka) koja sadrži sve dnevno aktualne EU mjere koje treba primijeniti u trgovini s trećim zemljama, odnosno svojevrsni mozak carinskog informacijskog sustava i alat bez čije bi uporabe bilo gotovo nemoguće ocariniti robu.

Sastoji se od (Carinska uprava RH, Taric, 2015.):

- nomenklature robe
- stopa carine
- preferencijalne stope
- antidampinške mjere
- ostale propisane mjere u Europskoj uniji.

Iz toga proizlazi da TARIC predstavlja skup svih mjera Zajednice (tarifnih i netarifnih) koji se primjenjuju u trgovini s trećim zemljama, sadržanih u brojnim pojedinačnim propisima Europske unije.

Održava ga Opća uprava za poreze i carinsku uniju (DG TAXUD) Europske komisije. Trenutno je dostupan samo na engleskom jeziku i nije produkcijski, što znači da ne mora nužno odgovarati dnevnim podacima koji su objavljeni na web stranicama Europske komisije.

4. Republika Hrvatska i trgovinska politika EU

Ulaskom u EU, Hrvatska je prihvatila sve elemente trgovinske politike EU, kao i sve trgovinske sporazume koje je EU potpisala sa zemljama nečlanicama. Time su svi sporazumi o slobodnoj trgovini koje je Hrvatska samostalno potpisala prestali važiti. Ulaskom u Europsku uniju, vezano za tarifne propise i carinska davanja, van snage su stavljeni (Zajednička carinska tarifa EU, 2015.):

- Zakon o carinskoj tarifi i Uredba o carinskoj tarifi, uključujući nacionalnu podjelu i sva njome utvrđena uvozna i izvozna davanja, kao i Odluke o odobrenju preferencijalnog uvoza u okviru kvota, dodijeljene temeljem Uredbe o carinskoj tarifi za 2013.

- Protokol o pristupanju Republike Hrvatske Marakeškom ugovoru o osnivanju Svjetske trgovinske organizacije (WTO), uključujući obvezujući raspored na kojem se temelje osnovne stope carine i WTO carinske kvote.
- Svi sporazumi o slobodnoj trgovini koje je RH zaključila s drugim zemljama, uključujući sve njima utvrđene preferencijalne stope carine i preferencijalne carinske kvote.

Kao članici, Hrvatskoj je olakšan izvoz proizvoda na tržište EU jer postaje dijelom zajedničkog unutarnjeg tržišta (Kersan-Škabić, 2012.). Nakon ulaska RH u EU, vanjska granica EU postaje granica Hrvatske s Bosnom i Hercegovinom, Srbijom i Crnom Gorom te se na tim granicama provodi i pojačani carinski nadzor. Kao nova članica EU, Hrvatska je uskladila svoje zakonodavstvo i carinsku praksu sa praksom EU, te je od samog ulaska i primjenjuje. U tu svrhu donesen je i Zakon o provedbi carinskih propisa EU koji predstavlja nacionalni carinski zakon (Zakon o provedbi carinskih propisa Europske unije NN 54/13, 2015.).

Nakon ulaska također su se promijenili i uvjeti za obavljanje trgovine između gospodarskih subjekata u RH sa zemljama članicama EU-a, dok se trgovina sa nečlanicama provodi sukladno europskim i nacionalnim carinskim propisima. S obzirom da više nema graničnih crta niti carinske kontrole između država članica EU-a, više ne možemo govoriti o uvozu i izvozu dobara na području Europske unije pa se izraz „uvoz“ zamjenjuje izrazom „stjecanje“, a izraz „izvoz“ izrazom „isporuka dobara“. Ti izrazi su stavljeni na korištenje kako bi se mogli razlikovati od izraza „uvoz i izvoz“ s obzirom da se ti izrazi još uvijek koriste u trgovini sa državama nečlanicama EU-a.

S time u skladu, predmetom oporezivanja PDV-om na području Europske unije smatra se (Cipek, 2013.) :

- isporuka dobara uz naknadu na području neke države članice
- stjecanje dobara uz naknadu unutar Europske unije na području neke države članice
- obavljanje usluga uz naknadu na području neke države članice
- uvoz dobara na područje neke države članice, odnosno Europske unije.

Stjecanje dobara kao predmetom oporezivanja propisano je člankom 4. stavkom 1. točkom 2. Zakona o PDV-u. Stjecanje dobara kao predmet oporezivanja propisano je i člancima 2., 3., 27., 28., 29., 30. i 31. Pravilnika o PDV-u. S obzirom da stjecanje dobara unutar Europske unije nije više u nadležnosti Carinske uprave nego Porezne uprave, ona će uz pomoć poslovne dokumentacije izvršavati provjere vezane za stjecanje dobara iz drugih država članica (Cipek, 2013.).

Prema članku 9. stavak 1. Zakona o PDV-u „Stjecanje dobara unutar EU“ je stjecanje prava raspolaganja pokretnim materijalnim dobrima u svojstvu vlasnika, koja je iz jedne države članice u drugu državu članicu otpremio ili prevezao prodavatelj ili netko u njegovo ime ili osoba koja dobra stječe (Jerković, 2015.).

Sve dok je kupac porezni obveznik koji ima pravo na odbitak pretporeza, stjecanje je unutar EU-a neutralno (to je jedno od osnovnih načela PDV-a). Kako bi mogli obavljati stjecanje dobara unutar Europske unije, hrvatskim poreznim obveznicima je potreban PDV identifikacijski broj kako bi mogli imati oporezivo stjecanje. U slučaju da ne posjeduju PDV identifikacijski broj isporučitelj dobara iz druge države članice obračunat će PDV u skladu sa propisima svoje države članice (Jerković, 2015.).

Ulaskom Hrvatske u EU svako kretanje robe zemalja članica unutar EU-a predstavlja trgovinu između članica stoga ona ne podliježe obvezi provođenja carinskih postupanja. Međutim, kako trgovina između članica i dalje predstavlja robnu razmjenu ona se mora na neki način mjeriti radi planiranja, sastavljanja nacionalnih računa i platnih bilanci. S obzirom da se mjerenje ne može više provoditi temeljem carinskih deklaracija jer roba nije predmet carinskog postupanja

za trgovinu između zemalja članica uspostavljen je INTRASTAT - poseban sustav u okviru kojeg se prikupljaju podaci o razmjeni između zemalja članica.

5. Zaključak

Zajedničko tržište EU-a s definiranim carinskim sustavom država članica EU-a prema trećim zemljama zahtijevalo je i zajedničku vanjskotrgovinsku politiku prema trećima. Europska ekonomska zajednica koja je nastala 1957. godine potpisivanjem Rimskog ugovora, stvorena je kao carinska unija sa zajedničkom carinskom tarifom država članica prema trećima te željom za uklanjanjem svih prepreka u razmjeni dobara između samih članica. Istim tim ugovorom (op. Rimski ugovor) predviđeno je i stvaranje zajedničkog tržišta, što je podrazumijevalo usklađivanje ekonomskih politika zemalja članica te razvoj zajedničkih ekonomskih odnosa, odnosno u ovom slučaju trgovinskih odnosa s trećima.

S obzirom na to da je Europska unija najveća i najsloženija ekonomska integracija u svijetu, tijekom vremena jedna od važnijih odrednica Europske unije postao je razvoj i unapređenje zajedničke trgovinske politike zemalja članica prema trećima. Europska unija danas predstavlja gospodarstvo koje je prvenstveno najviše usmjereno prema trgovini s trećim zemljama te kontinuirano unaprjeđuje vlastite gospodarsko-političke odnose prema istima.

Rimskim ugovorom o osnivanju EEZ-a predviđene su tzv. „četiri slobode” koje predstavljaju ključne smjernice unutrašnje trgovinske politike. Sloboda kretanja roba je jedna od četiri temeljne slobode unutarnjeg tržišta Europske unije te je promicanje i zaštita slobode kretanja roba iznimno važno za funkcioniranje unutarnjeg tržišta Europske unije.

Ulaskom u Europsku uniju, Republika Hrvatska je preuzela zajedničku trgovinsku politiku EU-a, a samim time i jedinstvene politike zaštitnih mjera u odnosu prema trećim zemljama. Sukladno tome, glavni cilj hrvatske trgovinske politike postaje oporavak gospodarstva stvaranjem povoljnijih uvjeta za trgovinu i buduća ulaganja kako prema ostalim članicama EU-a, tako i prema trećima.

Poduzetnicima koji posluju na hrvatskom tržištu, plasman roba na tržišta država članica EU-a znatno je olakšan. Ravnopravan tretman hrvatskih proizvoda u odnosu na proizvode iz drugih država članica EU-a proširio je mogućnosti poslovanja i trgovine na tržištima drugih država članica EU-a. Korist carinske unije za zemlje članice ogleda se u ukidanju međusobne granične kontrole što podrazumijeva izravnu uštedu i vremena i troškova administrativne procedure špedicije i carinjenja te ubrzava i pojeftinjuje protok roba.

Ukidanjem fiskalnih granica prema državama članicama EU-a isporuka dobara u druge države članice više se ne smatra izvozom nego isporukom dobara unutar EU-a, dok se uvoz dobara iz drugih država članica EU-a smatra stjecanjem dobara unutar EU-a.

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Acquisition of goods between members of the European Union

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Abstract. The European Union is a unique economic and political partnership of 28 European countries. Single or „internal” market allowed the free movement of goods, services and people and become the main economic engine of the EU. The establishment of a single market removed most trade barriers. Given the fact that between the member states of European Union there are no boundary lines or customs control, we cannot talk about the import and export of goods when it comes to trade and the movement of goods in the EU. The term „import”, therefore, replaces the term „acquisition” and the term „export” the term „supply of goods to another member state”. These terms are used in order to distinguish those transactions from the „import and export” which are still utilized in the exchange of goods with non-member countries of the European Union, i.e. third parties. After joining the EU, Croatia accepted all of the elements of EU trade policy. The internal single market has brought many benefits for both manufacturers / suppliers and end consumers. The common market is the greatest achievement of the EU. In order to obtain a guarantee of free movement of goods, services, people and capital, lawmakers had to make hundreds of directives needed to remove technical, cultural, legal and regulatory difficulties within the EU that Croatia had to accept.

Keywords: European Union, trade, acquisition of goods

Developing small rural communities through cultural heritage tourism: A Spanish case

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Abstract. Inland rural areas in Spain have gradually become deprived territories since the migration towards cities that began in the XX century searching for a better life. Agriculture was not the pillar of rural economies anymore on the one hand, owing to periods of bad crops; and on the other, because of the very low prices but high costs involved in harvesting. As a result, young people decided to leave their homeland, looking for a job in the developing industry of big cities. Consequently, small rural areas were left with elderly people, which led to the total abandonment of some villages as old people died. Fortunately, the last years have seen an awakening in promoting rural environments as healthy and homely and therefore, as providers of a better quality of life. For some areas this was feasible thanks to privileged natural environments. However, other inland areas needed to reinvent themselves and benefit from their own valuable assets, i.e. their cultural heritage. The present analysis will introduce a case where a very small village on the Spanish plain has doubled its population in the last 10 years by resorting to their Celtiberian roots. This increase has also meant a significant development in the local community, as small businesses were started up in the wake of the rising number of incoming tourists. Consequently, this also meant jobs and so, young people returned to the rural environment, settling down there and, by starting their own families, increasing the population.

Key words: *rural areas, heritage tourism, population thrust*

1. Introduction

“The tourism industry is more interested in the business of tourism. It is up to communities to take hold of their futures in constructive ways while improving the community.”

McNulty & Koff, 2014, p. 14

This quotation sums up best the message that this paper aims to put forward, i.e. small rural communities have traditionally suffered an ongoing and slow deterioration because of economic reasons. And although there will still be villages that may even disappear because of this, those small communities that have the privilege to be the guarantors of heritage sites can survive thanks to their cultural past by showing this to others, that is, by attracting tourists to their destination.

The 2015 UNWTO/UNESCO Conference on Tourism and Culture finally highlighted the need to create a framework for collaboration between tourism and culture. Emphasis was also placed on the need to include an active participation of the host communities, apart from tourists and the private and public sectors. This was in line with previous work carried out by the UNWTO, such as the Global Code of Ethics for Tourism that was developed in 1999 with the objective to maximise benefits from tourism as well as minimising its potentially negative

impact on environment, cultural heritage, and communities, and later on adopted as a resolution by the General Assembly of the UNO in December 2001. Among the 10 principles outlined, two of them are worth mentioning here: on the one hand, principle 4 establishes tourism as a user of the cultural heritage of mankind and a contributor to its enhancement, thus respecting archaeological and cultural heritage so that future generations can still enjoy it, and also, traditional cultural products, crafts and folklore; on the other hand, principle 5 describes tourism as a beneficial activity for host countries and communities in the sense that it can contribute to employment. Likewise, the UNESCO World Heritage and Sustainable Tourism Programme has created an international framework for cooperation across sectors in order to safeguard heritage and achieve sustainable tourism and economic development. Its Action Plan 2013-2015 outlined major activities such as focusing on the empowerment of local communities and taking into consideration the local context and needs. And although no information is available on how the second phase (2016-2018) is developing, there is a hope that the collaboration of all the stakeholders involved and the estimated budget for the programme (US\$ 3,720,000) will make it succeed.

But firstly, a definition of *cultural heritage tourism* must be provided, since there are as many interpretations as possible definitions that can be found throughout the literature on the subject. However, only those that match the purpose of this paper will be introduced subsequently. According to McNulty & Koff (2014), it relates to visiting those places that are significant to the cultural identity of a particular community and consequently, that makes these people different from others. Similarly, the National Trust for Historic Preservation (Gibson, 2015) describes cultural heritage tourism as experiencing places, crafts, and activities that represent the past and present of particular people. Throsby (1999) uses the concept *Cultural Capital* meaning the group of tangibles and intangibles which reflect the history and identity of a group of people and which is to be understood as an asset through the flow of goods and services derived from it. However, this asset can depreciate if it isn't adequately preserved or build up if it is improved and money is invested. In other words, it is an economic phenomenon. Finally, Caves (2000) coins the term *Creative Capital* to refer to all those material and immaterial values in a society that encourage individuals and institutions to become innovative and dynamic. Obviously, both the degree of knowledge and the resources for acquiring and developing it are very important, but what really matters is to understand it as an attitude, an entrepreneurial spirit, where imagination and opportunity blend.

Spain is a good example of a cultural heritage tourism provider, as the potential visitor can enjoy 44 UNESCO World Heritage Sites. Well-known examples are La Alhambra (Granada) or The Mosque in Cordoba, if travelling down South; the Romanesque Way, which crosses the country from South to North, going through towns of great historical and heritage values; the Silk Exchange Building (Valencia), located on the Eastern coast. And surely, a representative example of cultural heritage in Spain is the Santiago de Compostela Way which was visited by 262,515 pilgrims in 2015, an increase of 10.3% compared to 2014 (Pilgrim Office, 2016). 53.38% of those visitors were foreign and came from 178 countries worldwide (39 more than the previous year). This is a good example of best practice on how the tourism regional and national stakeholders carried out a number of strategies in order to overcome the economic recession that stroke the country seriously from 2009. They realized that Spain had a lot to offer apart from sun and beach destinations and therefore, they decided to go back to their roots, i.e. to enhance and promote all the cultural values that the potential tourist could enjoy. The strategy was to develop quality cultural routes in order to attract quality tourism in areas such as, spa & wellness, sports, gastronomy, wine experience, and spiritual routes. In all these areas, the focus was placed on culture and routes/packages were offered so that customers could enjoy an attractive historical description of what they were

experiencing (Aznar, 2015). The outcome has been outstanding: Spain hit a record of tourist arrivals in 2015 with a total number of over 68 million, 4.9% more than the previous year (Spanish Institute of Tourism Research, 2016), and an increase of 8.5% in total expenditure (Spanish Statistical Office, 2016). Therefore, it is evident that the link between tourism and cultural heritage is key to success when the focus is placed on quality and sustainability.

However, these sites are located in major towns. Therefore, the main problem is how to enhance and promote all those heritage sites that can be found in rural Spain and that have nothing to envy to those landmarks mentioned above. It is a universal fact that rural areas are threatened by a number of factors: an aging population which leads to human desertification; a migration of inhabitants to bigger towns, as many of those who are born in these regions are not willing to stay and which consequently, results in depopulation, and sometimes even in the disappearance of communities; an increase in isolation that causes a degradation of economic activities and as a result, an increase in unemployment. And although the situation is worrying, there is a way out if rural communities regulate themselves both economically and socially through tourism (Hall & Brown, 2000). Even the UNWTO are well aware of this fact and this is why the First World Conference on Tourism for Development will be organized in Beijing in May, 2016, together with China; the focus will be on tourism for poverty reduction as well as tourism for peace. In fact, the Chinese authorities have launched a new Five-Year-Plan whereby by 2020 two million of China's rural population are expected to overcome poverty every year. But first, these communities must have something to offer and so, only those rural areas that have a specific cultural and natural appeal can attract tourists and hence, have a significant impact on rural development (Mostowfi, 2000). And there are good examples of how certain rural regions decided to take responsibility for their own development. Already in the mid 90's the European Commission, through the European Network for Rural Development (ENRD), launched the LEADER Gateway (Liaison Entre Actions de Développement de l'Economie Rurale) which became an important component of EU Rural Development Policy for over 20 years. Likewise, the European Network of Village Tourism (2008) is an important initiative for the involvement of the local communities in the development of their tourist initiatives. The strategy of the network is to increase the visibility of the regions involved and the development of high quality products through personalized tourism experiences, i.e. hosts interact directly with guests. The sought outcome is to diminish seasonality by creating activities that can attract visitors all year round.

The next chapter will present a good practice case in which a very small Spanish village which was seriously threatened as a living community could not only survive but boom thanks to their own cultural heritage and the will and involvement of the local inhabitants. But first a brief introduction will be made on the importance of developing a building community approach in the rural environment.

2. The development of a small rural community: A Celtiberian story

“Tourism is too important a resource to be left to the tourism professionals.”

Bob McNulty, President, Partners for Livable Communities (www.livable.org)

In hard economic times, as the world is going through nowadays, persuading people of the benefits of preserving cultural heritage can be a challenge, otherwise this obviously results in less financial resources from either public or private bodies. But this is the time when local communities can take the lead, as collaborative participation may undoubtedly steer to succeed in developing cultural heritage attractions as a way to improve their quality of life

and also, strengthen the community. Consequently, the interests of the community become the core of cultural heritage tourism (McNulty & Koff, 2014). The involvement of the local inhabitants develops as well in an emotional connection when they integrate the past to create a bond to the present time by developing attractions they see as a celebration of their own culture. And the creative interpretation of heritage becomes an asset that cannot be ignored because of its huge potential in terms of tourist attraction and so, economic development. As McNulty and Koff claim: "... highlighting the culture and heritage of a place cultivates attachment to that place, and thus makes people want to settle in that area and lay their roots down." (2014, p. 10). It is therefore hardly surprising to find out how governments are eager to facilitate the boom of cultural tourism, since this is seen as a great opportunity for the growth and diversification of the economic structure and for the modification of the image that potential tourists may have about the urban area and its surroundings (Herrera & Devesa, 2011). By focusing on cultural heritage, public decision-makers strengthen a number of key values such as, the quality of life that is associated with art and culture.

By providing quality cultural experiences, rural communities can attract the powerful segment of LOHAS (Lifestyles of Health and Sustainability). Tourists in this group have higher incomes and can bring more resources to the communities they visit. Furthermore, they are more frequent travellers and don't mind travelling long distances in order to get the experience they want. Moreover, and this is very important, they spend more money than the average tourist. The community approach can provide this by seeking a balance among the interests of tourists, preservationists and the community members themselves. Surely, this can be done by involving community members in making all those basic decisions about what should be done. This way self-confidence and a sense of community pride are promoted among participants as well as a better understanding of their own history. Besides, there is a tangible improvement in the residents' quality of life through the construction and renovation of new and existing facilities, and through the expansion of economic opportunities. There is also an intangible improvement because of the increase in the sense of trust, respect and closeness among the community members. As a result, on the one hand, there is a promotion of a greater involvement in public life; and on the other, a more vibrant community is created. The outcome may be both a sustainable development and community empowerment.

2.1 Introducing the small community

The name of the small community is Garray. It is a very small village located in the province of Soria on the Spanish plateau, about 230 km to Madrid, the capital of the country. According to their population census (Garray Town Hall, 2016), the village has 533 inhabitants of which 53.3% are males, as is the usual case in rural Spain.

The main pillars of the community economy have always been rain-fed agriculture, mainly cereals such as wheat; and sheep breeding. Traditionally, families lived on those products, however the Spanish Civil War (1936-1939) and particularly, the post-war period throughout the 40-year fascist regime, led to an impoverishment of the Spanish population that had a largest impact on the rural economy. Money was worth nothing (the new regime coined new coins and banknotes and therefore, the currency from the previous regime – the Republic – had no value whatsoever) so that investments in agriculture and farming were not possible anymore, and families had to live on household ration cards. The most direct consequence of this situation was a migration from the countryside to the largest urban areas (such as Barcelona, Madrid, or Valencia) in search of a better life through employment in the early stages of the infant industry in the country, that led to the abandonment of farming and the traditional way of life in the small rural communities; some of them completely disappeared after a few years. Fortunately, this hasn't been the case of Garray where a few inhabitants decided to remain and carry on with their lives. The fact that the village is located only 7

kilometres away from the main town of the province (Soria) surely was a key element in the struggle to survive of the community, although it can only be said for the last 30 years when there was a development of industry in the area.

2.2 Introducing the heritage site

The Celtiberians were Celtic-speaking people of the Iberian Peninsula in the final centuries BC, based in what is now north-central Spain. They resulted from marriage between Celts and Iberians after a period of continuous wars since their first warfare through the north of the Peninsula. They were divided into tribes, the most powerful one being the Arevaci, who are the ones that play an important role in the present case, since they dominated the most powerful stronghold in the area, i.e. Numantia. This settlement became a legend throughout history because of the Celtiberian Wars, and it still represents the triumph of value and perseverance for Spanish people: after 20 years of hostilities with Rome, Scipio Aemilianus Africanus laid siege to this settlement for 13 months, after which, and knowing they had been defeated, the Numantians decided to burn their own village and die free rather than stay alive and become slaves.

The archaeological site of Numantia is located on a hill in the municipality of Garray. It is a vast area of archaeological remains that still need much work to be done in order to excavate and bring to light the whole settlement. But for over 30 years, every summer Archaeology under-graduate students from the prestigious Complutense University in Madrid have been staying in Garray for months developing their field research on this site. This obviously helped people in the local community to know more – and admire – their own roots and history, apart from having the opportunity to mingle with people from the capital and become aware that these people were their equals (something which was never the case during the fascist regime, as villagers were always regarded as ignorant illiterate hillbillies). This undoubtedly planted the seed for the community development that was to come later on in time.

2.3 Impact of the Celtiberian heritage on the community

Culture provides all the resources for development but communities must be able to become aware of this. Those rural areas that are capable to emphasize the wealth and diversity of their cultural heritage may develop an economy that would guarantee employment and also, added value to the community itself. Likewise, the enhancement of the local cultural identity and the improvement in the quality of life strengthen the community's pride and sense of belonging, both of which should be regarded as vital to the survival and development of a rural community. In the case being described here, there was an evident cohesion in the population of the local community in question, i.e. Garray. A feeling of self-esteem as well as a pride for their own cultural roots soon spread over the villagers, which in turn led them to become creative and willing to take action concerning a number of activities related to the Numantia site and its history. Furthermore, there is a strongly-rooted feeling that this experience must be sustainable and transmitted across generations; and this is the reason why whole families participate in those activities, from new-born babies to their grandparents – or even great-grandparents, thus enhancing the creation of a stronger bond among the rural community members.

Besides, the impact on economic development is outstanding. In 2015, over 33,000 tourists (all of them nationals) visited the archaeological site, a large number of visitors considering the size of the village and its population. This is in line with the gradual increase in the number of tourists and consequently, with the rise in the number of enterprises that have been

set up throughout the 15 years that the cultural heritage endeavours have been carried out, as can be seen in the following figures:

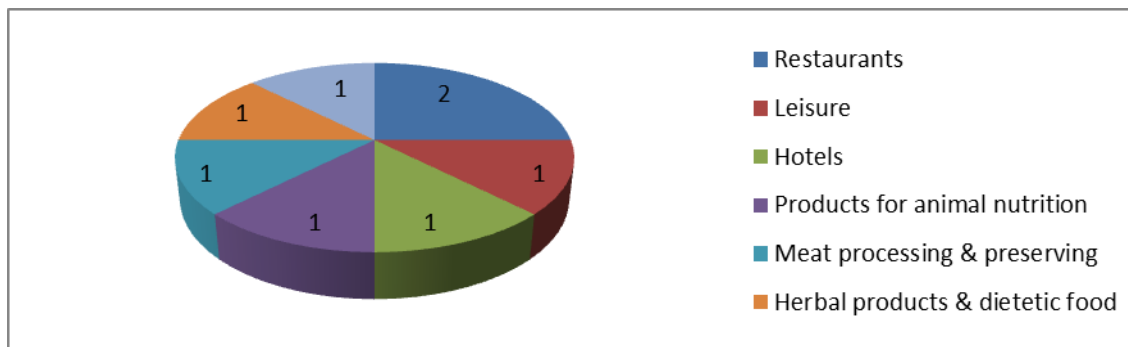


Figure 1 Number of enterprises before the year 2000

Although the above numbers may resemble too small, one cannot ignore the size of the village and its inhabitants. The most important companies deal with food and nutrition and have been in operation for over 35 years, which is only natural as the pillar of the economy had always been agriculture and livestock. However, there is a spectacular shift towards the creation of new small businesses from the year 2000:

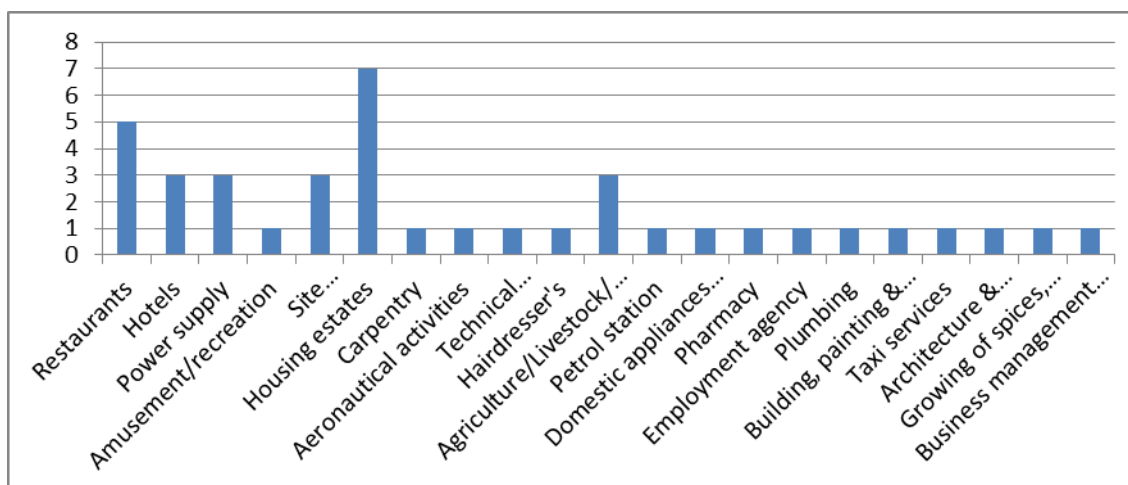


Figure 2 Number of enterprises after the year 2000

It is worth noting that altogether there are four new companies focusing on various aspects of the archaeological site, from amusement and recreation activities, particularly for children, to the marketing and advertising of the historical recreations; and also, a focus on social, economic, environmental, and ethnographic development as well as the conservation of the cultural heritage itself. Likewise, there are four new businesses related to agriculture & livestock but, differing from the past, these are now owned by young local people who finished their university studies and decided to come back to their roots and stamp a seal of technical innovation to these ancestral occupations. Furthermore, it is noteworthy the number of estate agents to cater particularly for those tourists who want to rent some rural accommodation for their holidays and also, the rise in service businesses that have been created to meet the needs of the visitors to the village.

Such a success always results in contributions from both public and private bodies and in this sense, the regional government has recently provisioned an important sum of money to the improvement of the archaeological site itself: new toilets for visitors; adapting the site to

make it more accessible for the physical disabled; and a new electric installation, lighting and sign-posting in order to better inform the visitor. Therefore, higher added value has been attached to the community again.

Besides, there was a clear growth in the community's demography as a direct consequence of the increase in the number of visitors to the village. This is due to their significant expenditure in the various businesses that started up in the wake of this new development which therefore, opened new chances to the villagers. This evolution can be seen in figure 3 where an analysis of the population census is made from the year 2000 up to 2016 (data has always been collected on January 1st of every year).

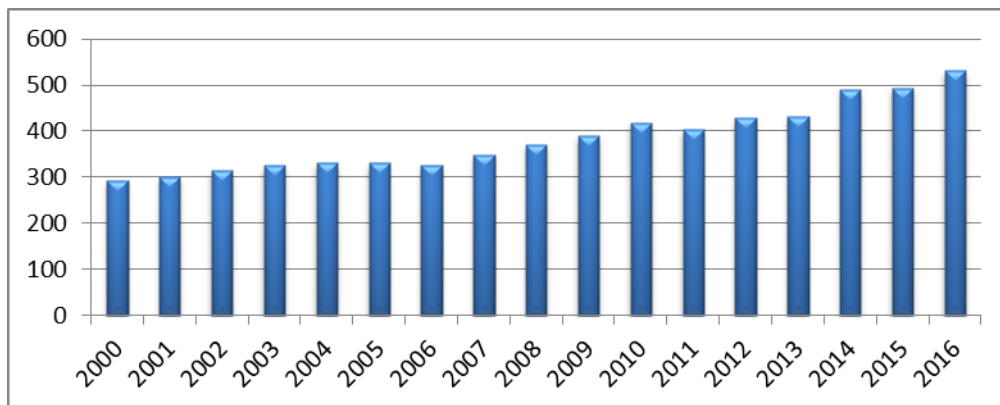


Figure 3 Population evolution, 2000-2016

It is worth noting that since 2000 the village's population has almost doubled, which is in accordance with the above considerations.

Finally, but most importantly, there is no doubt the villagers' altruistic contribution, vigour and willingness have made this tourist – and hence, economic – development a reality. As Obonyo & Fawaya (2012) claim, when local communities focus on their cultural heritage products, many rural issues such as service delivery, education and training, planning, or management may be supported. However, without a full participation of all the tourism stakeholders, it is not feasible to ensure that the products on offer are unique from other tourism products that may be found in the rest of the country. In the case of Garray, this was also crucial to the implementation of the various activities related to the archaeological site and thus, firstly, both the local town hall and the regional government offered their support and funds to develop a number of initiatives; and secondly, the business community in the region also granted some support and funds in the form of sponsorships. Thanks to their involvement, both the archaeological site and the village itself are being enhanced and renovated – which increases the attractiveness of the area – and also, special events and festivals related to the Celtiberian culture have been developed. It is worth noting here that what really matters to the local community is product quality and not product variety. They believe this is a crucial factor for maximizing the tourist's experience and consequently, for the sustainability of the events and businesses all year round. By focusing on authenticity and quality of the product, the community can establish itself as a unique tourist destination. Moreover, this can also lead to avoiding seasonality.

As rural tourism is a way of making the rural community participate in enterprises that require a local ownership, and even the management of tourism facilities (Viljoen & Tlabela, 2007), a non-for-profit association was founded by the villagers in 2003 aiming to promote the Celtiberian heritage and the local community itself. This initiative has meant the recovery and

culmination of the Celtiberian heritage that had been somewhat consigned to oblivion due to a number of social, economic, and political factors.

2.4 Outcomes of the community initiative

As mentioned above, a foremost outcome has been the increase in the number of SMEs in the village and surrounding area which consequently, has led to a reduction of the unemployment rates in this particular rural environment. Therefore, by having their lifestyle secured, villagers could happily turn towards the collaboration in all the actions brought about by their cultural association. They have not only brought to life an important episode of their own history but have also contributed to the development of the state of affairs concerning the cultural heritage itself by creating a Scientific Committee within the association whose role it is:

- a. To develop further the research on the Celtiberian history in the site itself. Experts on the subject as well as archaeology students from prestigious universities in Spain and abroad participate every year in the scientific study programmes that are carried out in the site of Numantia.
- b. To participate in workshops, conferences and the like so as to make people aware of the Celtiberian heritage. And as a result, the aim to draw potential tourists' attention towards the local community is also achieved.
- c. To exploit the traditional craft and artistic skills of the Celtiberians. Since these products are a symbol of the local culture, they have a large added value. Moreover, through this kind of initiatives they are recovered from a very likely abandonment, as is the tendency on many occasions in rural areas, unfortunately.
- d. To programme courses for both adults and particularly, children on the various issues concerning the Celtiberian culture, such as customs, garments, religion, art, among others. Likewise, the association visits schools in order to teach children their own heritage. All the courses are open and free for any person interested in this cultural heritage.
- e. To ensure the different activities carried out by the association are scientifically accurate. As far as cultural heritage tourism is concerned, tourists want to experience other cultures and learn about the past but it is fundamental not to forget that they are not necessarily specialists in the subject and consequently, they should be presented with an experience they are eager to enjoy in depth. Bearing this in mind, the association has developed a number of actions throughout the years:
 - Exhibitions in the village on the ancient Celtiberian and Roman daily lives.
 - Gastronomic days on the specific Celtiberian cuisine.
 - Participation in both national and international tourism fairs.
 - Collaboration with other Celtiberian/Iberian and Roman associations in their activities throughout the country.
 - The opening of a heritage and interpretative centre in the village. The old school building that hadn't been in use for years was renovated and turned into an interactive space where visitors can have their first experience on the Numantian

history before walking up the hill towards the site, and which has also become a valuable tourist centre for promoting the whole region.

- An annual performance outdoors by the Celtiberian remains. This performance has been done since 1999 when some of the villagers decided to take the risk and invited everyone in the region to attend. As it was a tremendous success, all the war episodes between the Numantians and the Romans have been staged since then once a year (end of July or beginning of August). At first, seats were arranged by one of the walls in the actual site. However, due to the increasing numbers of people attending these performances and consequently, the risk to damage the archaeological site, the association decided to build an open-air theatre just a few metres from the site but still on the very hill where Numantia was built. This way the public can still feel they are experiencing the historic episode in the actual historic place and too, the village has its own cultural venue.
- f. To work on the possibility to turn this important part of the Spanish cultural heritage into a film. Both a Hollywood and a Spanish film producer have shown an interest to put on film the history of Numantia.

These are only some examples of the actions carried out by the members of the association, i.e. by the local community villagers. By implementing all these cultural events – which are entirely free for the visitors, except for the visit to the archaeological site –, the whole population has become involved in the process of the local development. Furthermore, by combining those cultural programmes with gastronomic events, they have clearly aimed to increase the village's appeal and as a result, to encourage prolonged stays, thus contributing to the economy of the small rural hotels and restaurants scattered throughout the village. It is not surprising then that last year the association signed an agreement with the village's town hall and the regional government by which the association is responsible for the management of the guided tours in Numantia, returning the profits directly towards the enhancement of the archaeological site itself. Undoubtedly, it is a great recognition towards the local community's effort and stamina to go ahead.

3. Conclusions

In deprived rural areas that have the privilege of belonging to a rich cultural heritage, it is necessary to go for the encouragement of imagination and innovation and thus, creativity. The relics have always been there but in order to achieve a benefit from them, it is only the human factor that counts.

Surely, the human factor is not enough if all the stakeholders are not involved. In the case presented here, the active involvement of public bodies (the local town hall and the regional government), together with the regional business network, brought about an added value to this initiative and contributed to its success in terms of visitors to the site and economic development of the village.

However, the greatest success can be observed in the local community itself through:

- a. the creation of a spirit of cooperation and common goals within the community
- b. a re-invention of the sense of community
- c. an engagement of small enterprises in the tourist development

- d. the fact that more income has stayed locally by means of accommodation and restaurants; and also, by the fostering of crafts related to the ancient traditions of the Celtiberian heritage as well as of local products from agriculture and livestock.

However, it cannot be overlooked that this kind of initiatives involves the significant risk of on the one hand, overcrowding the experience with high numbers of tourists since this experience may turn into a nightmare and so, achieve the opposite effect to tourist attraction; and on the other, the relics, the sites, etc., may become the victims of their own success because serious damage can be inflicted on the remains which consequently, may endanger the cultural heritage of the community. Once again, this would derive in a decrease in the number of potential tourists already in the short term. Therefore, preservation is a must and this is particularly the main objective of the cultural Association that was created by the members of the small village regarding the Numantia archaeological site.

The fact that this community has managed to succeed is precisely due to their concern on the protection of their cultural heritage both tangibly (i.e. the remains themselves) and intangibly (i.e. the value of their historic past and roots). Not surprisingly, their effort has been rewarded both by the public, through the increase in the number of visitors; by the stakeholders, who believed in the community's initiative and supported them; and other organizations such as, TripAdvisor that has awarded the site of Numantia a Certificate of Excellence.

But surely the most important issue is that all of this simply started thanks to a very small group of villagers who had a vision and the courage to develop it much further.

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Virtualna stvarnost u marketingu

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Sažetak: Virtualna stvarnost (VR) posebno je okruženje koje simulira fizičku prisutnost u mjestima u stvarnom ili zamišljenom svijetu na računalu. VR tehnologija se prije svega počela primjenjivati na području kulturne baštine i arheologije, a danas se njezina primjena proširila na skoro sva područja, od znanstvene fantastike, likovne umjetnosti, video igrice, glazbe, zdravstva, sportskih treninga i obrazovanja, a posebno marketinga na što ćemo i staviti naglasak u ovome radu. Već je razvojem prvih računala čovjek pokušavao stvoriti virtualnu sliku svijeta koju bi na jednak način, kao i stvarni svijet, mogao doživjeti svim svojim osjetilima i u kojem bi mogao svojom virtualnom prisutnošću sudjelovati u procesima koji ga mijenjaju i oblikuju. Uređaji koji se koriste za virtualnu stvarnost su između ostalih uređaji za percepciju, tzv. izlazni, jer im računalo šalje generirane informacije o slici, zvuku, sili, mirisu, temperaturi te svemu onome što čovjek u stvarnom svijetu percipira, a sama svrha tih uređaja je pretvoriti dobivene informacije u oblik koji je prilagođen ljudskim osjetilima. Uređaji za interakciju ili ulazni uređaji, šalju računalu pretvorene informacije o ljudskim pokretima, ljudskom govoru, pulsu i slično. Svi se uređaji nastoje što bolje objediniti u jedan virtualni sustav kako bi čovjek što potpunije percipirao i ostvario interakciju sa stvarima u virtualnom svijetu. Ciljevi autora rada bili su, između ostalog, naglasiti da se virtualna stvarnost, koja će svoj boom tek doživjeti do kraja ove 2016. godine, može i mora koristiti kao jedan od najmoćnijih marketinških alata u budućnosti koja dolazi nikad brže.

Ključne riječi: *virtualna stvarnost, digitalni marketing, tehnološka podrška, VR marketinške kampanje*

1. Uvod

Virtualna stvarnost (eng. Virtual Reality) računalno je simulirano okruženje koje može simulirati fizičku prisutnost u mjestima u stvarnom svijetu ili u zamišljenim svjetovima. Virtualna stvarnost stvara trodimenzionalnu sliku koja okružuje korisnika i time mu daje potpuni doživljaj nekog mjesta ili situacije. Ona je oblik računalne simulacije u kojoj se korisnik osjeća kao da se nalazi u umjetnom okruženju. Tako primjerice korisnik može gledati kroz dva malena monitora (po jedan za svako oko). Senzori tada detektiraju kretanje glave ili položaj tijela, što za posljedicu ima promjenu virtualnog promatranja položaja. Korisnik može unositi podatke rukavicama (*datagloves*). Te rukavice su opremljene senzorima koji omogućuju korisniku podići ili pomaknuti virtualni objekti u simuliranoj okolini. Vide

virtualni svijet i dijelove svojeg tijela (ruke, tijelo, i sl.) kao dio virtualnog svijeta pomoću elektroničke opreme (rukavice, kaciga, odjeća, i drugo).

Ugledna kompanija Deloitte predviđa da će virtualna stvarnost u 2016. godini zaraditi svojih prvih milijardu dolara, od čega oko 700 milijuna dolara od prodaje hardverske opreme, a ostatak od prodaje nehardverskog sadržaja. Petnaesto izdanje *Predviđanja u sektoru tehnologije, medija i telekomunikacija* procjenjuje prodaju oko 2,5 milijuna primjeraka VR headsetova te igara u 10 milijuna primjeraka. Uz to, očekuje se da će na virtualnu stvarnost najviše novca utrošiti glavni korisnici, a ne povremeni igrači. To znači da će segment virtualne stvarnosti, premda će se svatko tko ima pametni telefon okušati u nekoj od inačica virtualne stvarnosti, većinu svojih prihoda u 2016. godini najvjerojatnije ostvariti od desetaka milijuna, a ne milijardi korisnika.¹

Virtualna stvarnost u posljednje je vrijeme glavna tema u javnosti i medijima, što i ne čudi, s obzirom na to da tehnologija koja se nekad viđala uglavnom u SF filmovima polako, ali sigurno postaje dio naše svakodnevice (Jelaska, D, Lovrić, I. i Jukić, I., 2014). Zato su zaslužne kompanije poput Facebooka, Oculus, Samsunga ili HTC-a koje ulažu sve napore da populariziraju i komercijaliziraju tehnologije virtualne stvarnosti. Međutim, ideja virtualne stvarnosti i nije toliko nova jer se na raznim konceptima i prototipovima počelo raditi i prije nego što su računala postala dio svakoga doma. U nastavku teksta autori rada opisuju nastanak pojma i primjenu virtualne stvarnosti.

2. Povijest virtualne stvarnosti

Kako bi se pobliže pojasnila virtualna stvarnost i njen utjecaj na stvarni svijet, u nastavku su nabrojani najvažniji događaji koji su prethodili virtualnoj stvarnosti kakvu danas poznajemo:

- Godine 1935. pisac SF-a Stanley G. Weinbaum objavljuje kratku priču *Pygmalion's Spectacles* u kojoj razvija ideju virtualne stvarnosti kojoj se pristupa korištenjem posebnih naočala.
- Godine 1957. filmaš i inovator Morton Hellig razvija Sensoramu, tada iznimno napredan simulator 3D slika, zvuka i mirisa.
- Godine 1961. kompanija Philco Corp. predstavlja projekt *Headsight* – kacigu s ugrađenim ekranom i sustavom praćenja pokreta, namijenjenu za vojne treninge.
- Godine 1968. računalni stručnjaci Ivan Sutherland i Bob Sproull stvaraju “Damoklov mač” – naglavni uređaj za virtualnu stvarnost spojen na računalo. Naravno, uređaj je u ono vrijeme mogao prikazivati tek jednostavnu računalnu grafiku.
- Godine 1978. znanstvenici s MIT-a razvijaju interaktivnu mapu grada Aspena, pod nazivom *Aspen Movie Map*. Riječ je o svojevrsnoj preteči Google Street Viewa.
- Godine 1982. virtualna stvarnost postaje tema zanimljiva i Hollywoodu, a rezultat je visokobudžetni uradak *Tron* koji se pamti po pionirskoj upotrebi 3D računalne animacije.
- Godine 1984. William Gibson objavljuje roman *Neuromancer*, čija se radnja velikim dijelom odvija u *cyberspaceu*, odnosno računalno kreiranoj stvarnosti. Zahvaljujući Gibsonu i ostalim žanrovskim piscima, cyberpunk estetika postaje jedno od obilježja kulture osamdesetih i ranih devedesetih.
- Godine 1987. pojam “virtualna stvarnost” ulazi u svakodnevnu upotrebu, a njegov nastanak pripisuje se računalnom znanstveniku, piscu i umjetniku Jaronu Lanieru (neki izvori pak tvrde kako je samo popularizirao već postojeći naziv).

¹ Podaci preuzeti s internetske stranice kompanije Deloitte: <http://www2.deloitte.com/hr/hr/pages/press/articles/tmt-prediction-2016.html> (03/2016)

- Godine 1991. Kompanija Virtuality Group lansirala nekoliko videoigara koje su se mogle igrati uz pomoć posebnih naočala i povezanih kontrolera.
- Godine 1993. Sega predstavlja svoje naočale za virtualnu stvarnost, međutim, sve je ostalo u fazi prototipa.
- Godine 1995. Nintendo lansirala 3D igrači sustav Virtual Boy koji ubrzo doživljava komercijalnu propast na tržištu.
- Godine 1999. SF film Matrix veliko je iznenađenje u svjetskim kinima, a zahvaljujući njemu koncept virtualne stvarnosti postaje neizostavan dio masovne pop-kulture.
- Godine 2011. Google razvija prototip svojih naočala za proširenu stvarnost – Google Glass.²
- Godine 2012. Startup Oculus VR razvija sustav i naočale za virtualnu stvarnost Oculus Rift te pokreće Kickstarter kampanju za financiranje projekta.
- Godine 2014. Facebook kupuje Oculus VR za dvije milijarde dolara. Iste godine Google razvija jednostavno rješenje za virtualnu stvarnost – Cardboard. Riječ je o jeftinom kartonskom “headseatu” s lećama koji se u kombinaciji s pametnim telefonom i pripadajućom aplikacijom pretvara u naočale za virtualnu stvarnost.
- Godine 2015. u suradnji s Oculusom, Samsung razvija uređaj za virtualnu stvarnost Gear VR, kompatibilan sa Samsungovim pametnim telefonima. Istodobno, konkurentski HTC predstavlja svoj virtualni sustav HTC Vive.
- Godine 2016. Samsung na Mobile World Congressu u Barceloni predstavlja nove modele svojih mobitela (Galaxy S7) i najavljuje kako će uz prednarudžbe darivati Gear VR uređaje. U Barceloni se neočekivano pojavljuje i vlasnik Facebooka Mark Zuckerberg koji u svome govoru najavljuje svijetlu budućnost virtualne stvarnosti.³

3. Tehnološka podrška virtualnoj stvarnosti

Najčešće krajnji korisnici nisu ni svjesni koliko je tehnološka podrška značajna kao podloga za razvoj virtualne stvarnosti jer oni u konačnici uživaju isključivo u krajnjem sadržaju. U ovom dijelu rada navest će se određena tehnološka rješenja, nužna za postizanje virtualne stvarnosti. Kako bi korisnici doživjeli virtualnu stvarnost za početak su vam dovoljne naočale namijenjene generiranju virtualne stvarnosti i slušalice kako bi se što bolje doživjela određena simulacija. Tehnologija se razvija pa se tako za još bolji doživljaj mogu koristiti rukavice ili čak cijela odijela.⁴

Ulazni uređaji:

- senzori pozicije/orijentacije (engl. *tracker*) - elektromagnetski, akustički, optički, mehanički, inercijski
- senzori sile/momenta sile - Spaceball i sl.
- senzori položaja tijela / ruke - DataGlove, BodySuit
- senzori pokreta - pokretna traka, bicikl ...
- ostalo - upravljanje putem disanja, slijeđenje lica, očiju.

Izlazni uređaji:

- vizualni izlazni uređaji - zaslon na glavi (HMD) - stereo ekrani - projekcijski sustavi
- zvuk
- haptički izlazni uređaji - taktilni izlazni uređaji - uređaji za povrat sile - pomične platforme
- ostalo < miris, vjetar, toplina.

² Primjer 3D modeliranja može se vidjeti na: <https://www.youtube.com/watch?v=e37Qmdcc-E> (prosinac, 2015.)

³ Preuzeto sa internetske stranice: <http://www.planb.hr/mali-vodic-kroz-povijest-virtualne-stvarnosti/> (veljača, 2016.)

U nastavku će se nabrojati nekoliko uređaja za virtualnu stvarnost koji su već na tržištu ili se tek trebaju pojaviti.

Oculus Rift trenutno je u Development Kit 2 fazi razvoja, s rezolucijom ekrana od 1920×1080 piksela (960×1080 po jednom oku) i brzinom osvježavanja od 90 Hz te senzorima za praćenje pokreta glave sa „6DOF“ (6 degrees of freedom) – detekcijom pokreta u svim smjerovima. Kako je u uređaju ekran koji se gleda na nekoliko centimetara razmaka od očiju, vrlo je bitno da je taj ekran visoke razlučivosti što pridonosi realnosti prikaza slike. Završna verzija za krajnje korisnike će tako imati još višu rezoluciju – 2160×1200 piksela (1080×1200 po svakom oku). Na računalo će se spajati preko DVI/HDMI i USB sučelja. Očekivani izlazak ovog uređaja na tržište je u prvom kvartalu 2016.⁵

HTC Vive: za razliku od Oculus Rifta ne koristi jedan ekran podijeljen na dva dijela, već dva zasebna ekrana rezolucije 1920×1080 piksela i brzinom osvježavanja od 90 Hz za svako oko. S razvojem su otišli korak dalje od Oculus Rifta te su razvili i dva uređaja za praćenje pokreta ruku koji se drže u šaci. Također dolazi sa dvije laserske bazne stanice koje postavljene na dva kraja sobe mogu prostorno pratiti pokrete osobe, u prostoru oko 20 metara kvadratnih. Ovaj uređaj ukupno koristi preko 70 senzora za praćenje pokreta.

Project Morpheus je Sonyjev VR headset. Moći će se koristiti isključivo s igračom konzolom PlayStation 4. Sonyjev Project Morpheus koristi ekran manje rezolucije od svojih konkurenata, 1920×1080 piksela (960×1080 po jednom oku), ali s brzinom osvježavanja od 120 Hz. Također će imati dva uređaja za praćenje pokreta ruku u kombinaciji s već dostupnim uređajem PS Eye, slično kao i HTC Vive. Planirani izlazak je u prvom kvartalu 2016. godine.

HoloLens - Microsoft je u siječnju predstavio HoloLens, impresivni uređaj virtualne stvarnosti. HoloLens izgleda puno elegantnije od Oculus Rifta. HoloLens bi u verziji za developere trebao doći na tržište u prvoj polovici 2016. godine.

Jump VR - Google je lansirao novu vrstu kamere za snimanje videa u virtualnoj stvarnosti. Jump uključuje 16 kamera poredanih u krug što omogućuje snimanje iz različitih perspektiva. Softver zatim pretvara snimke u 3D video.

Google Cardboard - Googleov kartonski uređaj za virtualnu stvarnost omogućuje svima da na jednostavan, zabavan i jeftin način iskuse virtualnu stvarnost.⁶

4. Marketinška primjena VR u praksi

Tehnologija virtualne stvarnosti se u svojim počecima primjenjivala na području baštine i arheologije, a danas se njezina primjena proširila na područja znanstvene fantastike, likovne umjetnosti, video igara, glazbenog svijeta, terapija, treninga, a i na područje obrazovanja.

Virtualna stvarnost otvara stručnjacima za marketing nova vrata za plasiranje sadržaja njihovim korisnicima. Izvrсна je platforma za kompanije u smislu prenošenja željenih poruka svojim ciljnim skupinama korisnika. Osim što će potrošačima pružiti jedinstveno iskustvo doživljaja proizvoda i usluga, virtualna stvarnost također ima velik potencijal u podršci i jačanju prodaje poduzeća. Slučaj je to, primjerice, kod prodaje turističkih aranžmana gdje, u usporedbi s brošurom ili web stranicom, potencijalnim korisnicima pruža znatno bolji doživljaj avanture u koju se upuštaju. Uz podršku prodaji, za virtualnu stvarnost navodi se

⁵ Primjer upotrebe Oculus Rift uređaja moguće je vidjeti na: <https://www.youtube.com/watch?v=JQvFidopZug> (veljača, 2016.)

⁶ Prvi pokušaj bile su Google naočale te se one i dalje razvijaju, a iz Google-a su se odlučili na suradnju sa Luxxoticom, kompanijom koja stoji iza brandova Oakley i Ray Ban. Googleovo partnerstvo naziva se "strateškom suradnjom u dizajniranju, razvoju i distribuciji Glass naočala" te obećava kako će korisnicima ponuditi gadget koji će biti nešto između high-fashiona, lifestylea i inovativne tehnologije (Google+, 2014). S obzirom da Luxxotica posjeduje 5.000 vlastitih prodajnih mjesta i distribucijskih kanala širom svijeta, da se primijetiti namjera Googlea da se Google Glass ne prodaje samo u trgovinama s tehničkom robom, već i u dućanima koji drže naočale najpopularnijih brandova. To bi im trebalo predstavljati garanciju da pametne naočale neće kupovati samo „techno freakovi“ već da postanu prestižni modni detalj s dodatkom visoke tehnologije.

kako veoma velik potencijal ima i u edukaciji potrošača o proizvodu ili usluzi, prenošenju iskustva različitih događanja, maloprodaji, regrutaciji i zapošljavanju te istraživanju tržišta (Jelaska, D, Lovrić, I. i Jukić, I., 2014).

4.1. Marketinške kampanje uz pomoć virtualne stvarnosti

Marketinške kampanje uz pomoć virtualne stvarnosti koriste se u različitim industrijskim sektorima, ali svima je zajedničko da su stvorili uzbudljive načine na koji korisnici mogu komunicirati s omiljenim brendovima. VR pomaže u rješavanju niza problema koje marketinški stručnjaci imaju oko angažmana i svijesti iz sljedećih razloga:

Interaktivnost - korisnici koji nose slušalice su potpuno uronjeni u sadržaj, a to znači manje ometanja i više pažnje na poruke.

Dojmljivost - intenzitet iskustva VR-a je veći nego kod tradicionalnih medija, stvarajući snažne emocije u korisnicima koji su vezani na stvarne promjene u ponašanju.

Pamtljivost - naši mozgovi su izgrađeni tako da zapamte događaje povezane s mjestima, to znači da iskustvo VR-a ima dublji trag u sjećanju publike.

U nastavku, autori su odabrali neke od najupečatljivijih i najuspješnijih primjera virtualne stvarnosti u marketingu.⁷

Marriott – The Teleporter

Kompanije Framestore VR Studio i Relevant udružile su se s tvrtkom Marriott kako bi stvorili jedinstveno iskustvo teleportacija za široke mase. Framestore VR Studio napravio je "revolucionarno 4D turističko iskustvo za Hotele Marriott, koje vas prvo teleportira u hotel Marriott, a zatim na plažu na Havajima." Unutar konstrukcije koja sliči na telefonsku govornicu, koristi se Oculus Rift, grijači i mlaznice vjetra kako bi se korisnike povelu na izlet do Havaja i Londona. Iako to nije sasvim isto kao i zapravo biti tamo, moglo bi pomoći da se korisnici odluče o odabiru budućih putovanja. Također je pomoglo hotelima Marriott da se pozicioniraju kao relevantan brend na tržištu turističkih usluga.

Merrell - Trailscape

Ova kampanja je bila usmjerena na podršku lansiranju nove čizme za planinarenje - Capra. Merrell je stvorio VR iskustvo pod nazivom *Trailscape* koje vas vodi na opasno pješčenje planinama. Sudionici hodaju po pozornici koja je ucrtana na virtualnu mapu kako bi se stvorila nova razina interaktivnosti. Tehnologija *motioncapture* dozvoljava pustolovima istražiti planinu, s taktilnim elementima poput šetnje užetom i nestabilnim drvenim mostovima što čini ovu kampanju jednom od najvažnijih i najupečatljivijih VR iskustava do sada. Prikazana je prvi puta na Sundance Film Festivalu, 2015. godine, a zamisao je kompanije Merrell, agencije Hill Holliday i Framestore VR Studija.

Ujedno je i prva komercijalna upotreba "*walk around*" virtualne stvarnosti u kojoj korisnici istražuju virtualni svijet šetnjom.

Patron – The Art of Patron

Može se učiniti da kompanija koja se bavi proizvodnjom tekile i nije očigledan korisnik VR marketinške strategije, ali kompanija Patron koristi moć VR-a da ispriča zanimljivu priču oko svojih proizvoda. Koristeći mješavinu žive akcije i računalne grafike, stvorili su 3D iskustvo životnog ciklusa proizvoda, od polja agave, što je glavna sirovina za proizvodnju tekile, do posluživanja gotovog proizvoda na glamuroznoj zabavi. Cjelokupna produkcija trajala je šest mjeseci, a razvijena je od strane kreativne agencije Firstborn, postprodukcije agencije Legend i agencije za dizajn zvuka Antfood. Kad Patron radi događaje, donose virtualnu stvarnost te pokazuju publici čitav proces proizvodnje i distribucije. U kampanji korišten je binauralni (3D) zvuk te po mjeri napravljen dron s pripadajućom GoPro kamerom.

⁷ Preuzeto s internetske stranice: <http://www.mbryonic.com/best-vr/> (veljača, 2016.)

Volvo – XC90 TestDrive

Test vožnja automobilom uz pomoć virtualne stvarnosti itekako ima smisla ako nemate distributera automobila u neposrednoj blizini. Sjajno je vidjeti da je Volvo napravio aplikaciju za podršku lansiranju svojeg modela automobila XC90 SUV. VR vas stavlja u kokpit automobila i vodi vas na idiličnu vožnju kroz zemlju. Iako je većina korisnika primijetila da je iskustvo malčice nestvarno i netočno, svi su bili oduševljeni idejom. Ova kampanja je također odrađena od strane Framestore VR Studija.

Immersive VR – Apollo 11 Mission

Apollo 11 je kulna svemirska misija iz 1969. godine, kada je prvi čovjek stupio nogom na Mjesec. Kompanija Immersive VR Education odlučila je educirati entuzijaste te ponovno stvoriti taj događaj u virtualnoj stvarnosti pod istim imenom. Korisnici su mogli osjetiti kako je to biti astronaut.⁸

Sir Paul McCartney – LiveConcert

Kompanija Jaunt producirala je video zapis, posebnom 360 tehnologijom, koncerta Sir Paul McCartneyja u Candlestick parku. Aplikacija se može preuzeti na iOS ili Androidu te doživjeti događaj. Ova aplikacija instalirana je na više od 500.000 mobilnih uređaja.

TopShop – Catwalk Experience

Ovaj primjer kampanje je malo stariji, ali je toliko bio uspješan da ga se mora spomenuti u ovom radu. TopShop ponudio je javnosti jedinstveni pogled na prednji red njihove ekskluzivne modne piste tijekom London Fashion Weeka pomoću panoramskog video streama s 360 tehnologijom. Sretni dobitnici su doživjeli ovo iskustvo u posebnom pop-up prostoru u najvećoj i najpoznatijoj trgovini kompanije TopShop u Londonu. Kao bonus, korisnik može pronaći dodatne scene snimki iz backstagea te tako doživjeti potpuno iskustvo ovog modnog događaja. Ovo iskustvo stvoreno je od strane London VR studija Initium. Ova kampanja osvojila je nagradu za projekt godine na BT Retail Week Technology Awards 2014. godine te također Najbolji Hybrid Event/Najbolji virtualni događaj na Event Tech Awards 2014. godine.⁹

New York Times – Displaced

Jedan od socijalno osviještenih primjera marketinga i VR-a je onaj iz kampanje New York Timesa. Rat je raselio 30 milijuna djece iz njihovih domova. The New York Times ispričao je te tragične priče u upečatljivom dokumentarcu koji je dostupan za preuzimanje kao mobilna aplikacija te putem Google Cardboarda. Ovo nije bila tipična marketinška kampanja, ali je New York Times pomogao u distribuciji milijun besplatnih Google Cardboarda svojim čitateljima, a ta vijest bila je vijest mjeseca na skoro svim relevantnim portalima i medijima. Ovu kampanju i aplikaciju stvorio je Vrse.works studio te se smatra jednom od njihovih najvećih uspješnica.

5. Ostale primjene VR-a

Moguća područja primjene virtualne stvarnosti, osim kao marketinškog alata su:

- Proizvodnja i održavanje

Najvažniji primjer primjene virtualne stvarnosti u procesu proizvodnje jest da se vizualne instrukcije prikazuju direktno na opremi ili strojevima, te da operater ne mora proučavati upute jer ima sve potrebne informacije na pravom mjestu i pravo vrijeme. prikazuje motor s virtualnim oznakama dijelova. Kada korisnik obilazi motor oznake s nazivom tog dijela i osnovnom funkcijom pojavljuje na svim vidljivim dijelovima.¹⁰

⁸ Primjer ove kampanje se može pogledati na: <https://www.youtube.com/watch?v=nOHM8gnin8Y> (ožujak, 2016)

⁹ Primjer ove kampanje se može pogledati na: <https://www.youtube.com/watch?v=c8jSlq8Tqlc> (ožujak, 2016)

¹⁰ Podaci preuzeti s internetske stranice: <http://www.tportal.hr/gadgeteriya/tehnologija/376633/Virtualna-i-prosirena-stvarnost-vrijedit-ce-milijarde-dolara.html> (ožujak, 2016.)

- Zdravstvo

Virtualna stvarnost se već neko vrijeme koristi u raznim medicinskim terapijama. Psihijatri na Sveučilištu u Louisvilleu primjerice koriste VR u kognitivno-bihevioralnoj terapiji ponašanja kako bi liječili osobe koje pate od socijalne anksioznosti, straha od letenja, govora u javnosti ili visine. Kontrolirana okolina omogućava liječnicima da pacijente izlože simulacijama i nauče ih kako da se na pravi način nose sa svojim strahovima. Osim toga, medicinski časopis *Frontiers in Neuroscience* objavio je prošle godine studiju o korištenju virtualne stvarnosti u liječenju fantomske boli u nozi ili ruci kod ljudi koji su ostali bez jednog uda. Terapija se sastoji u korištenju senzora koji hvataju informacije iz živčanih stanica u mozgu, a pacijenti kontroliraju virtualni ud. Ako pacijent osjeća kao da mu netko steže šaku, dok gleda virtualnu šaku koju sam kontrolira uči kako opustiti svoju šaku.

Virtualna stvarnost se ostvaruje tako da se medicinske slike preklapaju s pacijentom, čime se dobiva vrsta virtualnog rendgena u stvarnom vremenu. Dobiva se takav efekt da liječnik vidi organe pacijenta kao da je tijelo prozirno. Najčešće se primjenjuje u kirurgiji, prilikom planiranja ili izvedbe zahvata. Budući da je za ostvarenje takvih primjena proširene stvarnosti potrebna izuzetna preciznost, one za sada još nisu u širokoj uporabi.

- Zabava

Zabava će vjerojatno biti jedan od prvih i najboljih primjera promjene koju će virtualna stvarnost donijeti. Primjerice aplikacija kao što je Oculus Cinema omogućava korisnicima gledanje filma koji je na raspolaganju samo njima. Ukoliko pak ne vole glasnu glazbu i bučnu publiku, osobe mogu pratiti koncert uz pomoć virtualne stvarnosti. Mogu primjerice slušati Eltona Johna i osjećati se kao da sjede pored njegova klavira ili zvučnika dok on izvodi "*Candle in the wind*" u svojoj VR aplikaciji.

- Automobilska industrija

Kompanija Ford već koristi virtualnu stvarnost u svom laboratoriju za uživanje kako bi pružila osjećaj koji ima kupac u svom novom automobilu. Pritom koristi uređaj *Oculus Rift* kako bi osobi omogućila pogled na interijer i eksterijer automobila. Također je razvila alate koji će biti korišteni u VR iskustvu razgledavanja automobila u mraku. To je vrlo korisno jer Ford može brže raditi na razvoju proizvoda bez čekanja na fizički prototip novog modela. I Audi će koristiti virtualnu stvarnost kako bi potencijalnim kupcima automobila pružio dubinski pogled na automobile.

Toyota je koristila virtualnu stvarnost u sklopu svoje kampanje *TeenDrive365* kako bi educirala tinejdžere i roditelje o dekoncentraciji u vožnji. Simulator dekoncentracije u vožnji uključuje senzore koji prevode ono što korisnik čini s pedalama ili volanom u simulaciju te uključuje odvlačenje pažnje poput zvonjave mobitela i brbljavih prijatelja na stražnjem sjedalu.

- Obrazovanje

U učenju se uvelike može koristiti VR - postoji potencijal za obuku gotovo svih stručnjaka - od mehaničara do kirurga. Za mlade učenike virtualna stvarnost u učionici može podrazumijevati virtualne izlete, igre u koje je potrebno udubiti se, a VR iskustva mogu biti korisna čak i djeci s posebnim potrebama uz pomoć kojih im je učenje maksimalno prilagođeno.

- Turizam

Kompanija Destination British Columbia lansirala je VR iskustvo pod nazivom *The Wild Within*, koje nudi dvije opcije - vožnju brodicom i planinarenje tom kanadskom pokrajinom. U promocijskom videu za aplikaciju, menadžer za marketinški razvoj turističke tvrtke Destination British Columbia tvrdi da ona pomaže putniku koji razmišlja o posjetu toj destinaciji.

- Vojska i policija

Nedavno je britanska vlada objavila da će koristiti *Oculus Rift* u obuci medicinskog osoblja za liječenje ozljeda zadobivenih u bitkama. Druga vojna korištenja VR-a predstavljaju simulacije koje uče pripadnike vojske ponašanju s eksplozivnim napravama - a simulacije poput tih mogu biti ponovljene - iz grešaka se ovdje može učiti.

6. Zaključak

Virtualna stvarnost nesumnjivo je budućnost marketinga, no unatoč velikom porastu oglašavanja na internetu i mobilnim uređajima, kao i tvrdnjama o umiranju tiskanih uređaja i klasične televizije, prema većini istraživanja upravo su potonji mediji na kojima se još uvijek najviše troši na oglašavanje. Virtualna stvarnost bi mogla, predviđaju vodeći japanski znanstvenici, postati najjači medij koje je čovječanstvo ikada imalo na raspolaganju.

Potaknuti futurističkim vizijama i znanstvenom fantastikom, tehnološke kompanije ulažu milijune dolara na razvoj sustava virtualne stvarnosti, a prema predviđanjima analitičara iz Goldman Sachsa, ova bi industrija do 2025. godine mogla biti teška čak 80 milijardi dolara.

Sustav virtualne stvarnosti za sada se primjenjuje u zabavnoj industriji i *gameingu*, ali od njega bi vrlo skoro mogli profitirati i dizajneri interijera, automobilska industrija i ostali ponuđači proizvoda i usluga.

No također ne smijemo zanemariti i moguće negativne učinke. Došlo je do zabrinutosti zbog moguće povezanosti virtualne stvarnosti i desenzibilizacije. Misli se na to da na osobu više ne utječu ekstremni vidovi ponašanja kao što je npr. nasilje te da osoba ne pokazuje znakove empatije ili sućuti kao rezultat prevelike izloženosti virtualnoj stvarnosti. Ovo se najviše primijetilo na igračima video igrica, a posebno na onima koji igraju tzv. pucačine iz prvog lica (*first person shooter*) koje zahtijevaju visok stupanj "uranjanja" u virtualni svijet. Stručnjaci su također zabrinuti i zbog još jedne bihevioralne pojave tzv. "cyber ovisnosti". Postoje ljudi koji su postali ovisni o virtualnoj stvarnosti, a kao posljedica toga, počinju brisati granicu između stvarnog i virtualnog života. Provedu ogromne količine vremena u virtualnom okruženju, a što ima štetan učinak na njihov život u stvarnom svijetu.

Gore opisani nedostaci virtualne stvarnosti minorni su u odnosu na prednosti virtualne stvarnosti kao cjeline, ali je također jako važno da se o ovim problemima piše i razmišlja.

Zamislite samo kada bi mogli uskočiti u hologramski dnevni boravak ili prošetati svojom novom kućom i prije nego je izgrađena. Zvuči jako zanimljivo, a u doglednoj budućnosti i ostvarivo. Budućnost nikada nije bila bliže.

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Virtual reality in marketing

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Abstract. Virtual reality (VR) is a special environment that uses a computer to give a user the experience of being physically present in real or imaginary places. VR technology was first used in the field of cultural heritage and archaeology, and today its application has spread to almost all areas, from science fiction, art, video games, music, health, to sports training and education, and in particular marketing - which is the focus of this paper. Ever since the development of the first computer, people were trying to create a virtual image of the world which would be similar to the real world, an experience for all of a user's senses, a place where the user's virtual presence can participate in the processes that alter it and shape it. Devices that are used for virtual reality (e.g. perception devices) are also called output devices because the computer relays the generated image information, sounds, force, smell, temperature, and everything that a person in the real world is perceiving, and the very purpose of these devices is to convert the information into a form that is adapted to human senses. Interaction or input devices send information to the computer about human movements, human speech, the pulse, etc. There have been attempts at consolidating all these devices into a single virtual system so that the consumer can fully perceive and interact with things in the virtual world. The primary objective of the authors of this paper was to emphasize that virtual reality, whose boom is expected in 2016, can be used as one of the most powerful marketing tools in the future - that is coming faster than ever.

Key Words: *virtual reality, digital marketing, technological support, VR marketing campaigns*

Zaštita turističkih potrošača u Europskoj uniji i Hrvatskoj

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Sažetak. Obilježja turističkog tržišta i promjene u preferencijama turističkih potrošača, učinile su turistički aranžman dominantnim proizvodom suvremenog turističkog tržišta. Turistički aranžman sastoji se od niza dobara i usluga različitih ponuđača koje vremenski, prostorno i sadržajno moraju biti usklađene. Ulogu posredovanja između velikog broja ponuđača turističkih proizvoda i usluga koje su sastavni dio turističkog aranžmana te prostorno udaljenih turističkih potrošača preuzimaju organizatori putovanja. Upravo organizatori putovanja kreiraju različite suvremene turističke proizvode koje od njih kupuju turistički potrošači. Organizatori putovanja izravno odgovaraju za izvođenje, ali i garantiranu kvalitetu usluga turističkog aranžmana. Međutim, činjenica da turistički potrošači u okviru jedinstvenog turističkog aranžmana konzumiraju različita dobra i usluge koje ne isporučuju sami organizatori putovanja, otvara pitanje preuzimanja odgovornosti te naglašava potrebu adekvatne zaštite potrošača na turističkom tržištu. S druge strane, budući da se u okviru istog turističkog aranžmana usluge mogu konzumirati u više destinacija različitih zemalja, stvara se potreba usklađenosti nacionalnih okvira zaštite turističkih potrošača. Cilj ovoga rada je objasniti okolnosti koje su dovele do potrebe uvođenja jedinstvenih odredbi zaštite turističkih potrošača u Europskoj uniji. Usporedbom odredbi iz područja zaštite turističkih potrošača na razini Europske unije s onima koje su u nadležnosti pojedinih zemalja članica, istaknut će se potreba usklađenosti pojedinih propisa, ali i prezentirati, na primjeru Hrvatske, konkretna rješenja primjene odredbi europskih direktiva u nacionalnom zakonodavstvu zemalja članica u području zaštite turističkih potrošača.

Key words: *turistički aranžman, organizator turističkih putovanja, zaštita turističkih potrošača*

1. Uvod

Uloga posrednika na turističkom tržištu značajna je od razdoblja kada se turizam počinje razvijati kao masovna pojava, a u uvjetima kada turizam postaje globalni fenomen, uloga posrednika na turističkom tržištu postaje nezamjenjiva.

Specifičnost turističkog tržišta proizlazi iz obilježja turističke ponude i turističke potražnje, te njihovog međusobnog odnosa. Obilježja turističke ponude, s jedne strane, te turističke potražnje, s druge strane, dovode do potrebe stvaranja posebnog gospodarskog subjekta koji će tvoriti vezu između ova dva pola turističkog tržišta.

Jedno od najznačajnijih obilježja turističke potražnje u uvjetima razvoja turizma kao globalne pojave je fizička pokretljivost turističke potražnje. Naime, osuvremenjivanje prometne infrastrukture i razvoj prometnih sredstava učinio je daleke destinacije fizički dostupnijima unatoč tome što se razlike u kulturi, običajima, komunikaciji nisu smanjivale. S druge strane vremenska koncentriranost turističke potražnje na određeno razdoblje godine, što je jedno od

najuočljivijih obilježja turističke potražnje koje literatura poznaje pod nazivom sezonalnost, uvjetuje potrebu za određenom vrstom regulacije koja će svojim mehanizmima nastojati smanjiti pritisak na špicu sezone te ravnomjernije rasporediti turističku potražnju, u cilju smanjenja negativnih implikacija sezonalnosti. Budući da turističku potražnju sačinjavaju brojni subjekti koji su međusobno vrlo različiti s aspekta svojih turističkih motiva i preferencija, te mogu biti fizički vrlo udaljeni od subjekata turističke ponude, nužno trebaju posrednika koji će im pomoći pronaći one ponuditelje koji na najbolji mogući način mogu zadovoljiti njihove potrebe. S druge strane, turistička ponuda često je sastavljena od velikog broja malih gospodarskih subjekata, fizički vrlo udaljenih od turističke potražnje, koji ne raspolazu potrebnim znanjima o načinu funkcioniranja tržišta i tržišnom natjecanju. Njihovi kapaciteti vezani su za mjesto nastanka, ne mogu se fizički približavati turističkoj potražnji, a ne mogu joj se ni na druge načine u kratkom roku prilagoditi.

Iz ovakvih obilježja sudionika turističkog tržišta javlja se potreba za gospodarskim subjektom koji će povezati sudionike turističke ponude i turističke potražnje, a tu ulogu na turističkom tržištu na sebe preuzimaju posrednici. Posrednici na turističkom tržištu povezujući ponudu i potražnju uklanjaju njihove međusobne prepreke u komunikaciji, premošćuju razlike u kulturi, okupljaju i okrupnjuju heterogenu skupinu turističkih potrošača usmjeravajući je prema turističkoj ponudi od koje na sebe preuzimaju dio aktivnosti iz domene tržišnog poslovanja. Među posrednicima na turističkom tržištu posebno se ističu turističke agencije i turoperatori.

Specifičnost zaštite turističkih potrošača proizlazi iz specifičnosti turizma kao pojave, karakteristika turističkog tržišta, odnosno specifičnosti turističke ponude i potražnje.

Iako su prednosti korištenja usluga tržišnih posrednika na turističkom tržištu brojne, da bi se mogle razumjeti potencijalne opasnosti za turističke potrošače koje proizlaze iz trojnog odnosa na turističkom tržištu te potreba i značaj zaštite potrošača na turističkom tržištu, potrebno je objasniti obilježja samog turističkog proizvoda.

2. Turistički aranžman i rizik koji sa sobom nosi

Iako se uobičajeno navodi da je turistički (paket) aranžman najznačajniji proizvod turoperatora, promjena trendova turističke potražnje i ponude te dinamičko okruženje koje vlada na turističkom tržištu doveli su do toga da se opstanak i razvoj turističkih agencija veže uz napuštanje klasičnih poslova posredništva u prodaji pojedinačnih usluga subjekata turističke ponude te promjenu poslovnog usmjerenja prema stvaranju i plasmanu vlastitih turističkih proizvoda, turističkih aranžmana.

Turistički aranžman sastoji se od dvije usluge ili više njih, koje su u vremenu i po sadržaju sinkronizirane, a nude se potencijalnom turistu bilo po vlastitoj odluci agencije, bilo na traženje klijenta, kojima turist zadovoljava u potpunosti ili djelomično svoju turističku potrebu (Vukonić, 2003.). Zakon o pružanju usluga u turizmu (čl. 5.) definira paket aranžman (paušalno putovanje) kao unaprijed utvrđenu kombinaciju od najmanje dvije pojedinačne usluge koje se sastoje od prijevoza, smještaja ili drugih turističkih i ugostiteljskih usluga što čine cjelinu, a pružaju se u vremenu dužem od 24 sata ili uključuju barem jedno noćenje te se prodaju po ukupnoj unaprijed utvrđenoj (paušalnoj) cijeni.

Turistički (paket) aranžman, najvažniji proizvod putničke agencije, čine usluge i proizvodi davatelja različitih djelatnosti s kojima turist često nije u direktnom ugovornom odnosu, već njihove usluge koristi temeljem različitih ugovora s turoperatorom ili putničkom agencijom.

Obilježja turističkog (paket) aranžmana koja ga čine drugačijim i specifičnim u odnosu na robu i proizvode široke potrošnje su: nemogućnost izlaganja kao robnog uzorka, nemogućnost provjere i pregleda prije kupnje, kao i nemogućnost iskušavanja, mogućnost korištenja samo uz prisutnost korisnika, nemogućnost uskladištenja, nemogućnost zamjene manjkavog

aranžmana, plaćanje se u pravilu odvija unaprijed, kupovina je vezana uz subjektivnu predodžbu o proizvodu, u trenutku korištenja proizvoda potrošač ostvaruje kontakt sa svim pružateljima usluga koje su sastavni dio integriranog proizvoda (Čavlek, 1998.).

Kupnjom turističkog aranžmana korisnici ostvaruju određene prednosti (Čačić, 1995.) koje se odnose na činjenicu da se odluka o kupovini paketa usluga u okviru turističkog aranžmana može donijeti relativno jednostavno i uz uštedu vremena koje je potrebno za organiziranje takvoga putovanja jer se kupovina može izvršiti i u mjestu stalnog boravka turista. Troškovi putovanja i boravka poznati su unaprijed i iskazani su kroz paušalnu cijenu aranžmana, tako da je rizik od pojave neočekivanih troškova sveden na minimum. U pravilu se financijske obveze prema agenciji podmiruju unaprijed što pruža veću sigurnost kod putovanja. Veći broj usluga prodaje se po jedinstvenoj cijeni koja je niža od one koju bi turist platio kada bi usluge kupovao pojedinačno od pružatelja usluga. Sigurnost korisnika aranžmana posljedica je činjenice da je složen posao pripreme i organiziranja turističkog putovanja obavila profesionalna organizacija te da je izvođenje aranžmana povjereno stručnim osobama koje odredi agencija. Raznovrsnost asortimana turističkih aranžmana koje agencija nudi na tržištu potencijalnim korisnicima nudi mogućnost izbora i donošenje odluke o kupovini onog proizvoda koji odgovara njihovim potrebama. Za suvremenog potrošača u turizmu veliku ulogu igra i garancija kvalitete koju pružaju organizatori putovanja kada organiziraju putovanje.

Turistički aranžmani su neopipljivi i heterogeni, odnosno, ne može se izvršiti kontrola kvalitete prije potrošnje i nema doživljaja potrošača koji je isti kao prethodni. Izvor problema može biti turoperator, ali i prijevoznik, hotel, putnička agencija ili bilo koji drugi izravni isporučitelj turističkih usluga uključenih u aranžman. Zbog toga je potrebno definirati propise koji utvrđuju minimalne standarde koji se moraju poštivati (Radosavljević, 2009.).

Osim toga, turistička putovanja sadržana u turističkim aranžmanima su vrlo često međunarodnog karaktera, što znači da turist ne poznaje zemlju, pravo ni običaje zemlje davatelja usluga u kojoj privremeno boravi. To je samo jedan od razloga zbog kojih je potrošač u turizmu često osjetljiviji na rizike u usporedbi sa drugim potrošačima.

Nadalje, potrošači su sve informiraniji i izbirljiviji u prihvaćanju sve šireg asortimana ponuđene robe i usluga. Osjećaj sigurnosti i zaštićenosti osobe i imovine pri korištenju usluge nezaobilazan je faktor zadovoljstva potrošača. Čim je rizik veći, tim je jači utjecaj osjećaja sigurnosti i zaštićenosti na odluku o korištenju određene usluge. Naime, po logici stvari, kod istovrsnih ili sličnih usluga rast će potražnja za onim uslugama pri čijem se korištenju potrošač osjeća sigurnijim i zaštićenijim. Viša razina zaštite potrošača znači i veće zadovoljstvo klijenta što rezultira lojalnošću klijenata i pozitivnom slikom, a time i povećanjem konkurentnosti i smanjenjem troškova pridobivanja novih i zadržavanja postojećih klijenata. Prvobitno povećanje troškova poslovanja uzrokovano uvođenjem mjera zaštite potrošača, dugoročno dovodi do smanjivanja troškova nuđenja usluga. Stoga će davatelji usluga u turizmu i sami poduzimati različite aktivnosti kojima će povećati razinu zaštite svojih klijenata, sve u cilju povećanja konkurentnosti svojih usluga. Naravno da i sami potrošači, individualno ili putem udruga potrošača, poduzimaju aktivnosti radi zaštite svojih prava i interesa. To znači da svi subjekti u turizmu poduzimaju određene mjere zaštite korisnika usluga u turizmu, tj. da su nositelji zaštite potrošača u turizmu (Pešutić, 2008.).

3. Zaštita turističkih potrošača u Europskoj uniji

Potreba za zaštitom turističkih potrošača nametnula se tek na određenom stupnju razvoja turizma. Na zaštitu potrošača gledalo se kao na proširenje obveza pružatelja turističkih usluga. U vrijeme ekspanzije turoperatora na turističkom tržištu i turoperatoru su nastojali umanjiti svoju odgovornost i svoje obveze. Međutim, učinak takvog ponašanja turoperatora izazvao je

negativne izravne i neizravne posljedice – nezadovoljstvo, gubitak klijenata i negativnu multiplikativnu usmenu komunikaciju (Gardijan, 2001.).

Studije su pokazale da se 40% žalbi odnosi na jeftine paket aranžmane koji ne garantiraju odgovarajući smještaj. S jedne strane, turoperatori nastoje nižim cijenama privući potrošače, a s druge strane potrošači su nezadovoljni uslugom koju su dobili (Holloway, 2009.). Budući da su turoperatori u pojedinim zemljama imali vrlo različit stupanj odgovornosti prema svojim klijentima te da je prodaja i ponuda aranžmana bila različito pravno regulirana, radi zaštite sve većeg segmenta potrošača koji je konzumirao proizvod turoperatora Europska unija je inicirala potrebu unificiranja zakona, propisa i administrativnih odredaba unutar zemalja članica koji se odnose na ponudu i prodaju aranžmana na teritoriju Europske unije (Spasić, 2013.).

Početkom 90-ih godina prošlog stoljeća započinje razvoj pravnog okvira zaštite turističkih potrošača u Europskoj uniji. Za poslovanje turoperatora od posebnog je značaja donošenje Direktive o putovanjima, odmorima i kružnim putovanjima u paket aranžmanima u srpnju 1990. godine. Direktiva je osmišljena kako bi razjasnila i proširila odgovornost na sve djelatnosti koje mogu biti uključene u stvaranje i plasiranje paket aranžmana na tržištu (Holloway, 2009.).

Direktivom se štiti potrošač, bez obzira na to da li je on ugovorna strana ili netko u čije je ime druga osoba zaključila ugovor ili osoba na koju je prenijeto pravo korištenja paket aranžmana. Pod paket-aranžmanom se podrazumijeva unaprijed utvrđena kombinacija najmanje dvije pojedinačne usluge koje se prodaju po cijeni koja uključuje razne usluge koje se pružaju u vremenu dužem od 24 sata ili uključuju smještaj i noćenje. Usluge koje se mogu kombinirati su: prijevoz, smještaj i ostale turističke usluge koje nisu pomoćne prijevozne ili smještajne usluge, a predstavljaju znatan dio paket aranžmana.

Direktiva stavlja naglasak na sljedeće odredbe (90/314/EEZ): Brošura koja se daje potrošaču na uvid mora na čitljiv, razumljiv i točan način određivati cijenu i pružati odgovarajuće podatke o odredištu i prijevoznim sredstvima te kategorijama korištenih prijevoznih sredstava, vrsti smještaja, njegovoj lokaciji te njegovim glavnim osobinama, odobrenju te klasifikaciji koju ima u skladu s propisima zemlje članice domaćina, planu prehrane, rasporedu putovanja, tome jesu li potrebne putovnice i vize za državljane zemalja članica te o zdravstvenim formalnostima potrebnim za putovanje i boravak, novčanom iznosu ili postotku od cijene koji je potrebno uplatiti na račun te redoslijedu ostalih uplata do konačnog podmirenja iznosa, tome je li potreban određeni broj osoba kako bi se paket aranžman ostvario, te ukoliko jest, koji je krajnji rok u kojem će potrošač biti obaviješten o eventualnom otkazu putovanja.

Organizator i/ili prodavatelj paket aranžmana mora u pisanom ili drugom primjerenom obliku potrošaču pravovremeno prije početka putovanja dati i podatke o vremenu i mjestu usputnih zaustavljanja te detaljima o mjestu koje putnik zauzima (npr. u kabini ili mjestu na brodu), imenu, adresi i telefonskom broju lokalnog predstavnika organizatora i/ili prodavatelja ili ako ga nema lokalnih agencija kojima se potrošač može obratiti za pomoć u teškoćama, odnosno ako takve agencije ne postoje, potrošač mora dobiti telefonski broj za slučaj izvanrednog događaja, mogućnostima sklapanja neobvezne police osiguranja radi pokrivanja troškova za slučaj da potrošač otkaže ugovor ili za slučaj troškova pružanja pomoći, uključujući povratak u domovinu u slučaju nesreće ili bolesti.

Ako je potrošač spriječen u ostvarenju paket aranžmana, svoju rezervaciju može prenijeti na osobu koja ispunjava sve uvjete koje se odnose na paket aranžman, ako o tome prije polaska organizatoru ili prodavatelju aranžmana dostavi opravdanu obavijest.

Na ugovorne cijene ne primjenjuju se promjene cijena osim ako je ugovorom izričito predviđena mogućnost revidiranja naviše ili naniže, a odstupanja se dopuštaju samo u

troškovima prijevoza (uključujući i troškove goriva), davanjima, taksama ili pristojbama koje se naplaćuju za određene usluge (npr. takse za slijetanje ili ukrcaj/iskrcaj u pomorskim i zračnim lukama) te valutnim tečajevima koji se primjenjuju na pojedine aranžmane. Tijekom dvadeset dana prije datuma polaska cijena navedena u ugovoru ne smije se povećavati.

Ukoliko je organizator aranžmana prije polaska prisiljen znatno izmijeniti bilo koji od bitnih uvjeta iz ugovora (npr. cijenu) u najkraćem roku mora o tome obavijestiti potrošača kako bi mu omogućio da donese odluku o odustanku od ugovora bez ugovorne kazne ili prihvaćanja dodatka ugovoru u kojem se utvrđuju izmjene i njihov učinak na cijenu, a potrošač je dužan organizatora ili prodavatelja aranžmana o svojoj odluci obavijestiti u najkraćem mogućem roku.

Ukoliko potrošač odustane od ugovora ima pravo prihvatiti zamjenski paket aranžman odgovarajuće ili više kvalitete ako mu organizator može ponuditi takvu zamjenu, a ako je ponuđeni zamjenski paket niže kvalitete, organizator mora potrošaču vratiti novac u iznosu razlike u cijeni ili na povrat svih uplaćenih iznosa prema ugovoru i to u najkraćem roku.

Ako nakon polaska znatan dio ugovornih usluga nije pružen, ili ako organizator utvrdi da neće biti u stanju osigurati znatan dio usluga koje treba pružiti, organizator je dužan pronaći, bez dodatnih troškova za potrošača, odgovarajuća zamjenska rješenja radi nastavka realizacije paket aranžmana, a ako je primjereno, nadoknađuje potrošaču i razliku između cijena ponuđenih i pruženih usluga. Ukoliko zamjenska rješenja nisu moguća ili ukoliko ih potrošač iz valjanih razloga ne prihvati, organizator potrošaču bez dodatnih troškova osigurava prijevoz do mjesta polaska ili do nekog drugog mjesta povratka s kojim se potrošač suglasio, te kada je to primjereno, potrošaču isplaćuje naknadu.

Države članice dužne su poduzeti potrebne mjere kako bi osigurale da organizator i/ili prodavatelj bude odgovoran potrošaču za ispravno izvršenje obveza iz ugovora, bez obzira na to da li te obveze moraju izvršiti organizator i/ili prodavatelj ili pružatelj usluga, ne dovodeći u pitanje pravo organizatora i/ili prodavatelja da poduzima mjere protiv drugih pružatelja usluga.

U pogledu štete koja je za potrošača nastala zbog neizvršenja ili nepravilnog izvršenja ugovora, države članice moraju poduzeti potrebne mjere kako bi se osigurala odgovornost organizatora i/ili prodavatelja, osim ako se odgovornost za neizvršenje ne može pripisati njima nego se odgovornost pripisuje potrošaču, trećoj strani koja ničim nije povezana s pružanjem ugovornih usluga pa je neizvršenje nepredvidivo ili neizbježno ili je do neizvršenja došlo zbog djelovanja više sile ili zbog događaja koji organizator i/ili prodavatelj ili pružatelj usluga nisu mogli predvidjeti ili spriječiti.

Organizator je dužan odmah pružiti pomoć potrošaču u nevolji.

U slučaju naknade štete uslijed neizvršenja ili neodgovarajućeg izvršenja obaveza, države članice mogu ograničiti naknadu u skladu sa međunarodnim konvencijama koje uređuju te usluge. Kada je u pitanju šteta, s iznimkom tjelesnih ozljeda, koja je posljedica neizvršenja ili nepravilnog izvršenja usluga obuhvaćenih paket aranžmanom, države članice mogu dopustiti da se naknada ograniči ugovorom, a takvo ograničenje ne smije biti nerazumno.

Potrošač mora o svakom uočenom propustu u izvršenju ugovora odmah obavijestiti pružatelja usluga na kojeg se to odnosi, a organizatora i/ili prodavatelja pisanim putem ili na neki drugi primjeren način, čim se za to ukaže prilika. Ta se obveza mora jasno i izričito navesti u ugovoru.

U slučaju podnošenja pritužbe organizator i/ili prodavatelj ili njihov lokalni zastupnik, ukoliko postoji, moraju odmah učiniti sve što mogu kako bi pronašli odgovarajuće rješenje.

Ugovorna stranka organizator i/ili prodavatelj dužni su pružiti dovoljne dokaze o sigurnosti povrata uplaćenog novca i povratka potrošača u domovinu u slučaju insolventnosti.

Države članice mogu radi zaštite potrošača donijeti ili zadržati strože propise u području na koje se odnosi ova direktiva.

Komisija za interno tržište Europske unije ozbiljno radi i u području konzumerizma koje se odnosi na izričitu zaštitu potrošača, a sa ciljem: zaštite građana Europske unije od pogrešnih informacija koje se odnose na paket aranžmana, proširivanje odgovornosti agencija i organizatora putovanja prema klijentu (prije i poslije putovanja) i uvođenja jedinstvenog postupka za rješavanje nastalih spornih slučajeva. Zaštita turista i njihovih interesa ne znači samo financijsku zaštitu. Nužno je da turisti imaju punu i konkretnu informaciju koja se odnosi na njihov odmor. Komisija inzistira da pogrešno i netočno informiranje mora biti suzbijeno i sankcionirano. Propisi Europske unije koji se odnose na zaštitu potrošača u turizmu, kao i mnogi drugi propisi preuzeti su uglavnom iz zakonodavstva i propisa udruženja europskih zemalja – članica i nečlanica, zbog sveobuhvatnije i bolje zaštite (Živković, 2013.).

4. Zaštita turističkih potrošača u Republici Hrvatskoj

Zaštita prava potrošača jedna je od temeljnih vrijednosti koje promiče Europska unija, a zagovara i Hrvatska jer je hrvatsko tržište dio zajedničkog unutarnjeg tržišta Europske unije. Hrvatski zakoni i propisi koji sektorski uređuju određena pitanja bitna za potrošača i njegovu zaštitu na tržištu, usklađeni su s pravilima Europske unije u području zaštite potrošača. Turisti – potrošači, ostvaruju podjednako visoku razinu zaštite svojih temeljnih potrošačkih prava kao i u bilo kojoj drugoj članici Europske unije (Ministarstvo gospodarstva, 2013).

U Hrvatskoj su pitanja zaštite potrošača – korisnika turističkih usluga regulirana Zakonom o pružanju usluga u turizmu, Zakonom o zaštiti potrošača i Zakonom o obveznim odnosima.

Zakon o pružanju usluga u turizmu (čl. 17.) navodi da je turistička agencija dužna za svako putovanje koje organizira (bilo da se radi o paket aranžmanu ili izletu) izdati program, prospekt ili katalog (promidžbeni materijal - tiskani ili elektronički) koji treba staviti na raspolaganje putniku prije sklapanja ugovora o organiziranju putovanja. Ugovor o organiziranju putovanja ovisno o uslugama mora sadržavati obavijesti o cijeni putovanja, odredištu (destinaciji), sredstvu, karakteristikama i kategoriji prijevoza, vrsti smještajnog objekta, njegovoj lokaciji i kategoriji te turističkoj klasifikaciji prema pravu države u kojoj se objekt nalazi, broju dnevnih obroka, planu putovanja, iznosu ili postotku predjuma te o broju i iznosu obroka otplate ostatka cijene, graničnim, viznim i zdravstvenim formalnostima u pogledu putovanja i boravka u odredištu, najmanjem broju putnika koji je potreban za organiziranje putovanja te o roku u kojem će putnik biti obaviješten o otkazivanju putovanja ako za putovanje nije prijavljen dovoljan broj putnika.

Zakon (čl. 18.) također nalaže da je turistička agencija koja organizira putovanje dužna za svaki paket aranžman osigurati jamčevinu banke ili osiguravajućeg društva kako bi putniku mogla nadoknaditi plaćenu cijenu putovanja ako zbog platne nemogućnosti ili stečaja turističke agencije izostanu usluge putovanja i troškove koji su nastali zbog platne nemogućnosti ili stečaja putničke agencije za povratak putnika u mjesto polaska. Jamčevina koju je turistička agencija dužna osigurati može biti u obliku police osiguranja, gotovinskog pologa ili bankovnog jamstva (odnosno, garancije).

Turistička agencija koja organizira putovanje (odnosno, paket aranžman) dužna je s osiguravateljem sklopiti ugovor o osiguranju od odgovornosti za štetu koju prouzroči neispunjenjem, djelomičnim ispunjenjem ili neurednim ispunjenjem obveza koje se odnose na paket aranžman.

Zakon o zaštiti potrošača osim što uređuje zaštitu osnovnih prava potrošača pri kupnji proizvoda i usluga kao i pri drugim oblicima stjecanja proizvoda i usluga na tržištu (pravo na zaštitu ekonomskih interesa potrošača, pravo na zaštitu od opasnosti za život, zdravlje i imovinu, pravo na pravnu zaštitu potrošača, pravo na informiranje i izobrazbu potrošača,

pravo na udruživanje potrošača u svrhu zaštite njihovih interesa te pravo na predstavljanje potrošača i sudjelovanje predstavnika potrošača u radu tijela koja rješavaju pitanja od njihovog interesa) u području poslovnih aktivnosti u domeni turizma posebno regulira pitanja vezana za ugovor o dugotrajnom turističkom proizvodu kao ugovor koji se sklapa na razdoblje duže od godine dana kojim potrošač uz naknadu prvenstveno stječe pravo na popust ili druge pogodnosti vezane uz smještaj, odvojeno ili zajedno s putovanjem ili drugim uslugama.

Zakon o obveznim odnosima propisuje sadržaj ugovora o organiziranju putovanja, temeljnog dokumenta koji pravno obvezuje organizatora paket aranžmana i turiste, te propisuje njihova temeljna prava i obveze. Prema Zakonu o obveznim odnosima (čl. 881.) ugovor o organiziranju putovanja obvezuje organizatora putovanja da pribavi putniku najmanje dvije usluge koje se sastoje od prijevoza, smještaja ili drugih turističkih usluga što čine cjelinu i koje se pružaju u vremenu dužem od 24 sata ili uključuju barem jedno noćenje (paket-aranžman), a putnik se obvezuje platiti mu za to jednu ukupnu (paušalnu) cijenu, pri čemu se organizatorom putovanja smatra i osoba koja prodaje paket aranžman koji je pripremila neka druga osoba.

Promidžbeni materijali, poput programa putovanja ili brošura, koji se odnose na paket aranžman, a koje je organizator putovanja stavio putniku na raspolaganje ne smiju sadržavati zavaravajuće obavijesti u pogledu cijene ili bilo koje druge odredbe ugovora o organiziranju putovanja. Osim obveznih informacija koje moraju biti sastavni dio promidžbenih materijala, kako propisuje i Zakon o pružanju usluga u turizmu, Zakon o obveznim odnosima nalaže da podaci sadržani u promidžbenim materijalima obvezuju organizatora putovanja i mogu biti izmijenjeni jedino na temelju sporazuma s putnikom ili ako je putnik o tim izmjenama obaviješten prije sklapanja ugovora, u kojem slučaju ta mogućnost mora biti izričito navedena u promidžbenim materijalima.

Ugovor o organiziranju putovanja sklapa se u pisanom obliku ili putem drugog trajnog, putniku dostupnog i razumljivog oblika, s tim da barem jedan primjerak ugovora mora biti dostavljen putniku. Ovisno o uslugama koje su njime obuhvaćene, ugovor o organiziranju putovanja mora sadržavati odredbe o tvrtki ili nazivu, odnosno imenu i prezimenu te sjedištu i adresi organizatora putovanja te njegova osiguravatelja, ako je osiguranje obuhvaćeno paket aranžmanom; odredištu te vremenu i nadnevku boravka u odredištu; sredstvu, karakteristikama i kategoriji prijevoza, nadnevku, vremenu i mjestu polaska i povratka; vrsti smještajnog objekta, njegovoj lokaciji i kategoriji, njegovim osnovnim karakteristikama te turističkoj klasifikaciji prema pravu države u kojoj se objekt nalazi; broju dnevnih obroka; planu putovanja; izletima, obilascima i drugim uslugama koje su obuhvaćene paket aranžmanom i koje su uključene u cijenu; cijeni i mogućnosti izmjene cijene te pristojbama za određene usluge koje nisu uključene u cijenu (primjerice, turističkim pristojbama, pristojbama za ukrcaj i iskrcaj u zračnim i ostalim lukama); načinu i vremenu plaćanja cijene; posebnim zahtjevima putnika o kojima je obavijestio organizatora putovanja prilikom rezerviranja putovanja, a koje je ovaj prihvatio; najmanjem broju putnika koji je potreban za organiziranje putovanja te roku u kojem će putnik biti obaviješten o otkazivanju putovanja ako za putovanje nije prijavljen dovoljan broj putnika; roku u kojem putnik mora iznijeti svoje prigovore u pogledu neispunjenja ili neurednog ispunjenja ugovora.

Zakon o obveznim odnosima također regulira sljedeće obveze organizatora putovanja (čl. 885. – 893.):

- zaštitu prava i interesa putnika (koja nalaže da je organizator putovanja dužan putniku pružiti usluge koje imaju sadržaj i svojstva predviđene ugovorom i skrbiti se o pravima i interesima putnika, u skladu s poslovnim običajima djelatnosti)
- obvezu obavješćivanja (koja nalaže da je organizator putovanja dužan u razumnom roku

prije započinjanja putovanja, u pisanom obliku ili drugom trajnom, putniku dostupnom obliku obavijestiti putnika o: mjestu međuođredišta ili izmjene prijevoznog sredstva te vremenu dolaska u to mjesto; njegovu mjestu u prijevoznom sredstvu, imenu i prezimenu, adresi i broju telefona mjesnog zastupnika organizatora putovanja ili, osobi kojoj se putnik može obratiti u slučaju poteškoća ili, broju telefona ili drugom sredstvu koje mu omogućuje kontakt s organizatorom putovanja; u slučaju putovanja maloljetnika, načinu uspostave neposredne veze s njim ili za njega odgovornom osobom; mogućnosti sklapanja ugovora o osiguranju kojim se osiguravaju troškovi raskida ugovora od strane putnika ili troškovi pomoći i povratka putnika u mjesto polazišta u slučaju nesreće ili bolesti)

- obvezu čuvanja tajne (koja nalaže da organizator putovanja obavijesti koje dobije o putniku, njegovoj prtljazi, njegovim kretanjima i imenima njegovih suputnika smije priopćiti trećim osobama samo s odobrenjem putnika ili na zahtjev nadležnog tijela javne vlasti)
- odgovornost za štetu (koja nalaže da Organizator putovanja odgovara za svu štetu koju prouzroči putniku neispunjenjem, djelomičnim ispunjenjem ili neurednim ispunjenjem obveza koje se odnose na organiziranje putovanja)
- odgovornost za štetu kad je pružanje pojedinih usluga organizator povjerio trećim osobama (koja nalaže da organizator putovanja koji je povjerio trećim osobama izvršenje usluga prijevoza, smještaja ili drugih usluga vezanih za izvršenje putovanja, odgovara putniku za štetu koja je nastala zbog potpunog ili djelomičnog neizvršenja tih usluga)
- sniženje cijene (koje nalaže da ukoliko su usluge iz ugovora o organiziranju putovanja nepotpuno ili neuredno izvršene, putnik ima pravo na razmjerno sniženje cijene pod uvjetom da je stavio prigovor organizatoru putovanja u roku od osam dana od dana završetka putovanja)
- jamčevinu za organiziranje putovanja (koja nalaže da je organizator putovanja dužan za svako organizirano putovanje osigurati jamčevinu kod banke ili osiguravajućeg društva za povrat cijene putniku, ako zbog njegova stečaja ili nesposobnosti plaćanja putovanje ne bude poduzeto, odnosno naknade troškova povratka putnika u mjesto polaska, ako bi iz istih razloga putovanje bilo prekinuto).

Obveze putnika prema Zakonu o obveznim odnosima odnose se na (čl. 894. – 898.):

- plaćanje cijene (putnik je dužan organizatoru putovanja platiti ugovorenu cijenu za putovanje u vrijeme kako je ugovoreno, odnosno uobičajeno)
- obveze davanja podataka (putnik je dužan na zahtjev organizatora pravodobno dostaviti sve podatke potrebne za organiziranje putovanja, a posebno za pribavljanje prijevoznih karata, rezervaciju smještaja te isprave potrebne za prelazak preko granice)
- ispunjavanje uvjeta predviđenih propisima (putnik je dužan brinuti se da on osobno, njegove osobne isprave i njegova prtljaga ispunjavaju uvjete predviđene graničnim, carinskim, sanitarnim, monetarnim i drugim propisima)
- odgovornost putnika za štetu (putnik odgovara za štetu što je prouzroči organizatoru putovanja neispunjenjem obveza koje za njega proizlaze iz ugovora)
- obavješćavanje o nedostacima ispunjenja (putnik je dužan, u pisanom ili drugom odgovarajućem obliku, obavijestiti o neispunjenju ili neurednom ispunjenju bilo koje usluge iz ugovora osobu koja je tu uslugu pružila, što je prije moguće, a organizatora putovanja u roku od 8 dana od dana završetka putovanja).

Od posebnih prava i obveza ugovornih strana koje regulira Zakon o obveznim odnosima u dijelu koji se odnosi na Ugovor o organiziranju putovanja izdvajaju se:

- pravo putnika na raskid ugovora (čl. 901.) koje nalaže da putnik može u svakom trenutku potpuno ili djelomično raskinuti ugovor. Međutim, ako putnik prije početka putovanja raskine ugovor u razumnom roku koji se određuje s obzirom na vrstu aranžmana

(pravodobni raskid), organizator putovanja ima pravo samo na naknadu administrativnih troškova. S druge strane, u slučaju nepravodobnog raskida ugovora organizator putovanja može od putnika zahtijevati naknadu u određenom postotku ugovorene cijene koji se utvrđuje razmjerno vremenu preostalom do početka putovanja i koja mora biti ekonomski opravdana. Važno je naglasiti da organizator putovanja ima pravo samo na naknadu troškova ako je putnik raskinuo ugovor zbog okolnosti koje nije mogao izbjeći ili otkloniti i koje bi, da su postojale u vrijeme sklapanja ugovora, bile opravdan razlog da ne sklopi ugovor, a i u slučaju ako je putnik osigurao odgovarajuću zamjenu ili je zamjenu našao sam organizator te

- pravo organizatora putovanja na raskid ugovora (čl. 902.) koje nalaže da organizator putovanja može raskinuti ugovor, potpuno ili djelomično, bez obveze naknade štete putniku, ako prije ili za vrijeme ispunjavanja ugovora nastupe vanjske izvanredne i nepredvidive okolnosti koje se nisu mogle spriječiti, izbjeći ili otkloniti, a koje bi, da su postojale u vrijeme sklapanja ugovora, bile za njega opravdan razlog da ugovor ne sklopi te ukoliko se za putovanje nije prijavio broj putnika koji je potreban za organiziranje putovanja, ako je o toj okolnosti putnika obavijestio u primjerenom roku koji ne može biti kraći od pet dana prije dana kad je putovanje trebalo započeti. Bitno je naglasiti da u slučaju raskida ugovora prije započinjanja s njegovim ispunjenjem organizator mora u cijelosti vratiti ono što je primio od putnika, a ukoliko je organizator raskinuo ugovor zbog izvanrednih okolnosti koje su nastupile za vrijeme njegova ispunjavanja, dužan je vratiti putniku razliku u cijeni između ugovorenih i pruženih usluga i poduzeti sve mjere nužne za zaštitu interesa putnika.

Uvidom u regulativu koja uređuje pitanje zaštite potrošača u Europskoj uniji, prvenstveno Direktivu o putovanjima, odmorima i kružnim putovanjima u paket aranžmanima (90/314/EEZ), koja je pravno obvezujuća za sve zemlje članice, u smislu da su zemlje članice dužne sve odredbe Direktive izravno inkorporirati u svoje zakonodavstvo te pregledom zakonskih odredbi hrvatskog zakonodavstva (Zakona o pružanju usluga u turizmu, Zakona o zaštiti potrošača i Zakona o obveznim odnosima) koje se bavi pitanjima zaštite turističkih potrošača, može se uočiti da su sve odredbe Direktive 90/314/EEZ uistinu našle svoje mjesto u hrvatskom zakonodavstvu, te da su određena pitanja vezana za zaštitu turističkih potrošača u hrvatskim zakonima regulirana strožije nego je predviđeno Direktivom 90/314/EEZ (što je također situacija koja je Direktivom navedena kao moguća).

5. Zaključak

Turizam je postao globalni fenomen u kojem sudjeluju potrošači iz cijeloga svijeta koji nastoje zadovoljiti svoje turističke potrebe stupajući u odnos s ponuditeljima turističkih usluga. Promjene trendova na strani turističke ponude i potražnje naglasile su potrebu posredovanja između subjekata turističke ponude i prostorno i vremenski udaljenih turističkih potrošača. Ulogu posrednika na turističkom tržištu preuzeli su turoperator i turističke agencije. Još od pojave prvih turoperatora na tržištu, turistički aranžman postaje njihov dominantan proizvod. S druge strane, promjene u okruženju nagnale su turističke agencije, da poslovanje preusmjere iz područja klasičnog posredovanja u pružanju usluga na stvaranje i distribuciju vlastitih proizvoda, turističkih aranžmana.

Zbog obilježja turističkog aranžmana, koji se sastoji od različitih usluga (i proizvoda) različitih ponuđača, a najčešće se kupuje kod turističkog posrednika koji nije izravni isporučitelj niti jedne od tih usluga, osiguravanje odgovarajuće razine kvalitete postaje ključno pitanje i za turističkog potrošača i za posrednika na turističkom tržištu. Stoga je pitanje zaštite potrošača na turističkom tržištu složenije od istog pitanja na drugim, na primjer tržištima roba.

Europa je najznačajnija turistička regija, kako s aspekta emitivnog tako i receptivnog značaja. Budući da je zaštita sigurnosti i prava potrošača prioritet svih politika Europske unije, Europska unija donijela je regulativu koja definira razinu zaštite turističkih potrošača u Europskoj uniji. Donošenjem direktive o putovanjima, odmorima i kružnim putovanjima u paket aranžmanima (90/314/EEZ), Europska unija obvezala je sve zemlje članice da sve odredbe iz direktive inkorporiraju u nacionalno zakonodavstvo.

Analizom odredbi koje su sastavni dio Direktive 90/314/EEZ te hrvatskog zakonodavnog okvira (prvenstveno Zakona o pružanju usluga u turizmu, Zakona o zaštiti potrošača te Zakona o obveznim odnosima) može se utvrditi da je zakonodavna vlast, uz činjenicu da je sve odredbe navedene direktive uključila u nacionalni zakonodavni okvir, čak u određenim segmentima strože regulirala pitanja vezana za zaštitu potrošača na turističkom tržištu. Stroža zakonska regulativa u odnosu na regulativu na razini Europske unije u pitanjima vezanim za zaštitu turističkih potrošača doprinosi porastu povjerenja turističkih potrošača u kvalitetu ponuđenih usluga, što je svakako jedan od preduvjeta za održivi razvoj hrvatskog turizma.

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Tourism consumer protection in the European Union and Croatia

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Abstract. The aspects of the tourism market and the changes in consumer preferences among tourists have made package tours the dominant product of the modern tourist market. A package tour consists of a number of goods and services from different providers that must be content harmonized, and spatially and temporally coordinated. The role of intermediation between the numerous providers of tourism products and services (that are an integral part of the package tour) and spatially distant tourist consumers is performed by tour organizers. More specifically, tour organizers are the creators of various modern tourist products that are purchased by tourist consumers. Tour organizers are directly responsible for the performance, but must also guarantee the service quality level of a package tour. However, the fact that tourist consumers on unique package tours consume different goods and services that are not provided by tour organizers, raises the question of taking responsibility, and emphasizes the need for adequate consumer protection on the tourism market. On the other hand, since services can be consumed in several destinations (and in different countries) as part of the same package tour, this points to the need to harmonize national frameworks to protect tourism consumers. The aim of this paper is to explain the circumstances that led to the introduction of unique provisions to protect tourism consumers in the European Union. Comparing the provisions in the field of tourism consumer protection in the European Union with those that are under the jurisdiction of individual member countries will emphasize the need for harmonization of certain regulations, but also present, in the case of Croatia, a concrete solution to the problem of implementing the provisions of European directives in national legislation of the member states in the field of tourism consumer protection.

Key words: *package tour, tour organizer, tourism consumer protection*

Doprinos turističkih vodiča poslovanju turističkih agencija

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Sažetak. Promjene na turbulentnom turističkom tržištu zahtijevaju od turističkih agencija da svoje poslovanje preusmjere iz područja klasičnog posredovanja prema stvaranju složenih turističkih proizvoda tzv. turističkih aranžmana. Međutim, u oba slučaja bit poslovanja ostaje u djelatnosti pružanja usluga. Preduvjet kvalitetnog pružanja usluga je visokovrijedan ljudski kapital. Iako široka paleta aktivnosti koje poduzimaju turističke agencije prilikom stvaranja i prodaje turističkih aranžmana zahtijeva angažiranje kadrova različitih znanja i vještina, fokus ovoga rada je usmjeren na ulogu i doprinos turističkih vodiča poslovanju turističkih agencija. Turistički vodiči smatraju se neslužbenim predstavnicima zemlje domaćina pred stranim turistima budući da izravno prezentiraju atraktivnosti destinacije turistima te stoga moraju i osigurati razinu kvalitete koju turističke agencije obećavaju svojim klijentima. Iako se od turističkih vodiča zahtijeva formalno obrazovanje stečeno najčešće uz neko drugo zanimanje, promjene u preferencijama turističkih potrošača zahtijevaju i specijalizaciju turističkih vodiča u užim područjima interesa. Bez turističkih vodiča ne bi bilo moguće realizirati tzv. vođenu turu, kao poseban oblik izleta koji je vrlo popularan u ponudi turističkih agencija. S druge strane, nitko osim usko specijaliziranih turističkih vodiča ne može kreirati tematski vođene ture, koje na poseban način obogaćuju ponudu destinacije. Ipak, turističke agencije vrlo rijetko zapošljavaju turističke vodiče u stalni radni odnos, nego se njihovim uslugama koriste po potrebi. Na takav način stvara se potencijalni problem za turističku agenciju pri pronalasku kvalitetnog turističkog vodiča s dovoljno profesionalnog iskustva, koji može garantirati razinu kvalitete usluge obećanu od strane turističke agencije.

Ključne riječi: turistička agencija, turistički vodič, vođena tura, tematska vođena tura

1. Uvod

Dinamičnost i neizvjesnost okruženja mijenja okvire turističke agencije nalažući joj prilagodbu, prihvaćanjem novih izazova i mogućnosti iz okoline kako općenito u poslovanju, tako i uže, u vlastitoj proizvodnji (Mihajlović, 2013). Iako je iskonski motiv osnivanja turističkih agencija bio posredovanje na turističkom tržištu, odnosno povezivanje prostorno i vremenski udaljenih subjekata turističke ponude i turističke potražnje, promjene u okruženju nagnale su turističke agencije da fokus svog interesa preusmjere iz područja posredovanja na stvaranje i prodaju vlastitih složenih turističkih proizvoda. I definicija profesora Vukonića koji definira turističku agenciju kao “gospodarstvenu organizaciju čija je osnovna djelatnost organiziranje i prodaja usluga putovanja i boravka te pružanje drugih usluga putnicima i sudionicima turističkog prometa” (Vukonić, 2003.), naglašava uslužnu djelatnost kao okvir unutar kojega se agencija fokusira na stvaranje vlastitog uslužnog programa posredujući i

dalje između subjekata koji nude turističke usluge i krajnjih korisnika, ali u kombinaciji koja predstavlja jedinstveni proizvod, turistički aranžman.

Utvrđivanjem uslužnog programa turističke agencije definiraju poslove kojima će se baviti na tržištu. Kako bi osigurale svoj opstanak u uvjetima stalnih promjena na turističkom tržištu koje odražavaju promjene u željama i preferencijama turističkih potrošača, ali i promjene u kanalima distribucije turističkih proizvoda, turističke agencije svoje uslužne programe prilagođavaju zahtjevima tržišta. U pripremi uslužnog programa za obavljanje agencijske djelatnosti nužno je osigurati ljudske i materijalne resurse i niz drugih uvjeta za rad koji su u velikom broju zemalja regulirani posebnim zakonskim regulativama. Poslovanje turističkih agencija na suvremenom tržištu karakterizira složenost i brojnost poslovnih operacija što utječe i na relativnu složenost procesa formiranja kadrovske strukture. To se prvenstveno odnosi na zahtjev za višom razinom općeg obrazovanja svih zaposlenika. Poseban utjecaj na kvalitetu pruženih usluga imaju kadrovi koji stupaju u izravan odnos s potrošačima obavljajući poslovne aktivnosti u prodaji i izvršenju turističkih aranžmana (Spasić, 2013.).

Pravilnikom o radu i Statutom, agencije utvrđuju sistematizaciju, popis i opis poslova te osnovne uvjete za realizaciju radnih zadataka (Bunja, 2007.). U literaturi se najčešće navodi podjela na komercijalno, pomoćno i specijalizirano osoblje. Komercijalno osoblje mora poznavati opću turističku problematiku, sve turističke usluge i njihove karakteristike, prilike na turističkom tržištu, dok pomoćno osoblje obavlja poslove dostave, čišćenja i slične pomoćne poslove. Za formiranje uslužnog programa turističke agencije zaslužno je specijalizirano osoblje koje je pretežito zaposleno na poslovima formiranja, prodaje i realizacije turističkih usluga te stoga mora posjedovati znanja iz zemljopisa, povijesti, kulturne baštine i običaja pojedinih naroda. Turistički vodiči spadaju u specijalizirano osoblje. To su osobe koje informativno obavještavaju turiste o određenoj zemlji, regiji ili gradu te svojom komunikativnom sposobnošću propagiraju dotično mjesto u kojem se turisti kreću.

Intenzivan razvoj turizma i složenost turističkog tržišta i odnosa koji na njemu vladaju, već davno upućivali su sudionike na tom tržištu na suradnju, koordinaciju svojih aktivnosti, izmjenjivanje iskustava i stvaranje što povoljnijih uvjeta za vlastito poslovanje. I država je nalazila svoj interes u povezivanju nositelja ponude u turizmu jer njihova suradnja i koordiniranost aktivnosti ujedno znači i sređeno djelovanje tržišta bez konflikata među poduzećima, što se odražava i na ukupnost ekonomskih odnosa i efikasnost poslovanja na nacionalnoj razini. Na isti način se udružuju i turističke agencije, iz različitih razloga i na različite načine. Udružuju se radi unaprjeđenja vlastitog poslovanja, uspješnijeg uključivanja u međunarodno turističko tržište te radi jačanja svog konkurentskog položaja. U novije je vrijeme sve više razlog udruživanja zaštita potrošača i partnera turističkih agencija. Suradnja turističkih agencija može se postići na više načina, a najčešće poprima oblik nacionalnih i međunarodnih profesionalnih organizacija. Danas, gotovo više i nema zemlje u Europi koja nema vlastito nacionalno udruženje turističkih agencija (Vukonić, 2003.).

2. Turistički vodič i njegova uloga u poslovanju turističkih agencija

Zakon o pružanju usluga u turizmu (čl. 5.) definira turističku agenciju kao trgovačko društvo, trgovca pojedinca, obrtnika ili njihovu organizacijsku jedinicu koji pružaju usluge organiziranja putovanja ili posredovanja usluga vezanih za putovanje i boravak turista. U svakom radnom procesu, kako onom koje se pretežito događa na turističkom tržištu, tako i izvan njega, sudjeluju različiti proizvodni čimbenici. Uvažavanje specifičnosti poslovanja određene djelatnosti prilikom kombiniranja proizvodnih čimbenika, pri čemu se na turističkom tržištu javlja zahtjev za angažiranjem veće količine proizvodnog čimbenika rada, pridonosi općoj i posebnoj učinkovitosti poslovanja svakog poduzeća. Iako su sredstva materijalna osnova poslovanja turističke agencije, osoblje je živi element koji osmišljava,

stvara i plasira na tržište temeljni proizvod turističke agencije - turistički aranžman, ali i pruža ostale usluge koje su predmet poslovanja turističke agencije. Tek zajedničkim i usklađenim djelovanjem živog rada i materijalnih sredstava agencija može ostvariti svoje zadatke i postavljene ciljeve te zadovoljiti vlastiti probitak i zadovoljstvo putnika odnosno korisnika usluge.

Uspjeh poslovanja turističke agencije ovisi o kvalitetno i kvalificirano obavljenom kreiranju, prodaji i izvršenju turističkih aranžmana. Dakako, kvalificiranost osoblja koje radi na tim poslovima dolazi u prvi plan. Za razliku od drugih djelatnosti, putničke agencije moraju raspolagati zaposlenicima koji imaju viši stupanj obrazovanja. Međutim, osim formalnog obrazovanja, koje može biti stečeno na različitim obrazovnim institucijama čak vrlo različitog profesionalnog usmjerenja, turistička se agencija u svom poslovanju najviše oslanja na osoblje koje ima specijalizirana znanja. Dakle, osim o specijaliziranim (posebnim) znanjima, govorimo i o specijalističkim poslovima pa i o specijalističkim kadrovima. U takve kadrove u turističkim agencijama ubrajamo: turističke vodiče, turističke (agencijske zastupnike) i prodavače putnih karata u zračnom prometu (Vukonić, 2003.).

Prema Federaciji Europskih udruga turističkih vodiča (FEG) turističkim vodičima smatraju se osobe koje vode posjetitelje, na jeziku po njihovom izboru te interpretiraju kulturnu i prirodnu baštinu određenog prostora. Ove osobe posjeduju dozvole i kvalifikacije priznate od strane odgovarajućih vlasti (http://www.feg-touristguides.com/cen_definitions.php). Osnovni zadatak turističkog vodiča je prezentacija turističke destinacije i tumačenje pojedinih aktivnosti pa se često navodi kako se turistički vodiči smatraju neslužbenim predstavnicima zemlje domaćina pred stranim turistima budući da izravno prezentiraju atraktivnosti destinacije turistima. Osim visokog stupnja obrazovanja, turistički vodiči moraju stalno raditi na prikupljanju i obradi informacija (Spasić, 2013.), a njihovo neformalno obrazovanje, hobiji i interesi daju dodatnu vrijednost širini i kvaliteti njihovog rada. Turistički vodiči moraju se doimati sigurno i suvereno vladati podacima koje pružaju te biti spremni kvalitetno odgovoriti na postavljena pitanja.

Glede djelovanja turističkih vodiča u Hrvatskoj Zakonodavac je donio i određene pravilnike kao: Pravilnik o stručnom ispitu za turističke vodiče i ispitnom programu za turističke pratitelje, Pravilnik o upisniku turističkih vodiča i Pravilnik o iskaznici turističkog vodiča.

Pravilnikom o stručnom ispitu za turističke vodiče propisuje se način polaganja stručnog ispita, ispitni program te sastav ispitne komisije. Stručni ispit za turističke vodiče polaže se na hrvatskom jeziku pred komisijom koju imenuje ministar nadležan za turizam pri odgovarajućem visokom učilištu. Sjedišta visokih škola na kojima se polaže stručni ispit su: Dubrovnik, Split, Šibenik, Zadar, Opatija, Pula, Zagreb te Osijek. O položenom ispitu visoko učilište kandidatu izdaje uvjerenje o položenom stručnom ispitu za turističkog vodiča (http://www.mint.hr/UserDocsImages/150113_ZoPUuT.pdf). Kompetencije koje vodiči stječu vezane su za područja političkog i gospodarskog sustava Republike Hrvatske, hrvatske povijesti, kulturno-povijesnih znamenitosti Republike Hrvatske, kulture govorenja i pisanja, osnova turizma i turističkog zakonodavstva, turističkog zemljopisa Hrvatske te poznavanja stranog jezika. Budući da se pojavljuju kao formalni, ali i neformalni uvjeti za obavljanje poslova vođenja turista, pitanje stručne spreme i poznavanja stranih jezika imaju bitnu ulogu. Što više jezika znaš to više vrijediš, stara je izreka koja u obavljanju poslova vođenja turista ima dobronamjernu primjenu. Vodič koji govori više jezika u nemjerljivoj je prednosti pred onim koji govori samo materinji jezik. Poznavanje stranih jezika bitno je u više dimenzija: radi komunikacije s turistima, radi pripreme za vođenje, istraživanja, prikupljanja i selektiranja informacija i upoznavanja kulture, obrazovnog, političkog i gospodarskog sustava zemlje u kojoj se vođenje odvija te radi komunikacije s lokalnim stanovništvom, lokalnim davateljima usluga i vlastima.

Dakle, poslovima turističkog vodiča ne može se baviti osoba koja ne zadovoljava uvjete propisane u navedenim Pravilnicima. Turistički vodiči polaganjem stručnog ispita, dobivaju licencu (dozvolu) vođenja za određenu turističku cjelinu (lokalitet). Turistički vodič može pružati uslugu i na ostalom području Republike Hrvatske koje nije određeno kao turistička cjelina (lokalitet) ako je položio samo opći dio stručnog ispita za turističkog vodiča. Također, ove bi osobe morale biti snalažljive, okretne, komunikativne te poznavatelji više stranih jezika. Bitno je naznačiti da Zakonodavac regulira i osobe koje mogu voditi turiste, a ne smatraju se turističkim vodičima. Naime, članak 26. stavak 8. Zakona o pružanju usluga u turizmu navodi da se turističkim vodičem ne smatra osoba koji obavlja poslove stručnog vođenja u muzeju, galeriji, zaštićenom području prirode, na arheološkom lokalitetu i sl., gorski vodič, planinski vodič, speleološki vodič, voditelj u ronilačkom turizmu te vodič u lovu i ribolovu. Za pružanje usluga turističkog vodiča turistički vodič mora imati odobrenje koje mu izdaje nadležni ured na čijem području djeluje.

Čitav je niz usluga počevši od dočekivanja i ispraćaja turista, prevođenja, transfera, asistencije pri smještaju i prehrani, preko organizacije zabave, animacije pa do realizacije, razgleda, izleta i tura u kojima značajnu ili čak i presudnu ulogu imaju turistički vodiči. Neovisno o kojoj se konkretnoj usluzi radi u svojoj biti, poslovi vođenja sastoje se od operativno tehničkih poslova s jedne strane, te pokazivanja i stručnog objašnjavanja turistima s druge strane (Trezner, 2008.). Ipak, postoje velike razlike u načinu na koji se poslovi organiziraju te kako se za njih osposobljavaju osobe koje vode turiste ovisno o tome dolaze li one s turistima iz zemalja njihova prebivališta ili ih dočekuju i obavljaju vođenje u zemlji koja je turističko odredište. Oko operativno tehničkih poslova vođenja nema značajnijih razlika niti razmimoilaženja, dok kod poslova pokazivanja i stručnog objašnjavanja postoji značajna rasprava u domaćima, ali i u europskim okvirima. Problem nastaje u smislu prava pokazivanja i tumačenja znamenitosti tijekom turističkog putovanja. S jedne strane pravo je organizatora putovanja da, u zemlji iz koje turisti polaze, samostalno prema svojim kriterijima osposobljava osobe koje će pokazivati i tumačiti znamenitosti prije svega zbog kvalitetnije interpretacije usklađene s obrazovanjem i sustavom vrijednosti turista. Na drugoj strani su interesi i prava lokalnih zajednica i zemalja u koje turisti dolaze da zaštite pravo interpretacije svoje baštine prvenstveno za domaće vodiče koji se osposobljavaju po posebnim pravilima uvažavajući nacionalne i lokalne specifičnosti, prije svega povijest i kulturu koju bi strani vodiči mogli pogrešno ili zlonamjerno interpretirati.

Razlikuju se dvije skupine turističkih vodiča (Vukonić, 2003.): turistički vodiči specijalizirani i ovlašteni za razgled određenog mjesta, grada ili područja i vodiči – pratitelji aranžmana (turistički pratitelj).

Turistički vodiči specijalizirani za razgledavanje određenih mjesta, gradova ili područja obično su osobe koje su za taj posao osposobljene i verificirane od strane nadležnih institucija nakon odslušanog i položenog ispitnog programa koji se sastoji od općeg i posebnog dijela. Turistički vodiči najčešće su organizirani u posebnim strukovnim organizacijama, neovisno o poslovanju turističkih agencija, a agencije se njima koriste temeljem ugovora i prema potrebama. Posao vodiča je da po potrebi vode grupe obično inozemnih turista i da im na njihovom materinskom jeziku pružaju usluge pokazivanja i stručnog objašnjavanja prirodnih ljepota i rijetkosti, kulturno-povijesnih spomenika, umjetničkih djela, etnografskih i drugih znamenitosti, povijesnih događaja, ličnosti, legendi o tim događajima i ličnostima, gospodarskih i političkih tijekova i zbivanja (Zakon o pružanju usluga u turizmu, čl. 26., st. 1.). S obzirom na izravan kontakt koji vodiči imaju s inozemnim turistima, često se zovu turističkim ambasadorima svoga grada ili svoje zemlje jer se njihova aktivnost ne iscrpljuje samo u spomenutim informacijama. Zbog svog relativno visokog obrazovanja takvi se kadrovi koriste u turističkoj agenciji i za druge potrebe, na primjer, prilikom obavljanja transfera u dolasku i odlasku, prilikom dočeka i ispraćaja turista (Vukonić, 2003.).

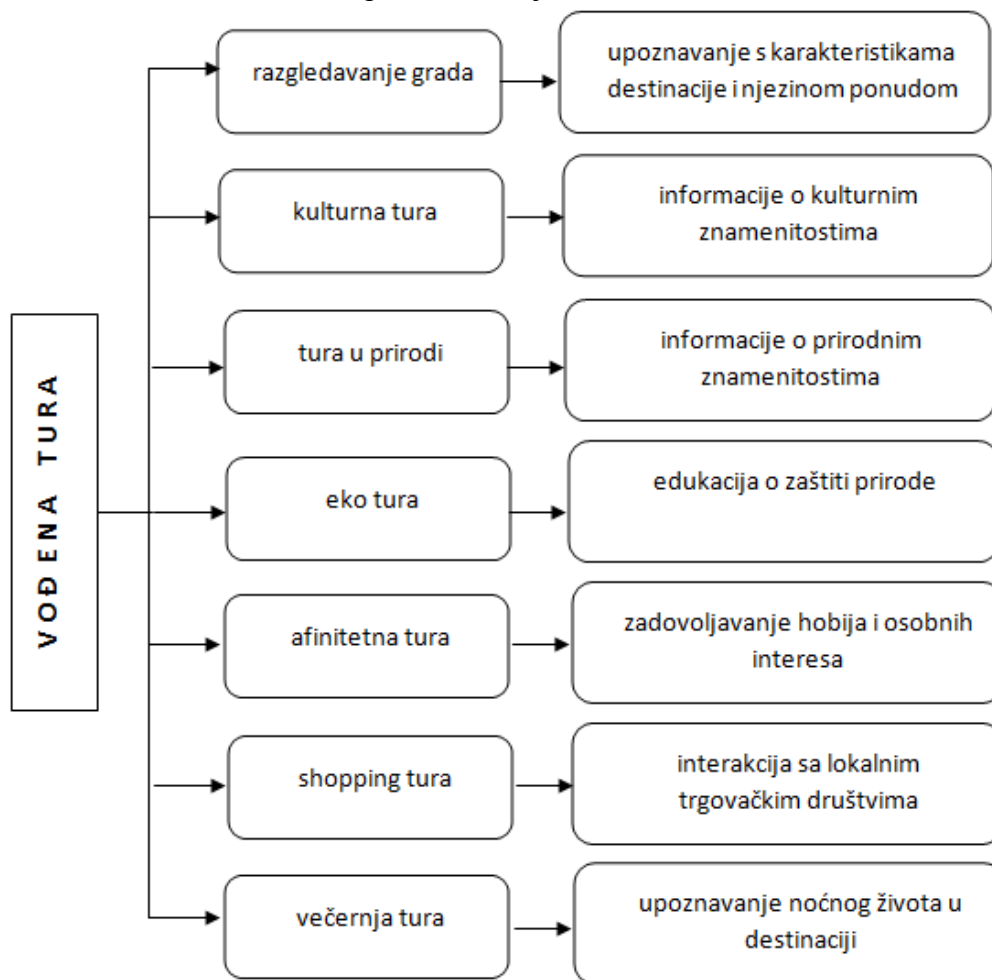
Turistički pratitelj obavlja operativno-tehničke poslove u vođenju i praćenju turista, a također može tijekom putovanja, osim u turističkim cjelinama (lokalitetima), davati putnicima osnovne informacije o područjima obuhvaćenim putovanjem (Zakon o pružanju usluga u turizmu, čl. 37., st. 1.). Zakon također nalaže da turistički pratitelj za pružanje usluga turističkog pratitelja mora imati položen ispit za turističkog pratitelja. Bitno je naglasiti da su osobe koje imaju položen stručni ispit za turističkog vodiča oslobođene obveze polaganja ispita za turističkog pratitelja. Zadaća je turističkog pratitelja da u ime svoje agencije, vodi brigu za što bolje izvršenje svih prodanih aranžmana od početka do završetka putovanja. Prije početka putovanja on mora biti detaljno upoznat sa svim pojedinostima aranžmana, mora točno provjeriti jesu li izvršene i potvrđene sve rezervacije te sve eventualne nejasnoće mora unaprijed rasvijetliti odnosno otkloniti. Drugi njegov važni zadatak je temeljito proučavanje itinerera, radi što boljeg i potpunijeg davanja informacija sudionicima putovanja o mjestima i krajevima kroz koje se prolazi. Turistički pratitelj mora sigurno i pouzdano voditi klijente kroz razne gradove, područja i mjesta, pri čemu klijenti ne smiju voditi nikakvu brigu o organizaciji putovanja, a svu odgovornost za rješavanje eventualnih problema rješava sam turistički pratitelj. On je u stalnom kontaktu sa putnicima, iz razgovora s njima ne doznaje samo njihove posebne želje u pogledu smještaja, izleta ili nabavke raznih predmeta, nego i o tome što ih, za vrijeme putovanja u krajevima i mjestima kojima prolaze, najviše zanima. Turistički pratitelj treba posjedovati tri glavne karakteristike: hladnokrvnost, okretnost i brzu snalažljivost u svakoj situaciji. Nervozan, nespretn i nesnalažljiv čovjek ne može biti dobar turistički pratitelj jer bi i sam mogao dovesti turiste u neugodne situacije (Vrignanin, 1957.).

Turistički vodiči udružuju se u strukovne udruge radi zaštite profesije turističkih vodiča te pružanja turističkih usluga, unaprjeđenja kvalitete usluga turističkih vodiča odnosno lokalnog turizma te turizma uopće kao i zaštite i promicanja kulturne, povijesne baštine na području cijele Hrvatske (http://www.zagrebguides.com/download/STATUT_ZG-GUIDES.pdf). Udruge turističkih vodiča imaju važnu ulogu kako na nacionalnoj tako i na međunarodnoj razini. Na razini Republike Hrvatske poznate su udruge turističkih vodiča grada Zagreba, Splita, Dubrovnika, Pule, Zadra, Šibenika dok se u Europi izdvajaju udruge turističkih vodiča Njemačke, Austrije, Engleske, Italije, Danske, Portugala, Španjolske i drugih (http://www.feg-touristguides.com/links.php#european_tourist).

3. Vođene ture kao specifičan proizvod putničkih agencija

U pogledu definiranja pojma vođene ture ima različitih stavova, prije svega zbog toga što se pojam „tura“ poistovjećuje s kružnim putovanjem. Vođene ture podrazumijevaju ture koje mogu varirati od kratke prezentacije turističkog vodiča na nekom posebnom mjestu tijekom ograničenog perioda ili, pak, uključivati produženi kontakt između vodiča i turističke grupe koji traje danima, ponekad i tjednima (Rabotić, 2009.). Pojam „vođena tura“ nije obvezno sinonim za pojam „turistički aranžman“ kako se uobičajeno misli pa između dva navedena pojma treba povući jasnu razliku. Turistički aranžman, kao kombinacija usluga, ne podrazumijeva obvezno i uslugu turističkog vodiča. S druge strane, vođena tura nije uvijek i kombinacija usluga jer ponekad uključuje samo uslugu turističkog vodiča (pješačka tura, tura u muzeju). Drugim riječima, turistički aranžman može u cjelini imati oblik vođene ture ili u nekim segmentima svog programa uključivati pojedine vođene ture dok vođena tura dobiva karakteristiku turističkog aranžmana kada osim turističkog vođenja sadrži na primjer i uslugu prijevoza. Stoga čak i poludnevne ili cjelodnevne ture, ukoliko se ostvaruju prijevoznim sredstvom, imaju karakter turističkog aranžmana. Vođene ture dijelimo s obzirom na kriterije kao što su: dužina trajanja putovanja, sezona, lokacija, način prijevoza, skupina turista i slično. Brojne su vrste vođenih tura koje se mogu izvoditi na određenom lokalitetu ovisno o čimbenicima atraktivnosti koji se nalaze na samom lokalitetu. Kratki pregled vrsta vođenih tura prikazuje shema 1.

Shema 1. Vrste vođenih tura prema sadržaju



Izvor: prilagođeno prema Rabotić, 2010.

Također, u poslovanju turističkih agencija bitno je razlikovati mikroturu od makroture (Rabotić, 2010.). Mikrotura je poludnevni ili cjelodnevni program razgledavanja određene atrakcije ili više njih koji se ostvaruje pješice, autobusom ili nekim drugim prijevoznim sredstvom. Karakterističan primjer mikroture je razgledavanje grada, pojedinih lokaliteta ili atrakcija. Pod makroturom, s druge pak strane, podrazumijevamo višednevni turistički aranžman, čiji program obuhvaća obilazak većeg broja turističkih destinacija (uz moguće angažiranje turističkog vodiča na određenim područjima). Razgledavanje uz turističkog vodiča postalo je ključni segment turističkog putovanja, ali i doživljaja koje turisti ostvaruju u turističkoj destinaciji.

Iz sociološke perspektive, nekoliko je prednosti vođenih tura. Vođena tura rješava problem izbora onoga što treba vidjeti u okviru ograničenog vremena te nudi psihološku sigurnost turistima, budući da su unaprijed poznati svi elementi turističkog putovanja, s naglaskom na program i troškove putovanja. Vođena tura također razvija solidarnost unutar same grupe. Prednost vođene ture iz perspektive lokalne zajednice i turističkog gospodarstva ogleda se u činjenici da vođena tura kontrolira broj turista koji posjećuju određeno mjesto. Bitno je da su prilikom izvođenja same ture turisti upućeni na upoznavanje za njih značajnih atrakcija određenog lokaliteta, a istovremeno udaljeni od svega što im nije interesantno. Vođena tura daje prednost aktivnom ili obrazovnom načinu korištenja slobodnog vremena, a budući da kombinira pustolovinu, bijeg od svakodnevnice i kulturni doživljaj, uz zajamčenu sigurnost sve je omiljenija među različitim segmentima turističkih potrošača.

Zajedničko za sve navedene vrste vođenih tura je činjenica da niti jedna vođena tura ne može biti realizirana bez nazočnosti licenciranog turističkog vodiča. Upravo stoga, svaka vođena tura je jedinstvena jer je pod utjecajem osobnih interesa i preferencija turističkog vodiča koji će uvijek na svoj jedinstveni način nastojati oživjeti u očima turista određeni lokalitet. S druge strane, na samo izvođenje i sadržaj vođene ture veliki utjecaj ima skupina turista kojoj se prezentira lokalitet jer u skladu s njihovim interesima, njihovoj znatizelji i prethodnom poznavanju lokaliteta, turistički vodič će nastojati na licu mjesta prilagoditi samu turu. S tim u vezi postaje jasno da kvaliteta vođene ture ovisi o kvalificiranosti, iskustvu, maštovitosti i prilagodljivosti turističkog vodiča, a poseban interes turističkih agencija postaje pronaći kvalitetne turističke vodiče koji mogu osigurati potrebnu razinu kvalitete usluge koju izravno pružaju posjetiteljima.

Posebna vrsta vođenih tura su tzv. tematske ture. Razvoj tematskih tura ovisi o čimbenicima atraktivnosti destinacije ali i o sposobnosti organizatora tematskih tura da oživi povijesne događaje, legende, bajke ili neke druge detalje koji se mogu povezati s lokalitetom, a mogu na poseban način probuditi interes turista u destinaciji. Osmisliti i ponuditi tematsku turu u destinaciji mogu samo najkvalitetniji turistički vodiči koji poznaju sitne karakteristične detalje lokaliteta, a u stanju su od njih kreirati priču koja govori o skrivenom kulturno-povijesnom, etnografskom, gastronomskom i drugom naslijeđu destinacije.

Jedna od najpoznatijih tematskih tura u svijetu je kombinirana autobusno-pješačka tura pod nazivom „Jack Trbosjek“ koju nudi britanska turistička agencija Evan Evans (<https://evanestours.com/sightseeing-tours/london-tours/afternoon-london-jack-the-ripper-combo/>).

U Hrvatskoj najbolju ponudu tematskih tura imaju gradovi: Zagreb, Osijek i Dubrovnik. Shema 2 daje kratki prikaz najzanimljivijih tematskih tura u navedenim gradovima sa kratkim opisom njihovog sadržaja.

Shema 2. Tematske ture na hrvatskom turističkom tržištu

Lokalitet	Naziv tematske ture	Kratak opis tematske ture
Zagreb	Opsjednuti Zagreb	Prva zagrebačka tura duhova koja se provodi u večernjim satima i otkriva najjezovitija mjesta i tajanstvene stanare ovoga grada.
	Uspavani zmaj	Jedna od nebrojenih zagrebačkih zmijskih legendi, govori o ukletoj zmijskoj kraljici koja ljubomorno čuva izgubljeno medvedgradsko blago.
	Zagrebarium	Tura koja vodi u steampunk potragu za futurističkom prošlošću, ekscentričnim ličnostima, stogodišnjim brendovima te zaboravljenim snovima o budućnosti.
	Zagrebačka zimska bajka	Sezonsko razgledavanje grada koje oživljava stare običaje i zagrebačku povijest.
Dubrovnik	Games of Thrones	Otkrivanje čari King's Landinga po lokacijama gdje se snimala istoimena serija.
Osijek	Osječki parkovi i rijeka Drava	Doživljaj živog svijeta parkova, flore i faune te „zelene ljepotice“ rijeke Drave koja se nedaleko od Osijeka ulijeva u Dunav, a svojim vodama natapa i obližnji park prirode Kopački rit.
	Život pod Osmanskim carstvom	Tura u pratnji kostimiranog „Sulejmana Veličanstvenog“ kroz interakciju s grupom oživljava priču o životu sultana, osmanskoj kulturi i načinu života, kao i o Osijeku u vrijeme Osmanskog carstva.

	Srednjovjekovni Osijek obitelji Korogy	Tura koja predočava srednjovjekovne dane “ponosa i slave” osječkih vladara, a sam grad Korod (Korogyvar) očarava veličinom, a začara brojnim legendama s kojima se povezuje.
	Fijaker stari gradom luta	Najromantičniji način upoznavanja Grada na Dravi je vožnja starim fijakerom s upregnutim plemenitim konjima, uz kočijaša odjevenog u crni frak s cilindar šeširom.
	Osijek iz zraka	Pogled na gradske znamenitosti s visine omogućava uživanje u vizuri Drave i njenim rukavcima koji se razlijevaju uokolo grada te obrađenim slavonskim poljima i šumama.

Izvor: <http://hr.secret-zagreb.com/obilasci-zagreba/>, <http://karaka.info/hr/game-of-thrones/>, <http://www.tzosijek.hr/index.php/upoznajte-osijek/tematske-ture-gradom>

Tematske ture od velikog su značaja za ponudu turističke destinacije. Tematske ture omogućavaju turistima koji se vraćaju u destinaciju da otkriju čari i detalje skrivene u legendama, bajkama, narodnim pričama kao i povijesnim zapisima, a obogaćujući ponudu turističke destinacije pružaju mogućnost lokalnoj zajednici da na što kvalitetniji način turistički valorizira raspoložive resurse.

4. Zaključak

Uspješnost poslovanja turističkih agencija ovisi o njihovom najvažnijem proizvodnom čimbeniku, ljudskom kapitalu. Iako je za osmišljavanje, stvaranje i plasiranje na tržište najznačajnijeg proizvoda turističkih agencija, turističkog aranžmana, potrebno osigurati kvalitetne zaposlenike koji raspolažu različitim znanjima i vještinama, kvalitetu turističkog aranžmana klijenti percipiraju prema razini kvalitete izravnih isporučitelja turističkih usluga, koje su sastavni dio samog aranžmana.

Turistički vodiči, iako u pravilu nisu zaposlenici turističkih agencija, izravna su veza turističkih agencija s njihovim klijentima te je njihova uloga u poslovanju turističkih agencija izuzetno važna. Oni izravno na turističkom lokalitetu oživljavaju proizvod koji je klijent kupio od turističke agencije. Stoga je jako bitno da agencija i turistički vodič pravovremeno informiraju jedni druge o svim bitnim detaljima, preferencijama, željama i interesima klijenata, kako bi percipirajući njihove želje i potrebe mogli još dodatno personalizirati pruženu uslugu te time podići razinu kvalitete isporučene usluge.

Specifičan turistički proizvod, koji se ne bi mogao realizirati bez angažiranja turističkih vodiča, vođene su ture. Zbog promjena trendova na turističkom tržištu koje se na strani turističke potražnje ogledaju kroz težnju turista da aktivno dožive turističku destinaciju koju posjećuju, vođene ture postaju sve značajniji segment turističkih aranžmana, ali i samostalan proizvod koji se zasebno nudi na tržištu. Budući da su vođene ture pod izravnim utjecajem turističkog vodiča koji ih izvodi, svaka je jedinstvena, a u interakciji sa turistima postaje u potpunosti personalizirana usluga. Od velikog broja različitih vođenih tura koje se mogu realizirati u destinaciji, možda su najzanimljivije tematske ture, koje bez novostvorene materijalne vrijednosti, na povijesnom naslijeđu, narodnim pričama, legendama i sl. grade novi turistički proizvod koji uistinu obogaćuje ponudu turističke destinacije. Uloga turističkih vodiča u osmišljavanju tematskih tura nezamjenjiva je jer jedino oni, kao poznavatelji potencijala lokaliteta te dojmova turista o zanimljivostima destinacije, pronalaze niše kojima golicaju maštu turista koji su uvijek spremni za nove doživljaje.

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Contribution of tourist guides to the business of travel agencies

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Abstract. Changes in the turbulent tourism market prompt travel agencies to refocus their business ventures from the field of classical intermediation towards the creation of complex tourist products, the so-called package tours. However, in both cases, core business remains in the activities of providing services. The prerequisite for providing quality services is high-quality human capital. Although a wide range of activities undertaken by travel agencies in the creation and sale of package tours require the staff to be familiar with different knowledge and skills, this paper focuses on the role and contribution of tourist guides to the business of travel agencies. Tourist guides are considered as unofficial representatives of the host country to the foreign tourists, since they present tourists with destination attractiveness and must therefore ensure the level of quality that travel agencies promised to their clients. Even though tourist guides are required to provide confirmation of formal education, acquired most often with some other profession, changes in consumer preferences of tourist demand also impose the need for the tourist guides to specialize in smaller specific areas of interest. Without tourist guides, it would not be possible to realize the so-called guided tour, as a special form of excursion which is a very popular product offered by travel agencies. On the other hand, no one other than highly specialized tourist guides can create thematic guided tours which, in a special way, enrich the offer of the tourist destination. However, travel agencies rarely employ tourist guides on a permanent basis, and they usually only hire them when it is necessary. This creates a potential problem for a travel agency in finding a quality tourist guide with sufficient professional experience, who can guarantee the level of quality of service promised by the travel agency.

Key words: *travel agency, tourist guide, guided tour, thematic guided tour*

Zaštita malih i srednjih poduzetnika od nepoštenog trgovanja

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Sažetak. Danas su veliki trgovački lanci sve češće izravni konkurenti malim i srednjim proizvođačima i trgovcima jer imaju vlastite trgovačke marke. Zbog bolje pregovaračke pozicije veliki poduzetnici su u mogućnosti ucjenjivati male i srednje poduzetnike odnosno ponašati se nepošteno prilikom sklapanja ugovora, ali i tijekom trajanja ugovornog odnosa. Odredbe o nepoštenom trgovanju u našem pravnom sustavu sadržane su u Zakonu o trgovini, koji ne razlikuje male i srednje poduzetnike od velikih te posljedično tome ne sadrži posebne odredbe o zabrani zlouporabe veće pregovaračke moći. Zbog nedostatne zaštite malih i srednjih poduzetnika od nepoštenog trgovačkog prakse u nacionalnim zakonodavstvima, Europska komisija je u siječnju 2013. godine donijela Zelenu knjigu o nepoštenim trgovačkim praksama među poduzećima u opskrbnom lancu prehrambenih i neprehrambenih proizvoda u Europi. U ovom radu analizirat će se najčešća djela nepoštenog trgovanja u odnosu na male i srednje poduzetnike te će se ispitati mogućnosti njihove pravne zaštite prema važećim propisima Republike Hrvatske.

Ključne riječi: nepošteno trgovanje, mikro, mali i srednji poduzetnici, zlouporaba pregovaračke moći

1. Uvod

Trgovina na malo predstavlja jednu od važnijih gospodarskih djelatnosti u Europskoj uniji pa tako prema podacima Eurostata iz 2010. čini 4.3 % BDP-a EU, zapošljava 8.3 % radnika EU, a 17 % te djelatnosti obavljaju srednja i mala poduzeća (SME).¹ Njome se osigurava distribucija robe i usluga, od poljoprivredno prehrambenih proizvoda, malih elektroničkih uređaja, odjeće, kozmetičkih proizvoda i sl.

Zadnja dva desetljeća ova djelatnost doživljava značajne promjene i to prvenstveno zbog ekonomskih, demografskih i socijalnih razloga koji su posljedica pojačanja globalizacije, razvoja e-trgovine, ali i proširenja EU na 28 država članica. Sve to dovodi do pojačanog tržišnog natjecanja među multinacionalnim konglomeratima, ulaska velikih multinacionalnih kompanija i pripajanja manjih poduzeća od strane velikih pa su tako neki veliki trgovci na malo poput *Metro Group* i *Carrefour* prisutni u 30-40 država, a *Casio*, *Auchan*, *Metro Group* ili *Schwarz Group* ostvaruju više od 60 % godišnjih prihoda izvan države svoga sjedišta.²

U takvim okolnostima manji broj relativno jakih trgovaca na malo stječe značajnu pregovaračku moć koja je sama po sebi uobičajena i legitimna pojava u trgovačkim odnosima,

¹ COM (2013) 37 Final of 31 January 2013, Green Paper on Unfair Trading Practices in the Business-To-Business Food and non-Food Supply Chain in Europe.

² Study on the Legal Framework Covering Business-to-Business Unfair Trading Practices in the Retail Supply Chain, Final Report, 26 February 2014.

ali upravo zloupotreba te moći utječe na stvaranje nepoštenih trgovačkih prakse. Naime, takvi trgovci razvijaju vlastitu praksu i standardizirane obrasce ugovora kojima kontroliraju lanac opskrbe i to pogotovo u onim državama čiji pravni sustavi odgovornost za propast ili oštećenje stvari prebacuju na prodavatelja.³ Upravo je u tome njihova snaga jer nametanjem takvih obrazaca ugovora, koje druga strana u pravilu prihvaća, onemogućava ravnopravnost sudionika tog poslovnog odnosa.

Europska komisija je još 2009. godine raspravljala o pojavi nepoštenih poslovnih praksi u prehrambenom sektoru⁴ i to zbog toga što su one značajno utjecale na prava potrošača na način da su potrošačima onemogućavale poštenu ponudu šire palete proizvoda kao i njihovih cijena, a s druge strane su posrednici, prerađivači hrane i trgovci na malo značajno ograničili moć poljoprivrednih proizvođača. Kako lanac opskrbe hranom⁵, koji obuhvaća niz različitih tržišnih subjekata (proizvođači, prerađivači, trgovci na malo) predstavlja značajnu stavku u svakodnevnom životu građana EU⁶, jasno je zašto je ovaj problem toliko značajan.

Stoga je Europska komisija 2013. donijela Zelenu knjigu o nepoštenim trgovačkim praksama među poduzećima u opskrbnom lancu prehrambenih i neprehrambenih proizvoda u Europi (u nastavku - Zelena knjiga) u kojoj je i navela glavne kategorije nepoštenih trgovačkih praksi.

Osim toga odredila je i subjekte kojima može nastati šteta korištenjem nepoštenih trgovačkih praksi, a to su odnosi među poduzetnicima ili poduzetnicima i osobama javnog prava u opskrbnom lancu prehrambenih i neprehrambenih proizvoda odnosno lanca koji služi dostavi robe prvenstveno namijenjenoj široj javnosti ili potrošnji u kućanstvu. Kako su većina tih poduzetnika u lancu opskrbe hranom mala, srednja i mikro poduzeća, primijećena je njihova ranjivost u odnosu na jače i veće trgovačke partnere i upravo njih najviše pogađaju nepoštenih trgovačkih prakse. One mogu imati izravne učinke koje utječu na njihovu sposobnost opstanka na tržištu, nova financijska ulaganja u proizvode i tehnologiju te razvoj prekograničnih aktivnosti malih, srednjih i mikro poduzeća na jedinstvenom tržištu, ali i neizravne učinke koji se očituju u strahu od ostvarivanja trgovinskih odnosa s potencijalnim partnerima.⁷

2. Pojam mikro, malih i srednjih poduzetnika

Mikro, mali i srednji poduzetnici smatraju se pogonom europske ekonomije te je devet od deset poduzeća mikro, mali ili srednji poduzetnik i zapošljavaju dva od tri radnika te je prema tome njihova uloga ključna za jačanje tržišnog natjecanja i povećanje zapošljavanja.⁸ Pojam mikro, malih i srednjih poduzetnika u europskom pravu, kao i u pravima država članica Europske unije određen je prvenstveno radi mogućnosti korištenja politika, programa, mjera i potpora koje daju Europska komisija i nacionalne države, kako bi ih se potaklo na financiranje i ulaganje u razvoj i inovacije. Stoga, definiciju mikro, malih i srednjih poduzetnika ne nalazimo u primarnom pravu Europske unije, kao niti u obveznom pravu nacionalnih država jer se radi o trgovcima koji se do sada nisu smatrali zasebnom kategorijom kojoj se dodjeljuje

³ Ibid.

⁴ Više o tome vidi u : A better functioning food supply chain in Europe, (COM(2009)591, 28 October 2009)

⁵ Lanac opskrbe hranom ima snažnu međunarodnu dimenziju i osobitu važnost u okviru jedinstvenog tržišta EU, jer prekogranična trgovina među državama članicama čini otprilike 20% ukupne proizvodnje hrane u EU, dok je barem 70% ukupnog godišnjeg izvoza poljoprivrednih proizvoda država članica namijenjeno drugim državama članicama. European Commission to tackle unfair practices in the food supply chain, Press Release, Brussels/Strasbourg, 15 July 2014

⁶ Prema podacima Eurostata iz 2012. čak 14% njihovih kućanskih izdataka otpada na hranu. U Hrvatskoj je situacija još nepovoljnija, jer prema podacima Državnog zavoda za statistiku o osnovnim karakteristikama potrošnje kućanstva u 2014. godini, Hrvatima čak 29.5% kućnih izdataka otpada na hranu i bezalkoholna pića.

⁷ COM (2014) 472 Final of 15.7.2014 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions; Tackling unfair trading practices in the business-to-business food supply chain

⁸ Vidi: file:///D:/Downloads/smedefinitionguide_en.pdf.

posebna pravna zaštita u odnosu na veće trgovce, premda su neki propisi doneseni prvenstveno radi njihove zaštite.⁹

Europska definicija sadržana je u čl. 2. Aneksa Preporuke Komisije iz 2003/361/EZ, prema kojoj su mikro, mali i srednji poduzetnici neovisna poduzeća koja zapošljavaju manje od 250 osoba i čiji godišnji promet ne prelazi 50 milijuna eura i /ili prema godišnjim financijskim izvješćima ne prelazi 43 milijuna eura.¹⁰

U Republici Hrvatskoj definicija je sadržana u Zakonu o poticanju razvoja malog gospodarstva.¹¹ Malo gospodarstvo u smislu tog Zakona čine subjekti u poduzetništvu i obrtu koji zapošljavaju prosječno godišnje manje od 250 radnika, u poslovanju su neovisni odnosno autonomni subjekti koji nisu klasificirani kao partnerski subjekti te povezani subjekti, sukladno Preporuci Komisije 2003/361/EC od 6. svibnja 2003. godine, prema financijskim izvješćima za prethodnu godinu ostvaruju godišnji poslovni prihod u iznosu protuvrijednosti do 50.000.000,00 eura ili imaju ukupnu aktivu ako su obveznici poreza na dobit odnosno imaju dugotrajnu imovinu ako su obveznici poreza na dohodak, u iznosu protuvrijednosti do 43.000.000,00 eura. Subjekti malog gospodarstva su fizičke i pravne osobe koje samostalno i trajno obavljaju dopuštene djelatnosti radi ostvarivanja dobiti odnosno dohotka na tržištu. Neovisnost u poslovanju, u smislu tog Zakona, znači da druge fizičke ili pravne osobe, koje ne udovoljavaju kriterijima iz stavka 1. ovoga članka, pojedinačno ili zajednički, nisu vlasnici više od 25 % udjela u vlasništvu ili pravu odlučivanja u subjektu malog gospodarstva. Neovisnost u poslovanju postoji i ako je prekoračen udjel od 25 % iz stavka 3. ovoga članka, u slučajevima: ako udio u vlasništvu ili pravu odlučivanja u subjektu malog gospodarstva ima investicijski fond ili drugi institucionalni ulagatelj, pod uvjetom da nemaju kontrolu nad subjektom malog gospodarstva, bilo pojedinačno ili zajednički ili ako raspored udjela u vlasništvu u subjektu malog gospodarstva nije moguće odrediti te se na osnovi posebne pisane izjave subjekta malog gospodarstva može opravdano pretpostaviti da druge fizičke ili pravne osobe, koje ne udovoljavaju navedenim kriterijima, pojedinačno ili zajednički nisu vlasnici više od 25 % udjela. Mikro subjekti malog gospodarstva su fizičke i pravne osobe iz članka 2. ovoga Zakona koje: prosječno godišnje imaju zaposleno manje od 10 radnika, prema financijskim izvješćima za prethodnu godinu ostvaruju godišnji poslovni prihod u iznosu protuvrijednosti do 2.000.000,00 eura ili imaju ukupnu aktivu ako su obveznici poreza na dobit odnosno imaju dugotrajnu imovinu ako su obveznici poreza na dohodak, u iznosu protuvrijednosti do 2.000.000,00 eura. Mali subjekti malog gospodarstva su fizičke i pravne osobe, koje prosječno godišnje imaju zaposleno manje od 50 radnika, prema financijskim izvješćima za prethodnu godinu ostvaruju godišnji poslovni prihod u iznosu protuvrijednosti do 10.000.000,00 eura ili imaju ukupnu aktivu ako su obveznici poreza na dobit odnosno imaju dugotrajnu imovinu ako su obveznici poreza na dohodak, u iznosu protuvrijednosti do 10.000.000,00 eura. Srednji subjekti malog gospodarstva su fizičke i pravne osobe čiji je godišnji prosječni broj radnika, ukupni godišnji promet ili zbroj bilance odnosno dugotrajna imovina veća od utvrđenih za malog subjekta.

⁹ Npr. u točki 1. Preambule Direktive 2000/35/EZ od 29. lipnja 2000. o borbi protiv kašnjenja u plaćanju u poslovnim transakcijama navodi da je Europski parlament u svojoj rezoluciji o integriranom programu u korist malog i srednjeg poduzetništva i obrtništva pozvao Komisiju da podnese prijedlog o rješavanju problema kašnjenja u plaćanju, iako se odredbe te Direktive primjenjuju na sva plaćanja izvršena radi naplate u transakcijama između poduzetnika, odnosno između poduzetnika i javnih tijela koja rezultiraju isporukom robe ili pružanjem usluga za naknadu.

¹⁰ U praksi nije lako odrediti radi li se o mikro, malom i srednjem poduzetniku. Europska komisija izdala je stoga upute za SME definiciju, vidi: file:///D:/Downloads/smedefinitionguide_en.pdf

¹¹ Narodne novine br. 29/02, 63/07, 53/12, 56/13.

3. Nepoštene trgovačke prakse

Nepoštene trgovačke prakse smatraju se prakse koje značajno odstupaju od dobrog poslovnog ponašanja, koje su oprečne dobroj vjeri i poštenoj trgovini te koje je jedan trgovinski partner jednostrano nametnuo drugome.¹²

Zelena knjiga uočila je neke od najučestalijih primjera nepoštene trgovačke prakse kao što su dvosmislene ugovorne odredbe, nepostojanje pisane forme ugovora, jednostrane promjene troška ili cijene proizvoda ili usluga s retroaktivnim učinkom, prijenos neopravdanog ili nerazmjernog rizika na ugovornu stranu, nepošteno korištenje informacija, jednostrani prekid poslovnog odnosa bez otkaznog roka ili prekid koji podliježe nerazumno kratkom otkaznom roku i bez objektivno opravdanog razloga i teritorijalne zabrane u opskrbi. Osim tih navedenih u Zelenoj knjizi, spomenut ćemo jednu koja se ne spominju u njoj, a u odnosu na koju je već donesena europska regulativa, a to je kašnjenje u plaćanju.

Svima je zajedničko da se one javljaju u "ozračju straha"¹³ u kojem je slabija ugovorna strana u strahu od prekida poslovnog odnosa s jačom stranom i upravo ta neravnopravnost stranaka stvara mogućnost nastanka nepoštene trgovačke prakse. Tipičan primjer takve situacije je prijetnja izbacivanja proizvoda iz ponude koju veliki trgovci na malo koriste da bi izravno ili neizravno iznudili razne oblike neopravdane i jednostrane koristi od dobavljača hrane.¹⁴

3.1 Nepoštene trgovačke prakse i Zakon o obveznim odnosima

Zakon o obveznim odnosima¹⁵ (u nastavku – ZOO) ne spominje direktno primjere nepoštene trgovačke prakse, što je i razumljivo jer se radi o Zakonu koji uređuje sve obvezne (ugovorne i izvanugovorne) odnose, ali ipak sadrži opća načela koja se primjenjuju na sve sudionike obveznog odnosa¹⁶. Tu se prije svega misli na načelo ravnopravnosti sudionika u obveznom odnosu, načelo savjesnosti i poštenja, načelo dužnosti suradnje te zabrane prouzročenja štete u skladu s kojima se treba promatrati svaki ugovor i poslovni odnos. Ova načela izgledaju suprotstavljena općem načelu slobode ugovaranja. Međutim, u nepoštenoj i neravnopravnoj situaciji nema prave slobode ugovornih stranaka. Sama činjenica da je netko ekonomski jača strana, ne predstavlja povredu prava, već kada je ta strana nepošteno postupila odnosno da je s drugom sklopila nepošteni ugovor ili ugovornu odredbu kao rezultat pregovora. Osim općih načela, u ZOO-u postoje i posebne odredbe koje mogu poslužiti kao rješenje za otklanjanje nekih od nepoštenih trgovačkih praksi.

3.1.1 Dvosmislene ugovorne odrede

Jedan od primjera nepoštene trgovačke prakse spomenute u Zelenoj knjizi je i postojanje dvosmislenih odredaba u ugovoru koje otvara mogućnost da se njihovim tumačenjem nameću dodatne obveze slabijoj ugovornoj strani. Naš ZOO ima rješenje za takvu praksu jer u čl. 320. propisuje da u slučaju kad je ugovor sklopljen prema unaprijed otisnutom sadržaju ili kad je ugovor na drugi način pripremila i predložila jedna ugovorna strana, nejasne odredbe tumačit će se u korist druge strane.

¹² COM (2016) 32 Final of 29.1.2016. Report from the Commission to the European Parliament and the Council on unfair business-to-business trading practices in the food supply chain

¹³ Europska komisija je razvila koncept koji naziva eng. „fear factor“.

¹⁴ COM (2013) 37 Final Mišljenje Stručne skupine za jedinstveno tržište, proizvodnju i potrošnju o Zelenoj knjizi o nepoštenim trgovačkim praksama među poduzećima u opskrbnom lancu prehrambenih i neprehrambenih proizvoda u Europi

¹⁵ Narodne novine br. 35/05, 41/08, 125/11, 78/15

¹⁶ Sudionici obveznih odnosa su fizičke i pravne osobe, bez obzira radi li se o trgovcima (B2B) ili potrošačima (B2C).

3.1.2 Nepostojanje pisane forme ugovora

Uočeno je da se nepoštena trgovačka praksa pojavljuje puno češće u ugovorima koji nisu sklopljeni u pisanoj formi. Naime, u takvim slučajevima je puno teže dokazati postojanje nepoštenih trgovačkih praksi. Naš zakonodavac ne propisuje obvezatnost određenog oblika pravnog posla, osim kao iznimke koje su posebno propisane. Ipak, bez obzira na sklapanje ugovora u usmenoj formi, ZOO u čl. 287. propisuje ovlaštenje bilo koje strane da od druge zahtijeva pisanu potvrdu usmeno sklopljenog ugovora sve dok druga strana ne ispuni obvezu iz ugovora. U slučaju da strana kojoj je upućen ovakav zahtjev isti odbije, druga strana može zahtijevati od suda da utvrdi postojanje ugovora i naknadu štete pretrpljene zbog toga što nije izdana pisana potvrda.

3.1.3 Prijenos neopravdanog ili nerazmjernog rizika na ugovornu stranu

Snošenje poslovnog rizika trebalo bi biti ravnomjerno podijeljeno između stranaka. Međutim, primijećeno je da trgovac na malo često prenosi rizik odgovornosti za krađu ili uništenje robe na dobavljača, iako mu je puno lakše kontrolirati krađu odnosno nestanak robe u svojim prostorijama. Nakon prenošenja rizika na dobavljača, interes trgovca na malo za provođenjem preventivnih mjera za sprječavanje krađe, odnosno nestanka robe drastično pada. Drugi načini nepoštenih trgovačkih praksi su i financiranje poslovnih aktivnosti drugog trgovca (npr. značajna ulaganja u njegove poslovnice) ili ubacivanje nekih dodatnih usluga uz prodaju proizvoda koje trgovac naplaćuje dobavljaču (npr. naknade za transport i promociju proizvoda, usluge vezane za korištenje prostora na policama i sl.). Stranke u ugovoru su slobodne odstupiti od dispozitivnih normi obveznog prava, međutim, ako su takve odredbe mikro, malom ili srednjem poduzetniku nametnute, tada se radi o nepoštenim ugovornim odredbama. Jači poduzetnik ne bi smio zlouporabom veće pregovaračke moći slabijem partneru nametnuti neravnomjerne obveze, tako da on snosi rizik i nakon predaje robe. Također, nepošteno je i da mu naplaćuje naknade za neisporučene usluge odnosno neisporučena dobra pa bi takve odredbe bile suprotne poslovnom moralu, kao dijelu koncepta morala društva, za što je propisana posljedica ništetnosti (čl. 322. st. 1. ZOO-a).

3.2 Nepoštene trgovačke prakse i Zakon o trgovini

Zakon o trgovini¹⁷ (u nastavku – ZOT) kao specijalni zakon za trgovinu u čl. 63. st. 1. daje definiciju nepoštenog trgovanja kao radnji trgovca kojima se radi tržišnog natjecanja povređuju dobri trgovački običaji¹⁸. To je generalna klauzula, koja se može primijeniti na sve slučajeve u ugovornom i izvanugovornom odnosu kada trgovac na tržištu postupi protivno poslovnom moralu.

U odnosu na definiciju iz Zelene knjige definicija iz ZOT-a je šira jer obuhvaća veći broj slučajeva koji se mogu podvesti pod definiciju nepoštenih trgovačkih praksi te ih ne ograničava na one slučajeve praksi koju je jedan trgovinski partner jednostrano nametnuo drugome. Razlika je i što ZOT navodi nepoštenu radnju trgovca, dok Zelena knjiga govori o praksi trgovca.

ZOT izričito zabranjuje nepošteno trgovanje, a kao posljedicu propisuje naknadu štete. U čl. 64. nabrajaju se primjeri nepoštenog trgovanja, koji se uglavnom razlikuju od onih nabrojanih u Zelenoj knjizi. No, s obzirom na propisanu generalnu klauzulu iz čl. 63. i svaka zlouporaba veće pregovaračke moći može se podvesti pod djelo protivno dobrim trgovačkim običajima. U nastavku ćemo prikazati neke od najčešćih primjera nepoštenih trgovačkih praksi spomenutih u Zelenoj knjizi.

¹⁷ Narodne novine br. 87/08, 96/08, 116/08, 76/09, 114/11, 68/13, 30/14

¹⁸ Pojam „dobri poslovni običaji“, označavaju poslovni moral, a koji pojam se razlikuje od trgovačkih običaja iz ZOO-a, kao dispozitivnog izvora prava.

3.2.1 Nepošteno korištenje informacija

Uobičajena razmjena podataka između trgovca i dobavljača o proizvodima koji su predmet kupoprodaje ne predstavljaju nepoštenu trgovačku praksu. Međutim, kada se ti podaci koriste za razvijanje vlastitog (konkurentskog) proizvoda, koji će spriječiti slabiju stranu u postizanju vlastite inovativnosti, onda korištenje takvih informacija predstavlja nepoštenu trgovačku praksu. Nepošteno korištenje informacija može predstavljati i odbijanje jedne strane da potpiše ugovor o tajnosti podataka ili nepoštivanje odredaba takvog ugovora.

ZOT u čl. 64. st. 1. al. 10. sadrži odredbu prema kojoj je zabranjeno protupravno pribavljanje poslovne tajne drugog trgovca ili bespravno iskorištavanje povjerene poslovne tajne drugog trgovca. Dakle, na ovaj slučaj naveden u Zelenoj knjizi kada veći poduzetnik zahtijeva od mikro, malog ili srednjeg poduzetnika otkrivanje podataka kako bi razvio vlastiti proizvod, mogla bi se primijeniti navedena odredba iz ZOT-a, jer bi tada veći poduzetnik bespravno koristio povjerenu poslovnu tajnu tog manjeg poduzetnika.

3.2.2 Jednostrani prekid poslovnog odnosa bez otkaznog roka ili prekid koji podliježe nerazumno kratkom otkaznom roku i bez objektivno opravdanog razloga

Ispunjenjem dugovane činiidbe redovito prestaje i poslovni odnos među strankama. Međutim, ponekad okončanje tog odnosa može predstavljati nepoštenu trgovačku praksu. Na primjer ZOT propisuje da nepošteno trgovanje predstavljaju radnje trgovca usmjerene na prekid poslovnih odnosa, između drugih trgovaca ili koje sprječavaju ili otežavaju poslovne odnose drugih trgovaca te neopravdano neispunjavanje ili raskidanje ugovora s pojedinim trgovcem kako bi se sklopio isti ili povoljniji ugovor s drugim trgovcem. Dakle, ZOT posebno ne navodi da je nepošteno i kad je poslovni odnos prekinut iznenada i bez ostavljanja primjerenog otkaznog roka. Prema tome, kada je na taj način veliki poduzetnik prekinuo poslovni odnos s mikro, malim ili srednjim poduzetnikom, trebalo bi se to primjenom odredbe iz čl. 63. ZOT-a smatrati nepoštenim trgovanjem jer mikro, mali i srednji poduzetnik treba predvidjeti trajanje ugovora kako bi imao vremena isplatiti svoju investiciju ili barem dobiti primjereni otkazni rok.

3.2.3 Teritorijalne zabrane u opskrbi

Primijećeno je da pojedini multinacionalni lanci, koristeći teritorijalne zabrane u opskrbi, sprječavaju trgovce na malo da nabave određene proizvode preko granice u centralnim skladištima i distribuiraju ih dalje po državama članicama. Naime, proizvođači jakih trgovačkih marki koji kontroliraju logistiku i veleprodajni lanac nemaju interesa za smanjivanjem cijena te će pregovarajući o uvjetima ugovora, nastojati održati razlike u cijeni proizvoda na razini država članica.

S druge strane, trgovci na malo nastoje nabaviti te proizvode po jeftinijim cijenama u veleprodajnim outletima ili podružnicama dobavljača i tako stvoriti pritisak proizvođačima, sklapajući ugovore direktno s konkurentskim dobavljačima koji nude vlastite trgovačke marke.

Trgovci u manjim državama članicama upozoravaju da u situacijama kada traže proizvode od stranih veletrgovaca ili direktno od dobavljača iz drugih, po cijeni puno konkurentnijih tržišta, oni ih upućuju na svoje podružnice odgovorne za to geografsko područje ili njihove nacionalne veletrgovce, koji imaju teritorijalne ugovore s dobavljačima. Upravo takva ograničenja stvaraju podjele na tržištu, koje u konačnici, rezultiraju značajnim razlikama u cijeni među državama članicama.¹⁹ Sve ovo negativno utječe na potrošače, kojima su cijene proizvoda više, a izbor uži, što je oprečno s koristima koje bi trebali imati na unutarnjem

¹⁹ Prema podacima Irskog parlamentarnog odbora iz veljače 2009, cijene određenih proizvoda u Irskoj i Ujedinjenom Kraljevstvu se značajno razlikuju, čak do 130%.

tržištu EU-a. Inače, prema pravu zaštite tržišnog natjecanja ništetni su ugovori kojima se dijele tržišta. Međutim, kada poduzetnici nisu sklopili ugovor o podjeli tržišta, a određena praksa poduzetnika dovodi do *de facto* podjele tržišta, tada se može raditi o nepoštenom trgovanju u smislu odredbe iz čl. 63. ZOT-a.

3.3 Nepoštene trgovačke prakse i ostali propisi

Pojedini primjeri trgovačke prakse koji nisu navedeni u Zelenoj knjizi niti poimence u ZOT-u ipak predstavljaju značajna kršenja dobre trgovačke prakse i ne samo što značajno otežavaju poslovanje malim trgovcima, nego ih u nekim situacijama dovode do stečaja i likvidacije. I u ovim slučajevima postoje razrađeni mehanizmi kako izbjeći takvu praksu, ali ih zbog već spomenutog straha slabije strane kojoj je takva praksa nametnuta, ta strana rijetko koristi.

3.3.1 Kašnjenja u plaćanju

Zakonom o financijskom poslovanju i predstečajnoj nagodbi²⁰ (u nastavku - ZFPPN) propisani su rokovi ispunjenja novčanih obveza i pravne posljedice zakašnjenja u cilju suzbijanja zakašnjenja s ispunjenjem novčanih obveza. Tako je ZFPPN-om određen rok plaćanja za poslovne transakcije između poduzetnika i osoba javnog prava u kojima je osoba javnog prava dužnik novčane obveze. Pravilo je da se u odnosima između poduzetnika može ugovoriti rok plaćanja koji nije dulji od 60 dana²¹, dok u slučaju kada stranke propuste ugovoriti taj rok, isti ne može biti dulji od 30 dana. U poslovnim transakcijama između poduzetnika i osoba javnog prava u kojima je osoba javnog prava dužnik novčane obveze, može se ugovoriti rok ispunjenja novčane obveze do 30 dana²². Isti rok važi i ako ga stranke nisu ugovorile.

Bez obzira na rokove, mnogi mali trgovci iz straha od prekida poslovanja s velikim supermarketima, ne poduzimaju nikakve radnje radi prisilne naplate takvih dospjelih potraživanja. Naime, svjesni da će u takvom slučaju teško plasirati svoje proizvode na tržište, prešutno odustaju od rokova propisanih ZFPPN-om što u većini slučajeva dovodi do otežane likvidnosti, a na kraju i stečaja malih trgovaca.

4. Zaključak

Mikro, mali i srednji poduzetnici su važan čimbenik u gospodarstvu pa su Europska unija i nacionalne države razvile niz politika, programa i mjera za njihovo poticanje. Kako su mikro, mali i srednji poduzetnici profesionalci koji u pravnom prometu trebaju postupati s povećanom pažnjom, do sada nisu razvijena posebna pravila koja ih štite od većih trgovaca. Međutim, zbog sve većeg rasta određenih poduzetnika koji dobivaju značajnu pregovaračku moć, na tržištu su se počele javljati nepoštene poslovne prakse u odnosu na mikro, male i srednje poduzetnike. Budući da nepoštena trgovačka praksa utječe i na ekonomska prava potrošača kao i na pravilno funkcioniranje unutarnjeg tržišta, Europska komisija je 2013. donijela Zelenu knjigu o nepoštenim trgovačkim praksama među poduzećima u opskrbnom lancu prehrambenih i neprehrambenih proizvoda u Europi u kojoj je navela glavne kategorije nepoštenih trgovačkih praksi. Nepoštene trgovačke prakse javljaju se kada jača strana zlouporabi svoju poziciju kako tijekom pregovora tako i tijekom ugovornog odnosa. Tako naš Zakon o obveznim odnosima sadrži niz načela i posebnih odredbi koje se mogu primijeniti na nepoštene ili nejasne ugovorne odredbe ili u slučaju kada pisani ugovor nije sklopljen. Također, u preostalim slučajevima, do donošenja posebne regulative Europske unije, moguće

²⁰ Narodne novine br. 108/12, 144/12, 81/13, 112/13, 71/15, 78/15. Zakon je dijelom usklađen s Direktivom 2011/07/EU Europskog parlamenta i Vijeća od dana 16. veljače 2011. godine o suzbijanju zakašnjenja s plaćanjem u trgovačkim ugovorima (SL 048, P. 0001 – 0010, 23. 02. 2011.).

²¹ Iznimno se taj rok može produljiti do 360 dana.

²² Iznimno se taj rok može produljiti do 60 dana.

je primijeniti posebne odredbe Zakona o trgovini ili ako pojedino djelo nije navedeno tada generalnu klauzulu, koja pruža široku osnovu za zaštitu oštećenog poduzetnika.

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Protecting small and medium entrepreneurs from unfair trade

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Abstract. Today, big chain stores frequently compete directly with small or medium manufacturers or traders, via their own house brands. Moreover, a favorable bargaining position enables big entrepreneurs to dominate small and medium entrepreneurs and to act unfairly when signing contracts, as well as during the course of the contractual relationship. In our legal system, stipulations related to unfair trading can be found in the Trade Act, which does not differentiate between small, medium and big entrepreneurs, and consequently does not include specific stipulations on prohibiting abuse of superior bargaining power. Due to inadequate protection of small and medium entrepreneurs from unfair trading practice in national legislatures, the European Commission has issued the "Green Paper

on unfair trading practices in the business to business food and non-food supply chain in Europe" in January 2015. In this paper, we analyze the acts of unfair trading in regards to small and medium entrepreneurs, and look into possibilities of legal protection in accordance with the current regulations of republic of Croatia. Finally, the paper shows the necessity of legislative intervention and modernization of our regulations on unfair trading.

Key words: *unfair trade practice, small and medium entrepreneurs, abuse of superior bargaining power*

Utjecaj logistike na maloprodaju i fizičku distribuciju u prehrambenoj industriji

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Sažetak. Globalizacijom tržišta i rastom trgovine prehrambenih proizvoda pred proizvođače se postavljaju sve kompleksniji zadaci. Cilj je u što kraćem vremenu isporučiti prehrambene proizvode i time zadovoljiti sve zahtjevnije potrošače. S druge strane, procesi distribucije koji uključuju pakiranje, skladištenje, transport, manipulativne operacije i druge usluge, često su kritična točka u opskrbnom lancu. Kvalitetan sistem distribucije prehrambenih proizvoda podrazumijeva primjenu određenih standarda i procedura na kompletnom logističkom lancu. Svježi izgled hrane povećava prodaju, a kupci često kvalitetu namirnice poistovjećuju s kvalitetom prodajnog mjesta. Stoga kvaliteta i zdravstvena ispravnost proizvoda moraju biti ciljevi svima koji su uključeni u prehrambeni lanac, od proizvođača, preko distributera do maloprodajnih objekata koji proizvode isporučuju do krajnjeg potrošača. Proizvođači postaju svjesni kako bez učinkovitog sustava upravljanja kvalitetom skladištenja i transporta ne mogu biti sigurni da će do kupca stići siguran i kvalitetan proizvod. U ovom radu dajemo osvrt na nove tehnologije u području logistike te na tržišne trendove koji utječu na specifičnost isporuke prehrambenih proizvoda, njihovu kvalitetu i sigurnost.

Ključne riječi: logistika, fizička distribucija, maloprodaja, prehrambeni proizvodi.

1. Uvod

Pod utjecajem informatizacije, internacionalizacije i globalizacije dogodile su se dramatične promjene u maloprodaji kao što su ubrzavanje maloprodajnih procesa, stvaranje novih prodajnih oblika i ubrzani rast prihoda. U posljednjih desetak godina najveći utjecaj na daljnji razvoj maloprodaje ima logistika kroz smanjenje troškova i poboljšanje razine kvalitete usluga unutar maloprodaje. Unutar logistike dolazi do promjena koje su posljedice tržišnih trendova koji utječu na logistiku. Među najznačajnijim trendovima je dramatično skraćivanje životnog ciklusa proizvoda koji tjera sudionike na ključnu promjenu dosadašnjih procesa i na međusobnu suradnju, komunikaciju i partnerstvo u cjelokupnom lancu opskrbe u cilju očuvanja profitabilnosti poslovanja (Vouk, 2005) .

Logistički lanac opreme i isporuke prehrambenih proizvoda obuhvaća niz procesa i aktivnosti vezanih za pakiranje, transport, skladištenje, manipulativne operacije i druge usluge neophodne za isporuku robe krajnjem potrošaču. Svi navedeni procesi i aktivnosti predstavljaju potencijalno mjesto opasnosti i rizika koji mogu dovesti do oštećenja robe i smanjivanja kvalitete i sigurnosti hrane. Kvalitetan sistem distribucije prehrambenih

proizvoda podrazumijeva primjenu određenih standarda i procedura na kompletnom logističkom lancu.

Preduvjet u participaciji u globalnoj trgovini hranom je kreiranje strategije koja uključuje transparentnost u cijelom postupku od proizvodnje do potrošača i razmjenu informacija unutar svih subjekata u lancu. Sljedivost je važan alat bez kojega kontinuirano praćenje i kontrola ne bi bila moguća koji kao dio zakona EU 2005. godine je obvezujući za veliki broj proizvođača hrane i pića koji žele sudjelovati na tom tržištu.

2. Praćenje kvalitete prehrambenih proizvoda

Kvaliteta prehrambenih proizvoda postaje sve važnija kupcima iz Europske unije kojima odluka o kupnji sve češće postaje rezultat informativnih oznaka na proizvodima pri čemu kupci žele znati odakle proizvodi dolaze i kako su proizvedeni (Dimara i Skuras, 2005).

Osiguranje kvalitete prehrambenih proizvoda posebno je kompleksno u situaciji kada se za proizvodnju proizvoda koriste proizvodi više dobavljača, što je skoro uvijek slučaj. U tom slučaju moguće je primijeniti model osiguranja kvalitete (engl. quality assurance model) u prehrambenom lancu dobavljača (engl. food supply chain) koji se smatra dokazanim mehanizmom za proizvodnju kvalitetnih proizvoda i usluga (Manning, 2006).

2.1. Konceptija sljedivosti proizvoda

Konceptija sljedivosti proizvoda znači pravodobno i točno praćenje fizičkog kretanja gotovih proizvoda i njegovih sastojaka kroz prostor i vrijeme odgovarajućim tijekom podataka, strogo redosljedno, po sekvencama s mogućnošću vraćanja unatrag.

Moe, Baines i Chadd (1998) smatraju da prema široj koncepciji sljedivosti sustav mora biti u mogućnosti povijesno pratiti proizvodne serije duž cijelog proizvodnog lanca ili njegova dijela od trenutka žetve, preko transporta, skladištenja, prerade, distribucije i prodaje (lanac sljedivosti) ili interno unutar neke od funkcija spomenutih u lancu sljedivosti.

Prema Schwagele, (2005) možemo razlikovati dva različita pravca praćenja u procesu sljedivosti :

- 1) Praćenje (engl. Tracking) je mogućnost da se slijedi put specificirane jedinice ili serije proizvoda kroz silazni protok lanca od početne točke do kraja. Ovaj se smjer praćenja naziva još i „niz tijek“ (engl. Downstream ili top-down), a opisuje postupke i alate ugrađene sa svrhom lociranja događaja nakon prijenosa vlasništva ili fizičkog prijenosa robe partnera iz lanca, trećem korisniku. Smisao bi bila da se može odrediti i pozvati aktualni status pošiljke, njene karakteristike u bilo kojoj točki lanca, npr. u logističke svrhe.
- 2) Traženje (engl. Tracing) je mogućnost identificiranja podrijetla specificirane jedinice ili serije proizvoda locirane unutar lanca, upućivanjem na zapise koje drže sudionici u smjeru prema početku lanca ili uzlaznom tijeku lanca „uz tijek“ (engl. upstream ili bottom-up). Osnovni smisao je mogućnost rekonstrukcije prošlosti neke pošiljke, pakiranja i sl. na način da se odredi lokacija proizvoda unutar svih točaka lanca kroz koje je prošao. Na taj se način postiže jednostavnost opoziva, odnosno povlačenja s tržišta.

Informacije koje se putem sustava sljedivosti prate mogu se pohraniti na dva načina: lokalno, u pojedinoj točki lanca tako da se sljedećoj točki šalju samo identifikatori proizvoda ili globalno, sve informacije kreću se duž lanca zajedno s proizvodom (Moe, 1998). U praksi se većina informacija pohranjuje lokalno, a manji broj slijedi proizvod tj. globalno. Razvijanje sustava sljedivosti ima za cilj osigurati da te informacije budu lako i brzo dostupne svim sudionicima aktivnosti i tokovima proizvodnog procesa. Moguće metode za postizanje tog cilja bile bi:

- 1) Kodirati proizvod i njegovu lokaciju u svakoj fazi;
- 2) Pohraniti i povezati podatke: odrediti vrijeme čuvanja podataka, metodu pohrane, lokacije i osnovne podatke koji se čuvaju i
- 3) Utvrditi i prikazati odgovornost za pojedinu fazu slijeđenja.

Osnovno je da svi članovi duž lanca imaju jednake standarde za kvalitetu i jednaku infrastrukturu informacija. Rješenje problema prikupljanja, transferiranja i analiziranja podataka unutar prehrambene industrije jest postojanje zajedničkog standarda komuniciranja dostupnog svima (Wilson i Clarke, 1998).

3. Standardi Europske unije za sljedivost

Zbog zakonodavnih promjena, tijekom devedesetih godina došlo je do porasta standarda i organizacija koje ih izdaju i pomaže ubrzavanju primjene sustava sljedivosti cjelovito i na čitavom području industrije hrane. Neki od tih standarda su obveznog karaktera, poput HACCP-a dok je primjena većeg broja standarda dobrovoljna.

Osnovne smjernice za razvoj standarda i njegovu provedbu nalaze se u Zakonu o hrani Europske unije iz 2002. godine. Njihova se svrha odnosi na poboljšanje standarda i konzistenciju dobavljača, uklanjanje nedostataka proizvoda, izbjegavanje višestrukih provjera te osiguranju jasnih informacija i potpore u slučaju incidenata s hranom (Vellema i Boselie, 2003). Kako sljedivost ima ključnu ulogu u prevenciji potencijalni šteta i rizika u prehrambenom lancu, na način da identificira i izolira rizike te poduzima korektivna akcije u slučaju incidenata, inkorporirana je u sve standarde za sigurnost i očuvanje kvalitete kao nezaobilazan element.

3.1. CIES (Food Business Forum)

Organizacija se sastoji od 175 vodećih međunarodnih trgovačkih lanaca i dobavljača iz preko 150 zemalja cijelog svijeta, zapošljava preko 4,5 milijuna ljudi i surađuje s približno 600 trgovina. CIES je od svog osnutka isticao kako je sigurnost hrane kao i zaštita potrošača i njihovo povjerenje prioritet u poslovanju. CIES je razvio Globalnu inicijativu za sigurnost hrane (GFSI) kojoj je svrha harmonizacija postojećih standarda kako bi se dobila jedinstvena norma umjesto sadašnje prakse gdje svatko definira vlastite standarde (Omejec i Pejić Bach, 2007).

3.2. IFS

Međunarodni standard za hranu (International Food Standard) razvili su njemački maloprodajni lanci radi provjere privatnih robnih marki, a prihvatila ga je i Nacionalna udruga njemačkih trgovaca 2002. godine. Cilj je bio razviti međunarodnu sigurnosnu normu za tvrtke koje se bave proizvodnjom privatnih robnih marki za trgovačke lance s jednoobraznim formulama, postupcima provjere i uzajamnim prihvaćanjem tih provjera. IFS norma osigurava visoku razinu transparentnosti diljem lanca isporuke robe, tj. prometa hrane (Omejec i Pejić Bach, 2007).

3.3. SQF (Safe Quality Food)

SQF predstavlja certifikat kojim se jamči da je proizvod, proces ili usluga potpuno u skladu s međunarodnim zakonodavnim i drugim specifičnim standardima (SQF Institute, 2006). Svrha certifikata je da svojom metodologijom spriječi i smanji slučajeve neadekvatne i opasne hrane na tržištu, a pridržavanje standarda koji propisuje SQF osigurava proizvodima visoki stupanj prihvaćenosti na globalnom tržištu (Omejec i Pejić Bach, 2007).

4. HACCP sistem u logistici

U proizvodnji i distribuciji hrane najznačajniji su njena kvaliteta i sigurnost. Svi sudionici proizvodnje i distribucije obvezni su izvršiti mjere prevencije kako bi se tržištu ponudila kvalitetna i zdrava hrana. Kao rezultat ovih nastojanja razvijen je koncept za analizu opasnosti i kritičnih kontrolnih točaka koji je nazvan HACCP (Hazard Analysis Critical Control Points). Originalni koncept HACCP-a je javnosti predstavljen 1971. godine, a 1985. Američka nacionalna akademija nauka (National Academy of Science) preporučila je korištenje ovog sistema.

U tadašnjim državnim propisima o ispravnosti i sigurnosti hrane, ali i u praksi, uočen je veliki broj nedostataka i zahtijevano je da se u buduću kao osnova za kontrolu procesa i sigurnosti hrane u SAD upotrebljava HACCP, a kasnije se počeo primjenjivati i u cijelom svijetu. Primjena HACCP sistema je nužna u svim područjima i fazama lanca proizvodnje, distribucije i konzumiranja hrane.

4.1. Razvoj HACCP sustava i standarda

Prema Cliver i Tajkarimi (2007) HACCP sustav čine dvije osnovne komponente:

- 1) HA (Hazard Analysis) – analiza rizika (identifikacija opasnosti u svakoj od faza proizvodnje i isporuke hrane i procjena značaja tih opasnosti za ljudsko zdravlje) i
- 2) CCP (Critical Control Points) – kritične kontrolne točke u lancu hrane u kojima je moguće spriječiti ili u potpunosti eliminirati rizik ili njegov utjecaj svesti na prihvatljiv nivo kao i vršiti njihovu kontrolu.

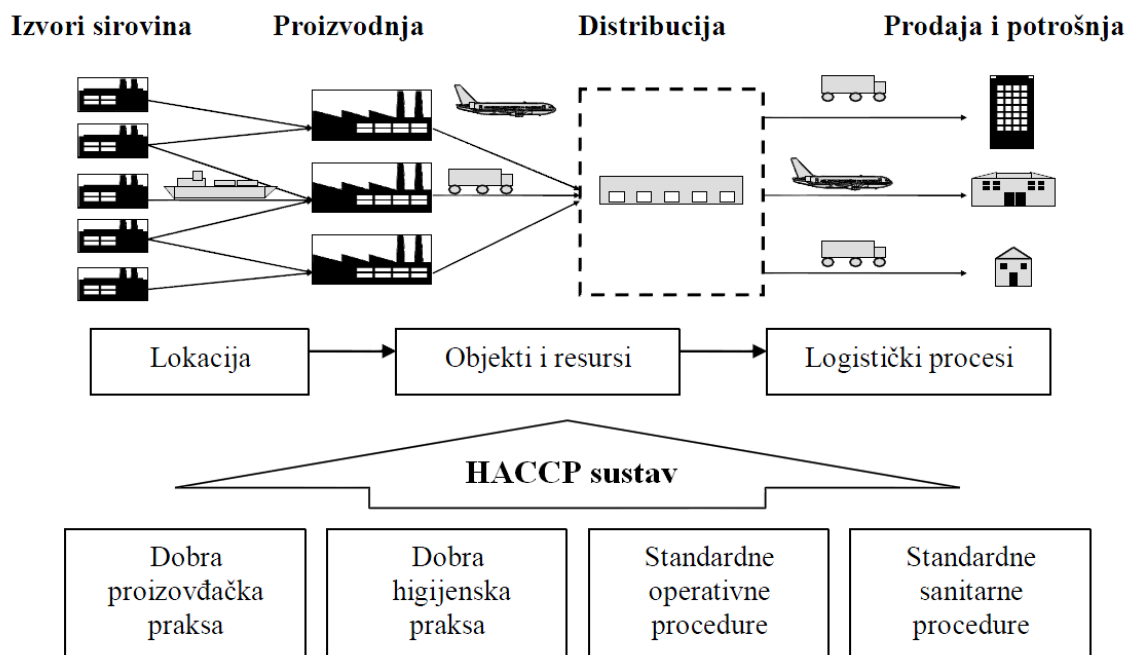
Uvođenje HACCP-a i standarda ISO 22000:2005 je imperativ za dostizanje tržišne konkurentnosti. Od 01. siječnja 2006. god. standardi sigurnosti hrane, posebno HACCP-a su obavezni na tržištu EU i Svjetske trgovinske organizacije. Implementacija HACCP-a je uvjet za izvoz naših prehrambenih proizvoda kao i uvjet da bi se uopće počelo pregovarati s velikim kupcima iz razvijenih zemalja.

Na području logistike i opskrbe prehrambeni proizvodi su izloženi utjecaju različitih rizika i opasnosti koji mogu ugroziti sigurnost hrane i ugroziti zdravlje potrošača. Svi logistički sistemi koji se bave distribucijom i isporukom hrane moraju razvijati i uvesti HACCP sistem i druge standarde sigurnosti hrane.

Uspješna primjena HACCP sistema uključuje cijeli tim eksperata različitih struka jer je nužan timski pristup rješavanju problema. Implementacija HACCP sustava mora uključiti i analizu kritičnih kontrolnih točaka kao potencijalnih mjesta opasnosti. Pri tome je potrebno voditi računa o lokaciji logističkih sustava koji će osigurati sigurno skladištenje, pakiranje, rukovanje i transport prehrambenih proizvoda, a da nisu izložena zagađenom okruženju ili nisu u blizini industrijskih postrojenja i drugih izvora kontaminacije hrane; objektima, sredstvima i opremi koja se koristi za kretanje i skladištenje prehrambenih proizvoda i logističkim procesima i aktivnostima vezanim za prijem, rukovanje, skladištenje, pakiranje i transport robe.

U program obavezne implementacije HACCP sistema moraju biti uključene i logističke kompanije koje se bave distribucijom i isporukom prehrambenih proizvoda. Ne može se govoriti o sigurnosti i zdravstvenoj ispravnosti prehrambenih proizvoda u lancu opskrbe ukoliko se ne primjenjuju odgovarajuće procedure, principi i standardi. Svi koji dolaze u dodir sa proizvodom u bilo kojoj fazi njegove obrade, prerade ili distribucije moraju primjenjivati HACCP koji omogućava „sljedivost“ i praćenje proizvoda u kompletnom logističkom lancu, a „sljedivost“ (engl. Traceability) je važan element u proizvodnji hrane, a povezuje se s identificiranjem proizvoda, praćenjem podrijetla materijala i sirovina, proizvodnje, prerade, distribucije i prodaje.

Svaka karika lanca proizvodnje, prerade, pakiranja, skladištenja, transporta, distribucije i rukovanja hranom predstavlja dio kompleksnog HACCP sustava (Slika 1.).



Slika 1. Položaj HACCP sustava u logističkom lancu (Kilibarada, Manojlović i Andrić, 2007) .

Izuzetno je važno izvršiti analizu procjene rizika koja se provodi na temelju ocjene vjerojatnosti pojavljivanja (mala, srednja ili velika) rizičnog događaja i ozbiljnosti posljedica za zdravlje kupaca odnosno reputaciju proizvođača (velika, srednja ili mala). Proces skladištenja robe prate fizičke, kemijske i mikrobiološke opasnosti.

Kao bitne komponente HACCP-a u logističkom sustavu izdvajaju se karakteristike proizvoda koje se odnose na fizička, kemijska, mikrobiološka i sezonska svojstva bitna za sigurnost prehrambenih proizvoda. Svaki proizvod koji se pojavljuje u logističkom lancu mora sadržavati specifikaciju i opis osjetljivosti proizvoda i potencijalne opasnosti za sigurnost.

Zahtjevi koji se postavljaju u sklopu svakog logističkog procesa prema Cliver i Tajkarimi (2007) odnose se na sljedeće:

- 1) Primarno pakiranje, podrazumijeva ambalažu koja je u neposrednom kontaktu s proizvodom i koja treba biti od odobrenih materijala za pakiranje prehrambenih proizvoda kao i sam proces i uvjete pakiranja proizvoda. Višekratno pakiranje mora biti otporno, jednostavno za pranje i dezinfekciju.
- 2) Transportno pakiranje uključuje utovarno manipulativne jedinice i ambalažu u koju se slažu i pakiraju primarna pakiranja odnosno procese formiranja i rasformiranja različitih utovarnih jedinica i pojava oblika robe u pojedinim fazama logističkog lanca.
- 3) Manipulacija robom koja obuhvaća načine, postupke i procedure vezane za tehnologiju utovara, pretovara i istovara robe. Potrebno je definirati načine podizanja, premještanja i odlaganja proizvoda koji će omogućiti očuvanje svih zdravstvenih i sigurnosnih svojstava.
- 4) Uvjeti skladištenja, potrebno je poznavati sve uvjete vezane za skladištenje određenog proizvoda kao što su temperatura, vlaga, provjetravanje i ostala specifična svojstva.
- 5) Uvjeti transporta, definiranje procesa distribucije, na koji način i kojim sredstvima i kako robu dopremiti na određeno mjesto.
- 6) Označavanje i obilježavanje proizvoda uključuje deklaracije proizvoda. Svaki proizvod mora biti jasno označen i s istaknutom deklaracijom posebno ako postoje zahtjevi za posebnim tretmanom u bilo kojem segmentu logističkog lanca.

Svaki logistički podsistem mora osigurati uvjete nužne za zaštitu hrane dok je ona u njihovoj nadležnosti. To se osigurava primjenom „dobre proizvođačke prakse“ GMP – *Good Manufacture Practices* ili „dobre higijenske prakse“ GHP – *Good Higijnick Practices*. Time se ispunjavaju preduvjeti za uspostavljanje i primjenu HACCP sistema i izradu HACCP planova. HACCP plan pisani je dokument koji je temeljen na HACCP principima i opisuje procedure koje se primjenjuju tijekom primjene HACCP sustava. Kompleksnost logističkih aktivnosti znatno usložnjava proces izrade HACCP plana.

5. Specifičnosti distribucije prehrambenih proizvoda

Lanac stvaranja vrijednosti u gospodarskom sektoru prehrambenih proizvoda počinje ondje gdje završava poljoprivreda, a završava tamo gdje konačni potrošač preuzima prehrambene proizvode. Prehrambeni proizvodi koji su proizvedeni u prehrambenoj industriji ili prehrambenom obrtu mogu se do potrošača kretati posredstvom trgovine na veliko, trgovine na malo, preko centralnog skladišta ili izravno (Schubert, 2007).

Centralna su skladišta uobičajena kod prehrambenih proizvoda koji nisu lako pokvarljivi, npr. smrznuta hrana. Izravna prodaja je česta kod prehrambenih proizvoda koje proizvodi obrtnik npr. mesnica, pekara, mliječni proizvodi, dok veliki potrošači nabavljaju robu izravno od proizvođača, trgovine na malo ili centralnih skladišta.

Opskrbni lanac za prehrambene proizvode je od izuzetne važnosti kako za ukupni gospodarski sektor prehrambenih proizvoda tako i za poljoprivredu. Logistički je koncept odlučujući za izbor novih lokacija prehrambene industrije i centralnih skladišta. Često se svježi poljoprivredni proizvodi proizvode na način da primatelj kontrolira i preuzima proizvodnju npr. sjetva žitarica, berba voća, koja se dalje upućuje na preradu u prehrambenu industriju jer se na taj način smanjuju gubici vrijednosnih sadržaja hrane. Što su kraći putevi distribucije, to je kvaliteta prehrambenih proizvoda veća.

Odgovarajućom se distribucijom utječe na kvalitetu, a time i na konačnu prodajnu cijenu pa se zbog toga postavljaju i odgovarajući zahtjevi na distribucijski lanac. Za održivost svježih prehrambenih proizvoda bitna je i tehnologija npr. hlađenje voća ili povrća.

U trgovni na malo prehrambenim proizvodima danas se razvija sve manje manjih i sve više većih prodavaonica prehrambenih proizvoda. Razlog tomu je što veća trgovniska poduzeća i grupacije imaju veliku tržišnu snagu i međusobno se nalaze u odnosnima konkurentske borbe, što utječe na skraćivanje distribucijskih kanala, što ujedno utječe na njihovu kvalitetu i sigurnost. U skladu s navedenim tendencijama, mora se voditi računa o okruženju u kojem se sami procesi odvijaju, ali isto tako i o unutrašnjim faktorima koji često mogu dovesti do nekog rizika. Kako bi identificirali mjesta rizika te osigurali kvalitetu prehrambenih proizvoda, potrebno je prethodno definirati standarde i mjere kojima će biti obuhvaćeni svi logistički procesi (Segetlija, 2010).

5. Zaključak

Na području logistike, prehrambeni proizvodi su konstantno izloženi utjecaju različitih opasnosti koje mogu dovesti do značajnih problema vezanih za sigurnost hrane i ugrožavanje zdravlja potrošača. S druge strane, procesi distribucije koji uključuju skladištenje i transport proizvoda često su kritična karika u prehrambenom lancu. Jedan od razloga je dinamičnost tih procesa gdje je proizvod potrebno dostaviti s jedne lokacije na drugu u što kraćem vremenu.

U distributivni lanac prehrambnih proizvoda često je uključen velik broj sudionika koji mogu biti, ali vrlo često nisu, zaposlenici tvrtke proizvođača. Zato sudionici u distribucijskom lancu moraju međusobno surađivati te imati uvid u praksu prethodnih i budućih sudionika, što uključuje dokumentiranje postupaka skladištenja i distribucije, propisivanje uvjeta te zahtjeva vezanih uz uređenje skladišnih prostora. Iz tih razloga, svi logistički sustavi koji se bave

distribucijom i isporukom hrane moraju razvijati i uvoditi HACCP sustav i standarde sigurnosti hrane.

U kontekstu navednog možemo istaknuti važnost ne samo nastavka implementacije sustava o sigurnosti hrane u svim fazama procesa proizvodnje do distribucije hrane, već i njegovog unaprjeđenja i razvijanja.

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The impact of logistics on retailing and physical distribution in food industry

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Abstract. Market globalization and food trade growth have been posing ever more complex problems for producers. The aim is to deliver as much food possible in the shortest possible period, and by doing so, satisfy demanding consumers. On the other hand, distribution processes that include packing, storing, transport, manipulative operations, and other services, are often the weakest link in the supply chain. A quality system of food distribution requires the application of certain standards and procedures in the complete logistics chain. A fresh food appearance increases sales, and buyers often identify the quality of the product with the quality of the retail store. Therefore, the quality and the health safety of products have to be the aims shared by every part of the food chain, from producers, to distributors, to retailers that deliver the products to the end consumer. Producers have become aware that they cannot be certain that the safety and quality products will reach their buyers without an efficient storage and transport control system. In this study we deal with new technologies in the field of logistics and market trends that have effect on the specificity of food delivery, its quality and safety.

Key words: *logistic, physical distribution, retailing, food*

Veza klime i sezonalnosti turističkog poslovanja priobalnih odmorišnih destinacija

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Sažetak. Veza klime i turizma na prvi pogled predstavlja jasne korelacijske odnose. No, paradoksnu detaljnim razmatranjem razvidne su brojne nelogičnosti. Poznato je da je klima jedan od ključnih turističkih resursa na kojem brojne destinacije, posebno one orijentirane odmorišnom priobalnom turizmu, grade svoju atrakcijsku osnovu. Klima, kao prirodni resurs, izdvojena je komponenta atrakcijske osnove, posebice u destinacijama priobalnog odmorišnog turizma, koje svoje poslovanje temelje na pogodnim klimatskim uvjetima. Paradoksnu, ovaj pokretač turističkih aktivnosti ujedno je i ograničavajući faktor turističkog razvoja. Naime, na klimu se gleda kao na glavnog uzročnika sezonalnosti turizma. Pogodni klimatski uvjeti čine destinaciju popularnu u jednom dijelu godine i zaboravljenu u drugom. Sezonska koncentracija turističke potražnje implicira brojne negativne učinke na turističku destinaciju. Svođenjem turističkih aktivnosti u kratko razdoblje godine, odnosno ljetnu turističku sezonu, s velikim diferencijama razine iskorištenosti kapaciteta između ljeta i zime, implicira ekonomsku, ekološku i sociokulturnu neodrživost poslovanja. Navedena kontradiktornost zahtijeva detaljnu analizu što je cilj ovog rada.

Ključne riječi: klima, atraktivnost, sezonalnost, priobalna odmorišna destinacija

1. Uvod

Varijacije u klimatskim uvjetima stvaraju različite sezonske potencijale i resurse turističkih odredišta, za koje se percipira da imaju određene sezonske kvalitete (Lee i dr. 2008.). Iz ovog fenomena nastaju sezonski turistički prostori koji su popularni tijekom turističke sezone i zaboravljeni u vansezonskom razdoblju, time su same turističke destinacije korelirane sa sezonskim krajolikom koji izravno ili neizravno proizvodi najveće turističke atrakcije (Haas i dr., 2007.). Turističke destinacije orijentirane odmorišnom kupališnom turizmu profitiraju zbog značaja ovoga vida turizma u ukupnim turističkim tokovima. Kupališne destinacije, kao što je hrvatsko priobalje, dodatnu prednost ostvaruju na činjenici da se njemu bitna emitivna tržišta, zemlje srednje i sjeverne Europe, nalaze blizu, a obilježena su nepovoljnim klimatskim uvjetima što ih dodatno motivira na putovanje. No, kupališni turizam nosi obilježje sezonalnosti. Sezonalnost turizma je nezaobilazna sastavnica turizma koja prvenstveno uz sebe vezuje negativne implikacije koje zahtijevaju pažnju. Negativne implikacije rezultat su izuzetno visoke koncentracije turističke potražnje na uskom obalnom pojasu u kratkom periodu u godini. Prema navedenom se klimatski resursi javljaju kao pokretači turizma, ali i ograničavajući faktori turističkog razvoja (Higham i Hinch, 2002.). Turistička destinacija generirat će potražnju na

osnovi klimatskih uvjeta kao faktora atraktivnosti, ali ujedno će ovaj atrakcijski resurs ograničiti poslovanje turističke destinacije na određenu sezonu, odnosno dio godine.

Svrha ovoga je rada prezentirati vezu klime i turizma u priobalnim odmorišnim destinacijama. Prvi dio rada posvećen je prezentaciji klime kao faktora atraktivnosti turističke destinacije na temelju kojeg brojne destinacije, a posebice priobalne odmorišne, grade svoju turističku osnovu. U drugom dijelu rada analiziran je utjecaj klime na sezonsku koncentraciju turističke potražnje, stvarajući najznačajniju karakteristiku turizma. Na kraju slijedi zaključak sa smjernicama za buduća istraživanja.

2. Klima kao atrakcijski faktor turističke destinacije

Resursi koji imaju sposobnost privlačenja turista su brojni i raznovrsni te u različitim su stadijima tržišne razvijenosti (Formica i Uysal, 2011.). Resursi postaju turističke atrakcije tek onda kada ih destinacijski menadžment svrsta u turističku ponudu i stavi na raspolaganje posjetiteljima te pretvori u turistička dobra koja imaju sposobnost zadovoljavanja turističkih potreba. Sukladno navedenom turistički resursi imaju važnu ulogu u turističkom sustavu, ali nemaju pravu vrijednost ukoliko nisu adekvatno osmišljeni i izgrađeni te ukoliko se njima uspješno ne upravlja (Gunn, 2002.).

Turistički djelatnici i znanstvenici suglasni su oko značaja atrakcija kao krucijalnih elemenata postojanja i razvoja turizma (Page i Connel, 2009.; Vanhove, 2005.; Crouch i Ritchie, 1999.; Gunn, 1994.; Ferrario, 1979.). Hu i Ritchie (1993.) smatraju da atraktivnost turističke destinacije odražava osjećaje, vjerovanja, i stavove koje pojedinac ima o mogućnostima destinacije da zadovolji specifične turističke potrebe.

Klima se uvrštava u prirodne ili naslijeđene atrakcije, atrakcije koje ljudi nisu stvorili s ciljem turističke eksploatacije nego su nastale djelovanjem prirodnih sila ili u različitim povijesnim okolnostima za ne turističke svrhe, ali su djelovanjem konverzijske funkcije turizma izgubile svoju prvobitnu namjenu te su postali vrijedni privredni turistički resursi. Elementi prirodne ili naslijeđene atraktivnosti su uporište komparativnih prednosti turističkih destinacija, one predstavljaju skupinu destinacijskih atributa koji su u potpunosti izvan kontrole destinacijskog menadžmenta. Klima kao prirodna ili naslijeđena destinacijska atraktivnost temelj je razvoja turizma određene regije. Upravo na ovome elementu formira se specifičnost destinacije u odnosu na druge turističke destinacije na danas izrazito konkurentnom turističkom tržištu. Iz navedenog proizlazi da klima ima sposobnost privlačenja turističke potražnje sukladno čemu se javlja kao generator turističkih dolazaka u receptivno turističko odredište.

Naime, klima je jedan od ključnih faktora koja omogućuje brojne turističke aktivnosti na otvorenome čime klimu svrstavamo u jedan od preduvjeta razvoja turizma u određenoj regiji (Kim, 1998.). Klimatske uvjete kao faktore destinacijske atraktivnosti istraživali su među ostalom Amelung et al., 2007., Bigano, Hamilton i Tol, 2007. te Gomez, 2005. Radi boljeg razumijevanja klime kao faktora atraktivnosti potrebno je spomenuti rad Mieczkowskog (1985.) u kojemu je autor prezentirao turistički klimatski indeks (TCI) koji se sastoji od pet komponenti: dnevne toplinske ugodnosti, svakodnevne toplinske ugodnosti, oborina, broja sunčanih sati i brzine vjetra. Glavni kriteriji klimatskog indeksa su temperatura i oborine jer, primjerice, broj sunčanih sati i vjetar nisu značajni turistu koji posjećuje destinaciju radi razgledavanja i kulturne baštine. Turistička potražnja koja bira destinaciju zbog klime ima veći prosperitet putovanja i konzumiranja tražene usluge u željenoj turističkoj destinaciji. Prema istraživanju Nicolaua i Masa (2006.) turisti u potrazi za ugodnom klimom voljni su putovati velike udaljenosti kako bi

zadovoljili svoje potrebe za turističkim uslugama u destinaciji koja ima klimatske uvjete sukladno njihovoj potražnji.

Klima kao faktor atraktivnosti turističke destinacije, a time i generator turističkih dolazaka od izuzetnog je značaja u destinacijama priobalnog odmorišnog kupališnog turizma koje svoj turistički proizvod upravo grade na povoljnim klimatskim uvjetima. Gunn (2002.) opisuje atrakcije turističke destinacije kao elemente sastavljene od tri zone vezane za prostorni ili fizički raspored atrakcije, pri čemu navodi središnju zonu s ključnom atrakcijom, tampon zonu u kojoj se nalaze pomoćni sadržaji i usluge povezane s ključnom atrakcijom, koja zajedno s dvije unutarnje zone formira prošireni turistički proizvod. Pozivajući se na ovu klasifikaciju atrakcija u destinacijama priobalnog turizma klima čini ključnu turističku atrakciju zajedno s kvalitetom mora i plaža. Turistička potražnja u potrazi za ovom vrstom turističkog proizvoda ciljano traži odredište koje će im osigurati nesmetanu konzumaciju i zadovoljenje njihovih potreba za klimatski pogodnim okruženjem. Shodno tome, klimatski pogodna turistička destinacija generirat će veći udio tržišnog segmenta.

Hrvatsko priobalje temelji svoju komparativnu prednost na podobnim klimatskim uvjetima. Naime, klima predstavlja konstantnu varijablu turističke ponude hrvatskog proizvoda sunce i more koja omogućava potražnju željene aktivnosti na otvorenome. Usprkos bogatstvu ostalih prirodnih resursa, ali i iznimnom nasljeđu kulturnih resursa, klima je dominantna odrednica hrvatskog turističkog proizvoda.

3. Klima kao uzročnik sezonalnosti turizma

Govoreći o sezonalnosti u turizmu govorimo o pojmu koji povezujemo s vremenskim (vrijeme odlaska na turističko putovanje) i prostornim problemom (destinacija odabira turističkog putovanja) (Jang, 2004.), pri čemu je potrebno naglasiti da sezonalnost turizma ne predstavlja povremene nepravilnosti u turizmu, nego je obilježje turizma koje je stabilno i dobro utemeljeno (Witt i Moutinho, 1995.).

Kao glavni uzročnik sezonalnosti turizma uz institucionalne faktore ubrajaju se prirodni faktori (BarOn, 1975.; Hyllerberg, 1992.; Hartmann, 1986.; Butler, 1994.; Frechtling, 2001.; Kolomiets, 2010.). Pod prirodnim uzrocima sezonalnosti u receptivnoj zemlji podrazumijevamo klimatske faktore kao što su prirodne varijacije temperature zraka i vode, razina kišnih i snježnih padalina, ledeni pokrivači, vlažnost, sunčeva svjetlost, vjetrovi, oblačnost i sl. Klima u emitivnom području predstavlja faktor poticaja osobe na putovanje u klimatski pogodnije krajeve. Kišovito, hladno i nestabilno vrijeme daju poticaj odluci odlaska na odmor u klimatski pogodna područja (Butler, 1994.). Navedeni uzroci sezonalnosti su izvan kontrole donositelja odluke turističke potražnje. Prirodna sezonalnost prati godišnja doba, a posebno je izražena u perifernim i udaljenim odredištima s izrazitim temperaturnim razlikama između godišnjih doba (Kolomiets, 2010.). Prirodna sezonalnost utječe na pojedince u različitim intenzitetima dok udaljavanjem od ekvatora raste i stupanj sezonalnosti (Lundtrop, Rassing i Wanhill, 1999.; Butler, 1994.). Odredišta s toplom i hladnom klimom izložena su sezonskim promjenama ovisno o klimi i godišnjem dobu. S obzirom na činjenicu da se većina turističkih aktivnosti odvija na otvorenom, u prirodnom okruženju, nedvojbeno je ovisnost istih aktivnosti o vremenskim i klimatskim prilikama što predstavlja ograničenje razvoju turizma (Koenig i Bischoff, 2005.). Kreutzwiser (1989.), prema Highamu i Hinchu (2002.), tvrdi da klimatski i vremenski uvjeti utječu na zadovoljstvo osobito rekreativnih izleta. Hartman (1986.) i Allcock (1989.) smatraju da su sezonske varijacije uzrokovane prirodnim čimbenicima predvidljive te da su one stabilne u određenim mjestima te se ponavljaju s relativno malim izmjenama. Varijacije su značajnije u

vansezonskom razdoblju obilježenim kraćim odmorima koji su ovisniji o oscilacijama u klimi i vremenskim pogodama.

Na koncept sezonalnosti turizma može se gledati kao na poznati i jasni koncept, no paradoksnu ne postoji jedinstvena i precizna definicija. Pojam sezonalnosti može biti razmatran s više aspekata te sezonalnost može imati različita značenja pripisana različitim područjima. U definicijama sezonalnosti prevladava naglasak da je sezonalnost sistematični pokret unutar godine, ujedno se sezonalnost opisuje kao vrsta pokretača posjetitelja na posjet koji se ponavlja svake godine. Većina definicija i opći pojmovi sezonalnosti opisuju taj fenomen samo u općim uvjetima ili se odnose na njegove uzroke. Sukladno tome, vlada nedostatak kvantitativnih definicija kada sezonalnost turizma nastupi, kako se turističke sezone mogu razlikovati te kako sezonalnost može biti uspoređena između različitih regija ili godina (Koenig i Bischoff, 2005.).

U nastavku slijedi kronološki pregled najcitiranijih definicija i razmatranja pojma sezonalnosti turizma:

- Sezonalnost predstavlja fluktuacije potražnje ili ponude u turizmu zbog čimbenika kao što su vremenske prilike i državni i školski praznici (BarOn, 1972.).
- Sezonalnost je efekt koji se javlja svake godine u skoro jednako vrijeme sa skoro jednakim intenzitetom, a proizlazi iz klimatskih uvjeta, ograničenja državnih i školskih praznika, posebnih atrakcija (npr. festivala) ili osobnog načina života (BarOn, 1975.).
- Sezonalnost predstavlja neravnomjernu raspodjelu korištenja resursa tijekom vremena (s godišnjim vrhom) što je jedan od najizraženijih problema turizma, jer uzrokuje neučinkovito korištenje resursa, gubitak potencijalnog profita, pritisak na socijalne i ekološke kapacitete kao i administrativne poteškoće (Manning i Powers, 1984.).
- Sezonalnost je prirodno obilježje turizma koje se temelji na pouzdanom i predvidivom povratu turista čime se stvara ekonomski okvir za razvoj turističke industrije (Hartmann, 1986.).
- Sezonalnost turizma predstavlja tendenciju turističkih tokova da se koncentriraju u relativno kratkim razdobljima u godini (Allcock, 1989.).
- Sezonalnost je sustavni, iako ne nužno redoviti, pokret unutar godine, uzrokovan klimatskim promjenama, učincima kalendara i vremena odluke, izravno ili neizravno kroz proizvodne i potrošne odluke donesene od agenata ekonomije. Ove odluke su pod utjecajem očekivanja i želja agenata kao i produkcijske tehnike dostupne u ekonomiji (Hylleberger, 1992.).
- Pojam sezonalnosti turizma može se definirati kao vremenska neravnoteža u fenomenu turizma, izražena u broju posjetitelja, njihovoj potrošnji, prometu različitih oblika prijevoza, zaposlenosti i dostupnosti atrakcija. Stoga se podrazumijeva da sezonalnost turizma utječe na sve aspekte aktivnosti ponude potražnje, uključujući cijene, popunjenost kapaciteta, ljudske resurse, stupanj ponude, ponuđene aktivnosti i dostupnost atrakcija itd. (Butler, 1994.).
- Sezonalnost je globalni turistički fenomen uzrokovan privremenim kretanjem ljudi (Butler, 1994.).
- Sezonalnost turističke potražnje je univerzalni prepoznat fenomen koji rezultira fluktuacijama turističkog obujma tijekom kalendarske godine te treba biti diferenciran od dugoročnih poslovnih ciklusa i kratkoročnih promjena koje se odnose na tjedna i dnevna putovanja (Baum i Lundtrop 2001.).

- Sezonalnost je nerazdvojivo obilježje turizma jer su turistički tokovi određeni s prolaznošću i prirodnim sezonskim faktorima (Commons i Page, 2001.).

Sezonalnost turizma nije karakteristika pojedinačne destinacije, nego se skoro svaka destinacija u svijetu susreće s vrstom sezonalnosti u poslovanju (BarOn, 1973.; Yacoumis, 1980.; Higham i Hinch, 2002.; Jang 2004.). No, negativne implikacije najizraženije su u destinacijama masovnog odmorišnog turizma (Allcock, 1996.). Pristupom problemu sezonalnosti nailazimo na odrednice koje se javljaju kao faktori utjecaja na formiranje sezonalnosti. Među navedene odrednice ubrajamo organizirani masovni turizam s komponentama sunce, more, pijesak koji se, sukladno motivima, odvija u klimatski atraktivnom razdoblju godine, nadalje, formiranje ponude na otočnim i obalnim destinacijama tako da funkcionalno i teritorijalno zadovoljavaju potražnju za vrijeme ljetnih praznika te društveni okvir u pogledu plaćenog godišnjeg odmora koji je formiran da se odobrava u ljetnim mjesecima. Izrazito naglašenu sezonalnu strukturu potražnje imaju mediteranske zemlje, zemlje obilježene kupališnim turizmom s dominacijom potražnje motiviranom ugodnom klimom. U ovu skupinu pripada i hrvatski priobalni turizam koji je međunarodno etabliran u odmorišnom proizvodu sunce i more. Turistički kapaciteti unutar destinacije suočavaju se s koncentracijom potražnje u jednom vrhu godine, i to u ljetnim mjesecima, s velikim diferencijama razine iskorištenosti kapaciteta između ljeta i zime (Karamusafa i Ulama, 2010.; Spotts i Mahoney, 1993.). Allock (1994.) ističe da je najznačajniji aspekt sezonalnosti taj da uključuje koncentraciju turističkih tokova u relativno kratkom razdoblju godine. Njeni godišnji vrhovi u turističkim aktivnostima kroz par hektičnih tjedana ili mjeseci s vjerojatnošću rezultira s neučinkovitosti industrije, kao i velikim teretom na fizičke i socijalne resurse destinacijskog područja (Koenig i Bischoff, 2005.). Opće je suglasje kako sezonski karakter turizma implicira brojne negativne učinke na gospodarstvo, ekološko i sociokulturno okruženje turističke destinacije pa i na turističku potražnju (Cellini i Rizzo, 2010.; Cooper et al., 2005.; Goulding, Bauman i Morrison, 2004.; Jang, 2004.; Goeldener i Ritchie, 2003.; Commons i Page, 2001.; Butler, 2001.; Krakover, 2000.; Butler, 1994.; Hartmann, 1986.; BarOn, 1975.).

Sezonalnost turizma je nekontrolirana situacija (Allcock, 1989.), a njezine implikacije rastu paralelno s rastom masovnosti turizma (Wall i Yan, 2003.). Butler (1994.) ukazuje da razvojem masovnog turizma dolazi do sve većih sezonskih raspona. Rastom standarda, rast će i turistička potražnja, a time će se sve veći broj poduzeća okrenuti turističkoj djelatnosti, povećavajući svoje kapacitete reducirat će svoju fleksibilnost i sposobnost prilagodbe promjenama na strani potražnje (Koenig i Bischoff, 2005.). U turističkoj industriji na sezonalnost se gleda kao na izazov i problem koji utječe na mnoga područja djelovanja, što ne izaziva reakcije samo kod vlade i turističkih institucija, nego i znanstvenika i akademičara koji su u potrazi za uzrocima sezonalnosti turističke potražnje, kao i strategijama za suzbijanje sezonskog karaktera poslovanja turističkih aktera. Problem sezonalnosti turizma stvaran je i njegovi razmjeri postaju sve veći, što uvjetuje da svi akteri i sudionici u sektoru turizma budu aktivirani i mobilizirani na zajedničku suradnju s namjerom širenja turističke sezone i formiranja pretpostavki za turizam u svim godišnjim dobima (Dritsakis, 2008.).

Relevantnost tematike sezonalnosti poslovanja u destinacijama priobalnog odmorišnog turizma obrađena je u istraživanju Ćorluke i Matošević Radić (2014.). Rezultati navedenog istraživanja ukazuju na ekstremnu sezonalnost u cijeloj priobalnoj Hrvatskoj u 2012. godini. Županija Dubrovačko-neretvanska ima najnižu vrijednost sezonskog omjera među sedam promatranih županija hrvatskog priobalja, ali s omjerom sezonalnosti od 2,72 u dolascima i 3,33 u noćenjima, što znači da je mjesec s najvećim brojem dolazaka i noćenja ima 2,72 puta više dolazaka i 3,33

puta više noćenja od godišnjeg prosjeka županije, tako da i ova turistička regija pati od ekstremne sezone koncentracije turističke potražnje. Omjeri sezonalnosti za ostale županije su dramatičniji te iznose: Istarska županija 3,20 u dolascima i 3,93 u noćenjima, Primorsko-goranska županija 3,34 u dolascima i 4,16 u noćenjima, Ličko-senjska županija 3,55 u dolascima i 4,62 u noćenjima, Zadarska županija 3,77 u dolascima i 4,61 u noćenjima, Šibensko-kninska županija 3,61 u dolascima i 4,44 u noćenjima, Splitsko-dalmatinska županija 3,39 u dolascima i 4,14 u noćenjima. O koncentraciji turističke potražnje u glavnoj turističkoj sezoni govore podaci dobiveni Lorenzovom krivuljom prema kojoj županija Dubrovačko-neretvanska ima najnižu sezonsku koncentraciju s udjelom turističkih dolazaka u najboljem godišnjem tromjesečju oko 65 %, odnosno noćenja s udjelom više od 75 %. Najveću koncentraciju u glavnoj turističkoj sezoni glede turističkih dolazaka i noćenja imaju Zadarska i Šibensko-kninska županija, koncentrirajući oko 85 % njihovih ukupnih dolazaka i više od 90 % noćenja u glavnom turističkom tromjesečju dok ostale županije bilježe koncentraciju turističkih dolazaka u glavnom turističkom tromjesečju od oko 70 % i turističkih noćenja oko 80 %.

4. Zaključak

Veza klime i turizma na prvi pogled predstavlja jasne korelacijske odnose. Poznato je da je klima jedan od ključnih turističkih resursa na kojem brojne destinacije, posebno one orijentirane odmorišnom priobalnom turizmu pa tako i Hrvatska, grade svoju atrakcijsku osnovu. Naime, priobalne odmorišne destinacije temelje svoju tržišnu komparativnu prednost upravo na klimatskim resursima, pri čemu se na klimatske uvjete gleda kao na konstantu koja u određeno doba godine omogućuje brojne aktivnosti na otvorenome te stvaraju preduvjete razvoja odmorišnog kupališnog turizma. Paradokсно, glavni atrakcijski čimbenik je ujedno glavni ograničavajući čimbenik poslovanja priobalnih odmorišnih destinacija, svođenjem turističkih aktivnosti u kratko razdoblje godine, odnosno ljetnu turističku sezonu. Klima je uzročnik sezonalnosti poslovanja priobalnih odmorišnih destinacija, ograničavajući poslovanje na ljetne mjeseci s velikim diferencijama razine iskorištenosti kapaciteta između ljeta i zime, pri tome implicira ekonomsku, ekološku i sociokulturnu neodrživost poslovanja. Destinacijski menadžment u priobalju trebao bi valorizirati pogodne klimatske uvjete izvan same špice turističke sezone te uz kupališni turizam razvijati ostale oblike odmorišnog turizma. Neophodno je probuditi svijest turističke potražnje o prednostima dolaska u priobalne turističke destinacije izvan razdoblja kupališne sezone kada su klimatski uvjeti izuzetno povoljni te omogućuju brojne turističke aktivnosti na otvorenome. Buduća istraživanja se trebaju usmjeriti na ispitivanje atributa turističke ponude priobalnih odmorišnih destinacija koji imaju snagu privlačenja turističke potražnje u pred i posezonskom turističkom razdoblju.

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The relationship between climate and seasonality of business in coastal tourist destinations

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Abstract. At first glance, the relationship between climate and tourism seems to have clear correlations. However, a detailed examination reveals many counter-intuitive notions. It is known that climate is one of key tourist resources. Many destinations, especially those oriented towards coastal tourism, base their core appeal on climatic resources. Climate, as a natural resource, is an outstanding attractiveness component, especially in coastal tourism destinations, whose business operations are based on favourable climate conditions. Paradoxically, this driver of tourism activities is also a limiting factor for tourism development. In fact, climate is seen as the main cause of tourism seasonality. Favourable weather makes destinations popular in one part of the year, and forgotten otherwise. The seasonal concentration of tourist demands implies a number of negative effects on the tourist destination. The concentration of tourism activities over a short period of time each year - in the summer season, with noticeable discrepancies in the utilization of capacities between summer and winter - implies economic, environmental and socio-cultural unsustainability. This contradiction requires detailed analysis and that is the objective of this paper.

Key words: *climate, attractiveness, seasonality, coastal destination*

Kreiranje održivog marketinškog spleta u ruralnom turizmu

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Sažetak: Ruralni turizam, kao značajan element održivog turističkog, ekonomskog i socijalnog razvoja ruralnih područja, nailazi na sve veće razvojne, marketinške, menadžerske i ekonomske poteškoće. Istovremeno se na strani turističke potražnje iskazuje sve značajniji interes za ovakvim oblikom turizma. Za razvoj ruralnog turizma važni su dobri prirodni i kulturni preduvjeti poput klime, tla, povoljnih mogućnosti za razvoj poljoprivredne proizvodnje i očuvana kulturna baština. U radu se analizira postojeće stanje i ponuda ruralnog turizma na području submediteranske Dalmacije, odnosno marketinški splet gospodarstava na području submediteranske Dalmacije.

Ključne riječi: ruralni turizam, marketinški splet, održivi razvoj.

1. Uvod

Najveći dio hrvatskoga ruralnog prostora je turistički vrlo atraktivan, ali i turistički slabo razvijen. Uključivanje ruralnog prostora u turističko korištenje, s jedne strane, izravno može obogatiti cjelokupnu hrvatsku turističku ponudu i povećati ukupan prihod od turizma, a s druge strane, može seljacima osigurati dodatne prihode, čime bi se, između ostaloga, spriječila i depopulacija ovoga prostora. Demografske promjene dovele su do slabijeg iskorištavanja travnjačkih površina te se u posljednje vrijeme predlaže model ekstenzifikacije poljoprivredne proizvodnje u cilju poboljšanja bioraznolikosti. Također se posljednjih desetljeća povećava interes za uvođenje autohtonih ukrasnih, ljekovitih i aromatičnih vrsta u uređenje javnih i privatnih prostora gdje bi se, kroz agroturizam, mogle izvrsno valorizirati. Ruralni turizam, kao značajan element održivog turističkog, ekonomskog i socijalnog razvoja ruralnih područja, nailazi na sve veće razvojne, marketinške, menadžerske i ekonomske poteškoće u svom razvoju, dok se istovremeno na strani turističke potražnje iskazuje sve značajniji interes za ovakvim oblikom turizma. Pri tome je nužno umrežavanje, kako gospodarskih subjekata, prvenstveno agroturističkih domaćinstava međusobno, tako i s

drugim segmentima i interesnim skupinama u segmentu ruralnog turizma i općenito ruralnog razvoja regionalne zajednice.

1.1. Pojam ruralnog turizma

U znanstvenim raspravama i praksi često se brkaju ili poistovjećuju pojmovi "ruralni turizam" i "agroturizam". Agroturizam je osnovni segment razvoja ruralnog turizma, i daje mu "osnovnu boju", konotaciju, te predstavlja osnovni čimbenik razvoja ruralnog turizma (Krajnović, 2011.). Ruralni turizam je uvjetovan turističkim atrakcijama koje se nalaze u ruralnom području (Damonja, 2010.). Važnost ruralnog turizma ogleda se u interakciji poljoprivredne proizvodnje tradicionalnih proizvoda, prezentiranja tradicije, tradicijske gastronomije i turističkih usluga, te korištenju već postojećih resursa. Poljoprivreda kao jedina gospodarska djelatnost koja se bavi proizvodnjom hrane za ljude i životinje također ima ulogu čuvanja biološke raznolikosti, nastanjenosti seoskog prostora, kulture krajolika i drugih prirodnih bogatstava (Volk et al., 2006.).

Da bi mogli definirati ruralno područje, ono u osnovi mora sadržavati prostor izvan gradskih i urbanih središta, te imati mali broj stanovnika, do 150 stanovnika/km². Također, potrebno je dominantno korištenje zemlje i šuma za opstanak ljudi te prevladavajuća društvena struktura, običaji i seoski identitet (Damonja i Ružić, 2010.). Ruralna baština je temelj ruralnog turizam, prije svega uključuje krajolik kao što je očuvana priroda, posebnosti flore i faune te materijalna i nematerijalna baština (Damonja i Baćac, 2012.). U Republici Hrvatskoj, ruralni prostor zauzima 91,6 % ukupne površine što je vrlo veliki potencijal za razvoj ruralnog turizma (Damonja i Ružić, 2010.).

1.2. Pretpostavke za razvoj ruralnog turizma

Pretpostavke razvoja ruralnog turizma u Hrvatskoj su brojne, a od veće važnosti su čisti zrak, čista voda, zdrava klima, očuvana okolina (prirodno i kulturno nasljeđe). Važna je mogućnost slobodnog kretanja u prirodi radi rekreacije i razgledavanja zanimljivosti u okolici (Damonja, 2010.). Turisti vrlo često traže i mogućnost stjecanja praktičnih znanja pa im je vrlo zanimljiva okolica u kojoj se mogu upoznati sa starim obrtima kao što su, kovanje, tesarstvo, klesarstvo i drugo (Ružić, 2005.).

Osim prirodnih obilježja također je bitan i čovjekov utjecaj na: oblikovanje prirodnog ambijenta, izgled i veličinu seoskih gospodarstava, širinu seoskih putova i staza, veličinu poljoprivrednih parcela, vrstu i uzgojene oblike trajnih nasada, vrste i raspored zaštitnog i simboličnog drveća te razmještaj zajedničkih objekata u prostoru kao što su crkve, škole, sajmišta i drugi. Kao primjer možemo navesti ruralnu kuću u Istri za odmor "Arbalovija" gdje je okućnica uređena kao travnjak. Prostor između puteljaka, vrta, povrtnjaka i začinskog vrta također se može urediti kao travnjak (Damonja i Baćac, 2012.). Također se povećava interes za uvođenje autohtonih ukrasnih, ljekovitih i aromatičnih vrsta u uređenje javnih i privatnih prostora posljednjih desetljeća (Vršek i Kurtela, 1995; Dorbić i ostali, 2012.).

Hrvatska ima značajnu i brojnu prirodno i socio-kulturnu resursnu osnovu za razvoj turizma u svim njenim područjima, a ne samo u maritimnom. Međutim, da bi ta resursna osnova bila upotrebljiva i na pravi način iskorištena, potrebno je oblikovati i primijeniti takav marketinški miks koji će omogućiti održivi razvoj ruralnog prostora u Hrvatskoj.

2. Uloga marketinga u razvoju ruralnog turizma

Marketing u turizmu predstavlja primjenu poznatih strategija i metoda marketinškog djelovanja na specifične uvjete u kojima se formiraju odnosi među subjektima tržišta, koji međusobno konkuriraju na temelju obilježja turističkih proizvoda. Prilikom primjene marketinga u turizmu valja poći od specifičnosti odnosa koji vladaju na turističkom tržištu, specifičnosti turističkog dobra ili proizvoda te specifičnosti turista kao potrošača i njegova ponašanja na turističkom tržištu. Marketing u turizmu predstavlja sustavno prilagođavanje politike turističkih poduzeća i turističke politike na lokalnom, regionalnom, nacionalnom i međunarodnom nivou da bi se zadovoljile potrebe turista i na taj način ostvario profit (Senčić i Vukanović, 1997.).

Suvremeno turističko tržište traga za novim oblicima provođenja slobodnog vremena. Masovni turizam u kojem se traži sunce i more došao je do točke zasićenja, kako na strani turističke potražnje, tako i na strani ponude. Adekvatan odgovor na ovaj tržišni izazov je ruralni turizam pa bi svaka zemlja koja ima za cilj povećati svoju konkurentnost nužno trebala sagledati vlastite potencijale za razvoj ovakvog oblika turizma te iznaći načine njegove kvalitetne valorizacije (Krajinović i ostali, 2011.).

Primjer Hrvatske, kao zemlje sa značajnim potencijalima za razvoj ruralnog turizma u praktički svim njenim područjima ukazuje na probleme i poteškoće na koje nailazi receptivna zajednica pokušavajući razviti ruralni turizam. Takvi se problemi i poteškoće odnose prije svega na slabu ekonomsku snagu obiteljskih poljoprivrednih gospodarstava, kojima je vrlo teško postići pozitivan financijski učinak. Nadalje, pojavljuje se problem nedovoljnih i/ili neadekvatnih financijskih poticaja od strane javnog sektora, neprepoznavanje ruralnog turizma kao oblika turizma koji dodaje vrijednost turističkoj destinaciji, nepostojanje ekspertize u malim obiteljskim gospodarstvima, neadekvatni zakoni koji tretiraju problematiku ruralnog turizma, vrlo loša ili neadekvatna marketinška aktivnost objedinjenih poslovnih jedinica (obiteljskih seoskih gospodarstava u ruralnom turizmu) i slično. Temelj čitavog problema nalazi se u neadekvatnom načinu upravljanja razvojem ruralnog turizma kao mehanizmom koji bi umanjio ili ublažio prikazane probleme, a neke i uklonio.

3. Pojmovno određenje marketinga i marketinškog miksa

S razvojem teorije marketinga i njegovom primjenom u praksi pojavljuje se veći broj definicija. Iako postoji opća suglasnost o tome da razmjena čini bit marketinga, autori definiranju marketinga pristupaju iz različitih perspektiva te ga promatraju kao proces, znanost, način izvođenja poslovne aktivnosti, umijeće, ljudsku aktivnost, skup aktivnosti, skup funkcija i dr. (Previšić i Ozretić Došen, 2007.).

Među definicijama najšire prihvaćena je definicija koju je potvrdila Američka udruga za marketing (AMA) 1985. godine, a ona glasi: "Marketing predstavlja proces planiranja i provođenja stvaranja ideja, proizvoda i usluga, određivanja njihovih cijena, promocije i distribucije kako bi se obavila razmjena koja zadovoljava ciljeve pojedinca i organizacije". Od 2004. godine Upravni odbor AMA-e redefinirao je definiciju marketinga koja glasi: "Marketing je organizacijska funkcija i skup procesa kojima se stvaraju, komuniciraju i

isporučuju vrijednosti potrošačima i kojima se upravlja odnosima s potrošačima s ciljem ostvarivanja koristi za organizaciju i sve uključene strane". (Previšić i Ozretić Došen, 2007.).

Marketinški miks, često nazivan 4P, predstavlja specifičnu kombinaciju elemenata koji se koriste za istovremeno postizanje ciljeva poduzeća i zadovoljenje potreba i želja ciljnih tržišta. Najčešće se izražava u obliku konceptualnog obrasca koji obuhvaća određeni broj elemenata marketinga kao što su: proizvod, cijena, promocija i distribucija. Ovi elementi predstavljaju varijable marketinga koje poduzeće može kontrolirati. Pored osnovna četiri elementa marketing miksa (4P), neki teoretičari navode da bi on trebalo biti proširen s dodatnim elementima, ovisno o svrsi za koju se koristi.

Marketing miks uključuje aspekte i strategije marketinga koje menadžment koristi za stjecanje konkurentske prednosti. Da bi marketing miks bio učinkovit mora biti prilagođen potrebama kupaca, kreirati određenu konkurentsku prednost, imati dobro uravnotežene elemente te biti usklađen sa raspoloživim resursima poduzeća. S obzirom na to da se kupci na pojedinim tržištima razlikuju prema iskazanim potrebama, upravljanje marketinškim miksom za različite kupce nudi različita rješenja (Kotler i ostali, 2006.).

4. Održivi marketinški splet

Pitanje održivosti se često navodi kao cilj poslovanja različitih tipova organizacija. Poznato je da je marketing poslovna funkcija usmjerena prvenstveno na ostvarivanje ekonomskih efekata, odnosno maksimizaciju profita kroz zadovoljenje potreba potrošača. Međutim, danas maksimizacija profita više nije primarni fokus poslovanja. Primjena koncepta održivog razvoja u turizmu dovela je do izvjesnog proširenja ciljeva marketinga. Pored poznatih ciljeva zadovoljenja potreba tržišta i ostvarenja profita, marketing koncepcija u turizmu devedesetih godina uvela je još jedan cilj, a to je poštivanje i očuvanje osnovnih vrijednosti na kojima se temelji turistički proizvod (Ahmetović-Tomka, 1995.). Takva održivost predstavlja presudan element upravljanja svim aspektima turističkog djelovanja. Stručnjaci za marketing u turizmu danas imaju na raspolaganju različite mogućnosti koje dopuštaju istovremeno ostvarivanje ciljeva održivosti i profitabilnosti pa se u najkraćim okvirima može reći da su danas uspješne organizacije one koje ne odvajaju etičnost od profitabilnosti (Bajić, 2011.).

Tradicionalni marketing miks (4P) čine četiri elementa koja se koriste pri izboru ciljnog tržišta. To su: proizvod (*product*), cijena (*price*), promocija (*promotion*) i distribucija (*place*). Kada su u pitanju uslužne djelatnosti, kao što je slučaj sa turizmom, Bums i Bitner (Booms & Bitner, 1981.) uvode tri dodatna elementa. To su: ljudi (*people*), fizičko okruženje (*physical evidence*) i procesi (*process*).

Mnogi autori su razmatrali pitanje marketing miksa u turizmu i na tradicionalni 4P miks dodavali različite elemente koji bi bolje iskazali jedinstvene karakteristike turističkih proizvoda. Najprihvatljivijim se čini model koji je u području marketinga u turizmu dao Morison (Morrison, 1989). Ovaj autor na osnovni miks od 4P dodaje četiri elementa: ljude (*people*), partnerstvo (*partnership*), pakiranje (*packaging*) i programiranje (*programming*) pozivajući se na ključne aktivnosti koje stručnjaci za marketing u turizmu čine u cilju kreiranja inovativnog i uzbudljivog iskustva za potrošače. Sintezom navedenih elemenata došlo se do unapređenog turističkog marketing miksa od 10 ključnih faktora, koji pored četiri

tradicionalna, sadrži tri dodatna P za marketing usluge koja su predložili Bums i Bitner i tri turistička P koja je predložio Morison. U tom slučaju turistički marketinški miks čine: proizvod, cijena, promocija, distribucija, ljudi, fizičko okruženje, procesi, partnerstvo, pakiranje i programiranje.

Sukladno ključnim načelima održivog turizma, utvrđenim od strane UNEP – UNWTO (2005.), marketing u turizmu treba koristiti holistički i strateški pristup, u kojima podržava ekološke procese, štiti kulturno nasljeđe i biodiverzitet i pomaže dugoročni razvoj. Stoga marketinški miks održivog turizma, koji predlažu Pomering i suradnici (Pomering, Johnson i Noble, 2009.), uključuje tri dodatna elementa; zajednica, ekosustav i profit. Ova tri elementa zapravo predstavljaju tri koncepta održivosti te ih treba uzeti u obzir pri donošenju marketinških odluka kako bi one imale održive ishode (slika 1.)

	Proizvod	Cijena	Promocija	Distribucija	Ljudi	Fizičko okruženje	Procesi	Pakiranje	Iskustvo	Partnerstvo
Zajednica										
Ekosustav										
Profit										

Slika 1. Suvremeni marketinški miks za održivi turizam

Izvor: Pomering et al., 2009, p. 6.

4. Uzorak, metodologija i rezultati istraživanja

Istraživanje marketinškog spleta u ruralnom turizmu realizirano je u siječnju 2016. na uzorku osam (8) obiteljsko-poljoprivrednih gospodarstava (OPG) u Šibensko-kninskoj županiji.

Cilj istraživanja je pronaći odgovor na pitanje:

- Je li marketing-menadžment sastavni dio poslovanja obiteljsko-poljoprivrednih gospodarstava u Šibensko-kninskoj županiji?

Kvalitativno istraživanje realizirano je metodom intervjua s vlasnicima koji su odgovorni za planiranje i realizaciju marketinških aktivnosti u OPG-u u Šibensko-kninskoj županiji. Uzorak od osam (8) OPG-a izabran je nakon preliminarnih mailova i razgovora s vlasnicima OPG-ova koji su bili spremni odgovarati na pitanja o marketing menadžmentu koji primjenjuju u poslovanju vlastitih OPG-ova.

Rezultati istraživanja kratko su navedeni u tablicama 1. i 2. U ukupnoj strukturi uzorka zastupljeni su OPG-ovi koji primjenjuju različite marketinške strategije i taktike te manje ili više precizno definiraju ciljno tržište i njegove potrebe. Premda je vlasnik samo jednog (1) OPG-a kao ciljno tržište definirao isključivo strane goste u dobi iznad šezdeset (60) godina, iz rezultata intervjua vidljivo je da i ostali vlasnici razmatraju pojam ciljnog tržišta i prema njemu nastoje prilagođavati i osmišljavati tržišnu ponudu. Dva (2) vlasnika OPG-a (25 %) smatraju da su u njihovoj ciljnoj populaciji podjednako zastupljeni domaći i strani gosti dok

ostalnih pet (5) vlasnika OPG-ova (62,5 %) svoju tržišnu ponudu usmjerava isključivo prema obilježjima i zahtjevima stranih gostiju.

Jedan (1) OPG (12,5 % uzorka) opisuje svoju ciljnu skupinu kao osobe starije od šezdeset (60) godina dok tri (3) OPG-a (37,5 % uzorka) smatraju da su njihovi ciljni kupci stariji od trideset (30) godina. Četiri (4) vlasnika OPG-a (62,5 %) opisuju strukturu svojih potencijalnih korisnika kao „goste svih dobnih skupina“. Rezultati intervjua pri tome indiciraju da OPG-ovi, uz izuzetak OPG-a „E“, koji su u okviru ciljnih korisnika prepoznali sve dobne skupine, ne prilagođavaju turističku ponudu u odnosu na dobnu skupinu, odnosno oblikuju jedinstveni marketinški miks za sve dobne skupine. OPG „E“, naime, u ponudi sadržaja nudi i dječje igralište što na neki način implicira oblikovanje ponude prilagođene ciljnom segmentu (u ovom slučaju populaciji djece).

Rezultati istraživanja indiciraju da OPG-ovi iz uzorka razvijaju specifičan asortiman proizvoda/usluga. Temeljni sadržaj ponude OPG-ova u pravilu uključuje ponudu autohtone prehrane i domaćih specijaliteta (8 OPG-ova ili 100 % uzorka) i prodaju autohtonih proizvoda (7 OPG-ova ili 87,5 % uzorka) koje gosti mogu kupiti tijekom boravka na OPG-u i ponijeti u svoje domicilne destinacije. Nadalje, samo tri (3) od ukupno osam (8) OPG-ova (37,5 %) iz uzorka svojim gostima nudi mogućnost smještaja na OPG-u, a samo dva (2) OPG-a (25 %) neke dodatne aktivnosti kao što su primjerice obilazak područja i upoznavanje s kulturnim vrijednostima u pratnji vodiča, branje maslina ili proizvodnju vina.

U području promocije, rezultati istraživanja ukazuju da su OPG-ovi u Šibensko-kninskoj županiji prvenstveno usmjereni na oglašavanje i komuniciranje s potencijalnim gostima posredstvom turističkih agencija (svih osam (8) OPG-ova ili 100 % uzorka). Turističke agencije imaju ulogu posredničkog kanala i omogućavaju OPG-ovima dolazak većih skupina stranih gostiju treće životne dobi koje su spremne izdvojiti više novca za svoj boravak na OPG-u u odnosu na prosječnog turističkog potrošača. Nadalje, OPG-ovi nastoje komunicirati s potencijalnim potrošačima posredstvom vlastitih web stranica i društvenih mreža (pet (5) OPG-ova ili 62,5 % uzorka). Premda rezultati istraživanja pokazuju da komuniciranje posredstvom društvenih mreža još uvijek ne prakticiraju svi OPG-ovi, jasno je da se njihov broj, prvenstveno zbog izrazito visokog povrata u odnosu na uložena sredstva, kontinuirano povećava. Vrlo važnu ulogu u privlačenju novih gostiju na OPG-ove ima usmena predaja, odnosno preporuke onih koji su jednom posjetili neki OPG i nakon toga isti preporučili članovima obitelji i prijateljima. U konačnici, možemo kazati da su i same oznake obilježavanja OPG-ova na određenoj mikrolokaciji povremeno poticaj slučajnom posjetitelju koji obilazi određeno područje da posjeti OPG.

Rezultati istraživanja lokacije OPG-ova, kao jednog od elemenata marketinškog miksa, ukazuje da OPG-ovi u pravilu djeluju na pristupačnim, lako dostupnim lokacijama u okviru kojih se nude raznovrsni autohtoni sadržaji oblikovani u skladu s tradicijom i poviješću specifičnog lokaliteta. Primjerice OPG „A“ nudi posebne sadržaje kao što su raznovrsna događanja u amfiteatru i etnografska zbirka. Nadalje, dva (2) OPG-a (25 % uzorka) posjeduju auto kamp, a jedan (1) OPG (12,5 % uzorka) boćalište i dječje igralište.

Unatoč činjenici da ulogu marketing-menadžera preuzimaju vlasnici s vrlo niskom razinom marketinškog obrazovanja, OPG-ovi iz uzorka se vrlo profesionalno ponašaju u području formiranja cijena. Kroz intervju s vlasnicima, primjetno je da se najveći broj OPG-ova, pri

formiranju cijene, ne fokusira na troškove već na konkurente i tržište što je potvrda marketinškog načina promišljanja. Udio OPG-ova koji mijenja cijene s promjenama potražnje vrlo je značajan (šest OPG-ova ili 75 % uzorka). Cijene se mijenjaju u ovisnosti o kretanju potražnje, veličini grupe, vrsti menija te vremenskom kalendaru. Dio OPG-ova, koristi raznovrsne akcijske cijene koje uključuju akcijske ponude za blagdane i tematske događaje (Valentinovo, „Proljeće na selu“, „Berba grožđa“).

Rezultati istraživanja ukazuju da OPG-ovi iz uzorka najčešće kao konkurentsku prednost ističu sastavni dio usluge OPG-a - razgledavanje OPG-a i autohtonih sadržaja koje OPG nudi. Nadalje, neki od njih kao konkurentsku prednost ističu kulturnu baštinu koju prezentiraju i mogućnost sudjelovanja turističkih posjetitelja u tradicijskim aktivnostima (branje maslina). Nekolicina onih koji su resursno ograničeni i ne raspolažu dovoljnom količinom autohtonih sadržaja kao prednost ističu originalnost, inovativnost i kreativnost.

Rezultati istraživanja također indiciraju da OPG-ovi iz uzorka nemaju uvijek primjereno usklađene marketinške aktivnosti. Primjerice, OPG-ovi „A“ i „B“ koji raspolažu zaštićenom kulturnom baštinom, koja je upisana u registar kulturne baštine ili zaštićena od strane UNESCO-a, vrlo su inertne u području promocije oslanjajući se isključivo na turističke agencije kao posrednike. Nadalje, OPG „B“ razvija i nudi vrlo uzak prodajni asortiman (isključivo autohtona prehrana i domaći specijaliteti), a OPG „A“ formirajući cijene neovisno o potražnji riskira da, unatoč kvalitetnoj ponudi i imidžu posebice u razdoblju izvan sezone, izgubi značajan dio turističkih posjetitelja.

Tablica 1. Rezultati istraživanja marketing menadžmenta u OPG-ovima Šibensko-kninske županije

OPG	A	B	C	D
Ciljno tržište	Strani gosti, starosna struktura 60+	Strani gosti, starosna struktura 35+	Strani gosti, starosna struktura 35+	Strani gosti, sve dobne skupine
Asortiman proizvoda/usluga	Autohtona prehrana i domaći specijaliteti, prodaja autohtonih proizvoda, aktivnosti: obilazak područja i upoznavanje s kulturnim vrijednostima u pratnji vodiča.	Autohtona prehrana i domaći specijaliteti.	Autohtona prehrana, klasična jela, prodaja autohtonih proizvoda-delicija.	Autohtona prehrana i domaći specijaliteti, prodaja autohtonih proizvoda, aktivnosti: branje maslina, proizvodnja vina, smještajni kapaciteti.
Oblici promocije	Promocija posredstvom turističke agencije, usmena predaja (preporuka prijatelja).	Promocija posredstvom turističke agencije, oznake za OPG na mikrolokaciji.	Promocija posredstvom turističke agencije, web stranica OPG-a, usmena predaja (preporuka prijatelja).	Promocija posredstvom turističke agencije, web stranica OPG-a, oglašavanje na društvenih mrežama, oznake za OPG na mikrolokaciji.
Obilježja lokacije	Pristupačna lokacija, posebni sadržaji: amfiteatar, etnografska zbirka.	Pristupačna lokacija, autohtoni izgled prostornih sadržaja.	Pristupačna lokacija, OPG posjeduje auto kamp.	Pristupačna lokacija.

Formiranje cijene	Cijene na razini konkurentskih, cijene se ne mijenjaju s potražnjom, nema akcijskih cijena.	Cijene na razini konkurentskih, cijene se mijenjaju ovisno o potražnji, veličini grupe, vrsti menija te vremenskom kalendaru.	Cijene na razini konkurentskih, akcijske i promotivne cijene bazirane na dogovoru.	Cijene na razini konkurencije, cijene su niže u rano proljeće i kasnu jesen, akcijske ponude za blagdanе i tematske događaje (Valentinovo, Proljeće na selu, Berba grožđa).
Konkurentska prednost OPG-a	Mogućnost razgledavanja OPG-a, zbirka upisana u registar kulturne baštine, učenje na iskustvu, priče i doživljaj.	Mogućnost razgledavanja OPG-a, zaštićena kulturna baština od strane UNESCO-a.	Originalnost, inovativnost, kreativnost.	Mogućnost razgledavanja OPG-a, sudjelovanje u tradicijskim aktivnostima (berba voća).

Tablica 2. Rezultati istraživanja marketing menadžmenta u OPG-ovima Šibensko-kninske županije

OPG	E	F	G	H
Ciljno tržište	Strani i domaći gosti, sve dobne skupine	Strani gosti, starosna struktura 35+	Strani gosti, sve dobne skupine	Strani i domaći gosti, sve dobne skupine
Asortiman proizvoda/usluga	Autohtona prehrana i domaći specijaliteti, prodaja autohtonih proizvoda, klasična jela, smještajni kapaciteti.	Autohtona prehrana i domaći specijaliteti, prodaja autohtonih proizvoda.	Autohtona prehrana i domaći specijaliteti, prodaja autohtonih proizvoda.	Autohtona prehrana i domaći specijaliteti, smještajni kapaciteti.
Ključni kanali promocije	Promocija posredstvom turističke agencije, web stranica OPG-a, usmena predaja (preporuka prijatelja).	Promocija posredstvom turističke agencije, oznake za OPG na mikrolokaciji.	Promocija posredstvom turističke agencije, web stranica OPG-a, OPG-a, usmena predaja (preporuka prijatelja).	Promocija posredstvom turističke agencije, web stranica OPG-a, oglašavanje na društvenim mrežama.
Obilježja lokacije	Pristupačna lokacija, posebni sadržaji: prostor za boćanje i dječje igralište.	Pristupačna lokacija, OPG posjeduje auto kamp.	Pristupačna lokacija.	Pristupačna lokacija, autohtoni izgled prostornih sadržaja.
Formiranje cijene	Cijene su na razini konkurentskih, akcijske i promotivne cijene ovise o potražnji.	Cijene na razini konkurentskih, akcijske i promotivne cijene tijekom godine.	Cijene na razini konkurentskih, ne mijenjaju se s potražnjom.	Cijene na razini konkurentskih, akcijske i promotivne cijene tijekom godine.
Konkurentska prednost OPG-a	Atraktivnosti, inovativnost, širina ponude.	Mogućnost razgledavanja OPG-a.	Mogućnost razgledavanja OPG-a.	Mogućnost razgledavanja OPG-a, sudjelovanje u tradicijskim aktivnostima (branje maslina).

5. Zaključak

Najveći izazov vezan za koncept održivog ruralnog turizma predstavlja njegova operacionalizacija i sagledavanje ruralnog turizma kao procesa koji se primjenjuje kroz razvojne planove i projekte i tekuće aktivnosti turističkih subjekata. Tradicionalni pristup marketingu, koji je fokusiran na ograničenu ideju maksimizacije profita poslovnih subjekata, nije bio u mogućnosti odgovoriti na brojne društvene i ekološke zahtjeve koje nameće koncept održivog razvoja.

Koncept marketing miksa je dobra polazna točka za istraživanje načina na koji stručnjaci za marketing u turizmu mogu zadovoljiti povećane društvene i ekološke zahtjeve. Elementi marketing miksa oblikuju viziju, misiju, strategiju i vrijednosti organizacije i umnogome određuju njen identitet.

Rezultati istraživanja indiciraju da su OPG-ovi na području Šibensko-kninske županije prepoznali ulogu marketinga u poslovanju i da uspješnim kombiniranjem elemenata marketinškog miksa izgrađuju pretpostavke za profitabilno poslovanje i izgradnju konkurentne pozicije na tržištu. Marketinška orijentacija OPG-ova vidljiva je kroz njihovo nastojanje da prilagode ponudu specifičnim dobnim skupinama, izgrade komunikaciju s posrednicima (turističke agencije) i krajnjim korisnicima te kroz stalno usklađivanje cijene s promjenama potražnje potaknu potencijalne korisnike na kupnju i konzumiranje vlastitih proizvoda i usluga. Pri tome, jasno je da OPG-ovi iz uzorka još uvijek ne koriste sve raspoložive potencijale, kao što je primjerice kulturna baština koju posjeduju, u izgradnji imidža i uspješnijem pozicioniranju na tržištu. Vlasnici OPG-ova više su fokusirani na potencijalne posjetitelje i asortiman proizvoda/usluga koje nude, a manje na koncept održivog razvoja ruralnog turizma koji bi im trebao osigurati dugoročni uspjeh i tržišni rast. Međutim, za davanje kvalitetnijih preporuka, nužno je provesti kvantitativno istraživanje na primjerenom broju OPG-ova u svim hrvatskim regijama.

Marketing u održivom ruralnom turizmu mora biti okrenut prema prirodnom i socio-kulturnom okruženju, društveno odgovornom poslovanju te etičnom ponašanju. Na budućnost održivog ruralnog turizma veliki pozitivan utjecaj može imati implementacija proširenog marketing miksa. Kod donošenja marketinških odluka, marketing miks se treba zasnivati na tri područja održivosti (ekološkim, socijalnim i ekonomskim).

Ako ruralni turizam želi biti održiv, sve aktivnosti na kojima se on zasniva moraju biti održive. Marketing može odigrati značajnu ulogu u ovom procesu, budući da održivi marketing nastoji zadovoljiti ukupne ekološke troškove u proizvodnji i potrošnji radi stvaranja održive ekonomije.

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Creating a sustainable marketing mix in rural tourism

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Abstract: Rural tourism, as an important element of both sustainable tourism and economic and social development of rural areas, faces all the major development, marketing, and economic challenges. At the same time, an interest in this form of tourism has been increasing significantly. Good natural and cultural conditions, such as climate, soil, beneficial

possibilities for the development of agricultural production, and well-preserved cultural heritage are important for the development of rural tourism. This study deals with the present condition of rural tourism in sub-Mediterranean Dalmatia with respect to what it can offer to tourists, and the marketing mix of the family farms in the area of sub-Mediterranean Dalmatia.

Key words: *rural tourism, marketing mix, sustainable development, family farm*

Implikacije klimatskih promjena na sezonalnost turističkog poslovanja priobalnih odmorišnih destinacija

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Sažetak. Autori su suglasni oko senzibilnosti turističke potražnje na promjene u klimi. Predviđa se da će rast temperature prouzrokovati prostornu i vremensku redistribuciju turističke potražnje. Klimatske promjene promijeniti će standardiziranu sliku sezonskog poslovanja priobalnog kupališnog turizma te učiniti će popularne ljetne destinacije manje privlačnim. Očekuje se da će stabilniji vremenski uvjeti u emitivnom području sa pogodnom klimom utjecati na razvoj domaćeg turizma, čime će potreba za putovanjem u inozemna područja opadati. Nadalje, očekuje se da će se klimatske promjene odraziti različitim intenzitetom među regijama. Navedene implikacije klimatskih promjena jasno projiciraju promjene u ustaljenoj slici turističkih aktivnosti. Pod direktnim utjecajem su priobalne odmorišne destinacije sa formiranom ljetnom turističkom sezonom i sezonskim poslovanjem. Zbog navedenih implikacija klimatskih promjena planiranje u turizmu neće biti zamislivo bez njihovog uvažavanja, posebice u segmentu kupališnog turizma koji je pod najvećom prijetnjom klimatskih promjena. Navedeno će izazvati nove odnose na konkurentnom turističkom tržištu.

Ključne riječi: klima, klimatske promjene, turistička potražnja, sezonalnost poslovanja, priobalna odmorišna destinacija

1. Uvod

Turistička industrija doživjela je ubrzani razvoj protekla tri desetljeća, ostvarujući korist prvenstveno od razvoja ekonomije, povećanja kupovne moći te smanjenja transportnih cijena (Pestana et al., 2011.). Turizmu se predviđa, uz informacijsku tehnologiju i telekomunikacije, uloga jedne od tri vodeće industrije dvadeset prvog stoljeća (Rachman et al., 2000.). Pri tome, kroz ubrzani rast ima značajan doprinos BDP-u, zaposlenosti, ekonomskom rastu, deviznom priljevu, generiranju prihoda, kao i regionalnom i društvenom razvoju zemlje (Volo, 2010.). Obalni odmorišni turizam kao najveća komponenta globalne turističke industrije s udjelom većim od 60 % u ukupnim putovanjima Europljana i više od 80 % ukupnih turističkih prihoda SAD-a predstavlja ključni turistički proizvod. Dominaciju ovog vida turizma u ukupnim turističkim tokovima Republike Hrvatske potvrđuje podatak da je 92,5 % turističkih noćenja u 2014. godini ostvareno u županijama priobalnog pojasa (Institut za turizam, 2014.).

Turizam kao sastavni dio globalnog poslovanja ovisan je o promjenama klimatskih uvjeta, ekonomskih aktivnosti, kao i ljudskog ponašanja i društva u cjelini (Baum i Lundtrop, 2001). Navedene promjene uzrokuju fluktuacije turističkih aktivnosti iz čega proizlaze sezonske oscilacije u razini poslovanja u globalnoj turističkoj industriji (Kolomiets, 2010). Varijacije u

klimatskim uvjetima stvaraju različite sezonske potencijale i resurse turističkih odredišta, za koje se percipira da imaju određene sezonske kvalitete (Lee i dr. 2008.). No, klimatske promjene mogle bi poremetiti uhodane turističke tokove. Rastom temperature trenutno popularne odmorišne destinacije mogle bi postati prevruće, dok bi drugim destinacijama klimatske promjene optimizirale temperaturu i učinile ih privlačnim odredištem turističkih aktivnosti (Berrettella i dr., 2006.). Prema navedenom obalni odmorišni turizam upravo je pod najvećom prijetnjom klimatskih promjena.

Svrha rada prikazati je potencijalne razmjere klimatskih promjena na sezonsko poslovanje priobalnih odmorišnih destinacija.

2. Klimatske promjene i njihove implikacije na turistička kretanja

Provedena istraživanja suglasno potvrđuju da je došlo do promjene u globalnoj klimi te da će se klima i dalje mijenjati. Prema podacima Međuvladinog panela o klimatskim promjenama (IPCC) zagrijavanje klimatskog sustava nedvojbeno je te se projicira da će do kraja 21. stoljeća globalna prosječna temperatura porasti za 1,8°C do 4°C. Kao glavni uzročnik globalnog zagrijavanja izdvaja se prekomjerna emisija stakleničkih plinova koji uzrokuju efekt staklenika u planetarnoj atmosferi. Čak, i ako se atmosferske koncentracije stakleničkih plinova stabiliziraju na sadašnjim razinama, Zemlja će se i dalje zagrijavati kao rezultat prošlih emisija stakleničkih plinova i toplinskih inercija mora (UNWTO i UNEP, 2009.). Posljedice klimatskih promjena bit će povećanje maksimalne temperature, veći broj vrućih dana, veći intenzitet tropskih oluja i snažnih vjetrova, veće količine oborina u jednim krajevima i duga sušna razdoblja u drugim krajevima.

Implikacije klimatskih promjena manifestirat će se na mnogim aspektima društva, pri čemu ni turistička industrija nije isključena, posebice zbog izrazito bliske veze klime, okoliša i turizma. Prethodno je već naglašen atrakcijski faktor klime te uloga klime kao regulatora prostorne i vremenske distribucije turističke potražnje. Paradoksnost, doprinos turizma emisiji stakleničkih plinova je u porastu. Izračuni ukazuju da turizam na globalnoj razini doprinosi emisiji ugljičnog dioksida (CO₂) u rasponu od 3,9 % do 6 % ukupnih ljudskih emisija. No, s obzirom na predviđeni rast turizma očekuje se porast od 130 % emisije sektora turizma u razdoblju od 2005. do 2035. Shodno tome, međunarodni turizam se smatra jednim od glavnih doprinositelja globalnog zagrijavanja (Korstanje i George, 2012.). Prema navedenom, može se konstatirati da turizam postepeno sam narušava svoju održivost. Veza turizma i klime je dvosmjerna veza s kompleksnim interakcijama, naime, turizam svojim aktivnostima doprinosi klimatskim promjenama dok nastale klimatske promjene značajno utječu na turističku industriju, posebno na atraktivnost turističkih destinacija i na turističke tokove (Hernandez i Ryan, 2011.).

Klimatske promjene imat će direktne i indirektne implikacije na turizam (UNWTO i UNEP, 2009.). S obzirom na to da su klima, okoliš i osobna sigurnost tri primarna čimbenika za izbor destinacija od strane turističke potražnje, globalnim klimatskim promjenama predviđa se značajan utjecaj na ova tri čimbenika na regionalnoj razini.

Direktni utjecaji odrazit će se redistribucijom turističkih putovanja, prostorno i vremenski. Turistička potražnja, suprotno ponudi, ima mogućnost da se prilagodi klimatskim promjenama izbjegavanjem odredišta pod utjecajem klimatskih promjena ili pomicanjem vremena putovanja kako bi se izbjegli nepovoljni klimatski uvjeti (UNWTO i UNEP, 2009.). Klimatske promjene promijenit će standardiziranu sliku sezonskog poslovanja priobalnog kupališnog turizma te će popularne ljetne destinacije, primjerice hrvatsko priobalje, učiniti manje privlačnim. Suprotno tome, potražnja će se vremenski redistribuirati u druge dijelove godine ili pak prostorno u druge

destinacije s ugodnim klimatskim uvjetima. Navedeno će izazvati nove odnose na konkurentnom turističkom tržištu. Intenzitet klimatskih utjecaja manifestirat će se različito među regijama. Novonastale promjene stvarat će tržišne prijetnje, ali i prilike. Navedene promjene odrazit će se na sezonalnost u turizmu mijenjajući kvalitetu, razdoblje i duljinu trajanja sezone (UNWTO, 2009.). Spoznaje iz provedenih istraživanja utjecaja promjene klimatskih uvjeta na turističku potražnju sugeriraju da će se sredinom i krajem 21. stoljeća dogoditi geografska i sezonska preraspodjela turističke potražnje, a da će razmjeri ovoga utjecaja varirati među pojedinim destinacijama. Predviđeni utjecaji uključuju postupnu selidbu potražnje u destinacije na višim geografskim razinama i na višim nadmorskim visinama u planinskim područjima. Turisti iz emitivnih zemalja koji trenutno dominiraju u međunarodnim turističkim tokovima (npr. sjeverna Europa) očekuje se da će provesti godišnji odmor u svojoj domovini ili u blizini, prilagođavajući svoje putne obrasce novim klimatskim prilikama u svom životnom okruženju. Koncentracija turističke potražnje u sezoni će se smanjiti, pri čemu će, eventualno, više turista putovati u predsezoni i posezoni, ili zimi jer će im klimatski uvjeti to omogućiti. Izravni učinak klimatskih promjena mogao bi biti dovoljno značajan da promijeni sliku glavnih turističkih regija, posebice onih gdje je klima ključni atrakcijski faktor pa tako i hrvatskog priobalja. Međutim, spoznaje ne upućuju na potencijalne promjene u obujmu turističkih putovanja na globalnoj razini. Naime, nema dokaza da će promjene u klimi izravno dovesti do značajnog smanjenja globalnog volumena turizma (UNWTO i UNEP, 2009.).

Indirektni utjecaji klimatskih promjena rezultat su klimatski izazvanog narušavanja okoliša. Utjecaji uključuju promjene u dostupnosti vode, gubitku bioraznolikosti, smanjenju estetike krajolika, mogućnostima poljoprivredne proizvodnje, povećanje prirodnih nepogoda, obalne erozije i poplava, oštećenja infrastrukture i povećanju učestalost zaraznih bolesti koje će se odraziti na turizam u različitim intenzitetima (UNWTO i UNEP, 2009.).

Prema istraživanju UNWTO (2009.) turističke destinacije i turistički operatori podliježu utjecajima klimatskih varijacija u sljedećim područjima:

- Klima definira duljinu i kvalitetu turističkih sezona (npr. kupališne sezone) različito među regijama. Pojedine turističke destinacije su klimatski ovisne destinacije, jer klima predstavlja glavni destinacijski resurs na kojem se temelji turizam.
- Klima izravno utječe na različite aspekte turističke operative (npr. opskrbu vodom i kvalitetu vode, troškovi grijanja i hlađenja, potrebe za navodnjavanjem, upravljanje štetočinama, evakuaciju i privremeno zatvaranje) koji utječu na profitabilnost poslovanja.
- Širok raspon ekoloških resursa koji čine krucijalne turističke atrakcije u mnogim destinacijama su osjetljivi na klimatske varijabilnosti, kao što su biljni i životinjski svijet i biološka raznolikost, vodostaj i kvaliteta mora.
- Klima, također, utječe na okolišne uvjete koji mogu odbiti turiste u njihovoj namjeri posjete, uključujući zarazne bolesti, požare, cvjetanje mora, insekte ili vodne nametnike (npr. meduze) i ekstremne događaje kao što su uragani, poplave i toplotni udari.
- Klima je ključna odrednica turističkog odlučivanja. Sezonske klimatske fluktuacije u turističkim destinacijama i u glavnim emitivnim tržištima su ključni pokretači turističke potražnje na globalnim i regionalnim razmjerima. Vrijeme je sastavna komponenta iskustva putovanja koje utječe na turističku potrošnju i zadovoljstvo odmorom.

Turizam je sektor karakteriziran raznolikošću, a time postoje značajne razlike u klimatskoj osjetljivosti i sposobnosti prilagodbe turističkih operatora i odredišta. Nadalje, posljedice klimatskih promjena za turističke operatore ili sama odredišta djelomično će ovisiti o utjecaju

klimatskih promjena na konkurente. Naime, negativan utjecaj u jednom dijelu turističkog sustava stvara prilike negdje drugdje (UNWTO, 2009.).¹

Ispitivanje utjecaja klimatskih promjena na turizam nije pridobilo adekvatnu pažnju među istraživačima (Hernandez i Ryan, 2011.; Hamilton i Tol, 2007.). Dosadašnja istraživanja koja su ispitivala tematiku odabira turističke destinacije nisu bila značajno orijentirana na faktor klime, razlog tomu je činjenica da su autori na klimu gledali kao na konstantnu varijablu (Eugenio-Martina i Campos-Soria, 2010.; Berrittella i dr., 2006.; Lise i Tol, 2002.). No, klima nije konstantna te se očekuje da će se mijenjati ubrzanim korakom (Lise i Tol, 2002.).

Neophodno je pristupiti detaljnom istraživanju utjecaja klimatskih promjena na turističke aktivnosti s fokusom na stjecanje konkretnih spoznaja o razmjerima utjecaja na pojedina područja (Hernandez i Ryan, 2011.). U nastavku slijedi pregled istraživanja kojima je cilj bio analizirati utjecaj klimatskih promjena na turističke aktivnosti.

Prema istraživanju Berrittella i dr. (2006.) klimatske promjene će utjecati na mnoge aspekte ljudskog života. Navike odlaska na odmor su među onim najosjetljivijim varijablama na varijacije u klimi. Shodno tome, vrlo važni uslužni sektor, turizam, bit će pod izravnim utjecajem što može imati važne gospodarske posljedice. Autori smatraju da će klimatske promjene moderirati turističke tokove, pri čemu će doći do prostorne i vremenske redistribucije turističkih aktivnosti, paralelno tome će iste izazvati redistribuciju turističke potrošnje. Navedeno će se negativno odraziti na turističke destinacije prepoznatljive po odmorišnom kupališnom turizmu koje su ekonomski izrazito ovisne o turizmu. Shodno tome, na globalnoj razini, klimatske promjene će u konačnici dovesti do gubitka blagostanja, nejednako rasprostranjenog među regijama. Istraživanje Prema Eugenia-Martina i Campos-Soria (2010.) pokazuje da će turistička potražnja, inače osjetljiva na klimatske uvjete, reagirati elastično na klimatske promjene i modificirat će svoje navike putovanja prema novonastalim klimatskim uvjetima. Autori naglašavaju snagu klime u mjestu stanovanja kao determinante odabira odredišta odmora, stanovnici u regijama s boljim klimatskim indeksom imaju veću vjerojatnost domicilnog putovanja i nižu vjerojatnost putovanja u inozemstvo. Nadalje, autori ističu da su stanovnici klimatski nepogodnijih područja manje osjetljivi na varijacije u klimi te su spremni prihvatiti „prosječne“ klimatske uvjete, suprotno stanovnicima naviknutim na izrazito pogodne klimatske uvjete koji će reagirati izrazito elastično na klimatske promjene. Bigano, Hamilton i Tol (2006.), također, ističu da turisti iz toplijih sredina imaju više naglašene preferencije putovanja. Stajališta su da će klimatske promjene implicirati promjene na turističkoj karti, potražnja će se pomicati prema sjeveru, ujedno reducirat će se broj putovanja u srpnju i kolovozu. Lise i Tol (2002.) izdvajaju klimu kao značajni faktor odabira turističke destinacije, ističući prosječnu godišnju temperaturu oko 21°C kao optimalnu, no ujedno konstatiraju da će klimatske promjene utjecati na popularnost trenutno poželjnih destinacija odmorišnog turizma, ali će zasigurno na tržište ući novi konkurenti što će povećati konkurentnost na turističkom tržištu. Hamilton i Tol (2007.) u svome istraživanju potvrđuju tezu o utjecaju klimatskih promjena na redistribuciju turističke potrošnje prema polovima, no oni preciziraju smjernice budućih turističkih tokova naglašavajući da će se klimatske promjene različito odraziti među regijama te samim time doći i do različitih međuregionalnih promjena u ponašanju potražnje. Bigano, Hamilton i Tol (2007.) konkretiziraju

¹ Detaljna analiza direktnih i indirektnih razmjera klimatskih promjena na turizma prikazana je u UNWTO i UNEP (2008), *Climate Change and Tourism, Responding to Global Challenges*, World Tourism Organization and the United Nations Environment Programme, Madrid, Spain.

spoznaje te ističu da će se klimatske promjene odraziti na domaći i međunarodni turizam. Predviđa se dupliranje domaćeg turizma u hladnijim zemljama te smanjenje domaćeg turizma za 20 % u toplijim zemljama. Međunarodni turizam će se u pojedinim zemljama utrostručiti dok će se u drugim prepoloviti. Navedene promjene u volumenu putovanja odrazit će se i na turističku potrošnju te u konačnici na ekonomsko blagostanje receptivnih područja.

3. Rasprava

Predviđene klimatske promjene izazvat će prostornu i vremensku redistribuciju turističke potražnje te time utjecati na sezonalnost poslovanja priobalnih odmorišnih destinacija. S obzirom na izrazitu elastičnost turističke potražnje, navedene promjene izazvat će prijetnje i prilike te potrebe prilagodbe na turističkom tržištu.

Prijetnje proizlaze iz prostorne i vremenske redistribucije turističke potražnje. Konkretno za hrvatski turizam, ako se potražnja prostorno redistribuira na područja s pogodnijim klimatskim uvjetima i ujedno glavna emitivna tržišta hrvatskog turizma povećaju broj domaćih putovanja, ugrožit će se poslovanje hrvatskog priobalnog turizma kojeg čini oko 90 % međunarodnih turističkih dolazaka. Vremenska redistribucija turističke potražnje, također, bi ugrozila poslovanje hrvatskog priobalnog turizma zbog njegove izrazite tržišne prepoznatljivosti kao destinacije popularne u ljetnom kupališnom tromjesečju.

Klimatske promjene izazvat će tržišne prilike u priobalnom odmorišnom turizmu. Brojne negativne ekonomske, ekološke i sociokulturne implikacije koje proizlaze iz sezone koncentracije turističke potražnje mogle bi se prebroditi pravilnom vremenskom redistribucijom turističke potražnje. Predviđeni rast temperature mogao bi reducirati razinu potražnje u glavnom ljetnom tromjesečju u kojem bi dominirala potražnja željna izlaganju iznimno visokim temperaturama dok bi se kupališna sezona proširila u mjesec pred i posezone. Navedenim bi se redistribuirao višak turističke potražnje iz trenutnog vrhunca sezone u vansezonsko razdoblje te generirala bi se nova potražnja.

Shodno iznesenom prilike koje bi proizašle iz klimatskih promjena nadmašuju prijetnje. No, priča zasigurno nije tako jednolična. Naime, činjenica da je turizam jedan od glavnih doprinositelja klimatskim promjenama te da će klimatske promjene, uz sami rast temperature, imati brojne indirektno negativne implikacije kao što su promjene u dostupnosti vode, gubitak bioraznolikosti, povećanje prirodnih nepogoda, obalne erozije i poplate te druge implikacije, uvjetuje određene promjene u budućim turističkim aktivnostima. Turističko poslovanje u priobalju trebat će se prilagoditi novim regulativama poslovanja. Na tržištu će opstati samo one destinacije koje svoje poslovanje usklade s novonastalim tržišnim uvjetima te marketinškim aktivnostima repositioniraju svoju ponudu na međunarodnom turističkom tržištu. Navedeno je kompleksna tematika koja zahtijeva zasebno istraživanje.

4. Zaključak

Autori su suglasni oko senzibilnosti turističke potražnje na promjene u klimi. Spoznaje da će stabilniji vremenski uvjeti u emitivnom području s pogodnom klimom utjecati na razvoj domaćeg turizma, da će potreba za putovanjem u inozemna područja opadati te da će doći do vremenske i prostorne redistribucije turističke potražnje i da će se klimatske promjene odraziti različitim intenzitetom među regijama, jasno projiciraju promjene u ustaljenoj slici turističkih aktivnosti. Pod direktnim utjecajem su priobalne odmorišne destinacije s formiranom ljetnom turističkom sezonom i sezonskim poslovanjem. Zbog navedenih implikacija klimatskih

promjena, planiranje u turizmu neće biti zamislivo bez njihovog uvažavanja, posebice u segmentu kupališnog turizma koji je pod najvećom prijetnjom klimatskih promjena.

Klimatske promjene su stvarne, iako trenutno nisu ozbiljno shvaćene. Njihove implikacije se postepeno odražavaju na turističke aktivnosti te će budući razmjeri izazvati značajne promjene u poslovanju turističkih destinacija priobalja. Buduća istraživanja veze klime i turizma trebaju biti detaljno usmjerena u dva pravca. Prvo regionalno ispitati utjecaj klimatskih faktora na sezonalnost turizma. Drugo, također regionalno, analizirati potencijalne razmjere klimatskih promjena i njihove implikacije, negativne i pozitivne, na sezonalnost poslovanja priobalnog turizma. Pravovremena anticipacija osnovni je preduvjet upravljanja nadolazećim situacijama.

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The implications of climate change on seasonal business in coastal tourism destinations

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Abstract. Authors agree that tourist demands are sensitive to climate changes. It is anticipated that the temperature increase will cause spatial and temporal redistribution of tourist demand. Climate change will change the standardized image of seasonal business in coastal tourism and will make popular summer destinations less attractive. It is expected that stable weather conditions in areas with favourable climate will affect the development of domestic tourism, which will reduce the need for vacationing abroad. Furthermore, it is expected that climate change will differ in intensity between regions. These implications of climate change will clearly project changes in the established image of tourist activities. Coastal destinations with established summer season and seasonal business will be directly affected. Because of these implications of climate change, planning in tourism will not be conceivable without heeding the changes in climate, especially in costal tourism areas, which are under the greatest threat of climate change. This will lead to new relationships on the competitive tourist market.

Key words: *climate, climate change, tourist demand, seasonality, costal tourism*

Značaj strateškog menadžmenta ljudskih potencijala za ostvarenje dugoročne održivosti poslovnih organizacija

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Sažetak. Strateški menadžment ljudskih potencijala uključuje prihvaćanje sustava i politika upravljanja ljudskim potencijalima koji pomažu poslovnim organizacijama ostvariti viziju i strateške ciljeve osiguravajući im održivu konkurentsku prednost. Kako suština dugoročne konkurentске prednosti leži u osiguranju njene održivosti, koncept održivog razvoja neminovno je vezan uz ovu problematiku. Održivi razvoj na razini poslovnih organizacija definira se na različite načine te uključuje ekonomsku, okolišnu i društvenu dimenziju održivosti. Brojna istraživanja pokazuju kako su značajan izvor dugoročne održivosti, na nacionalnoj razini, kao i na razini poslovnih subjekata, upravo ljudski potencijali, odnosno ljudski kapital. U ovom radu, kroz analizu dosadašnjih istraživanja, ukazat ćemo na značaj koji strateški menadžment ljudskih potencijala ima za ostvarenje dugoročne održivosti poslovnih organizacija.

Ključne riječi: *održivi razvoj, strateški menadžment ljudskih potencijala, društveno odgovorno poslovanje*

1. Uvod

Kao odgovor na sve izraženiju svijest i osjetljivost svjetske javnosti na ekološke, društvene i ekonomske probleme koji su posljedica poslovnih aktivnosti mnogih organizacija, sve je izraženija spremnost vodećih svjetskih kompanija da dokažu svoju opredijeljenost k održivom poslovanju. U suvremenom svijetu sve više postaje jasno kako organizacije pri donošenju poslovnih odluka moraju uzeti u obzir i mogući učinak tih odluka na okolinu u kojoj posluju. One tako doprinose vlastitom razvoju i rastu, ali i razvoju i rastu društva u cjelini. Dugoročan poslovni uspjeh temelji se na odlukama koje donosimo danas, a koje ne smiju ugroziti poslovanje u budućnosti. To je temelj koncepta održivog razvoja.

U ovom radu, analizom dosadašnjih istraživanja, dovode se u vezu pojmovi održivog razvoja, strateškog upravljanja i upravljanja ljudskim potencijalima.

U skladu s opće prihvaćenim konceptom održivog razvoja, moguće je promatrati održivi razvoj gospodarskih subjekata kao pokušaj prilagodbe tog koncepta na korporativnoj razini, usklađivanjem ciljeva stvaranja vrijednosti s okolišnim i društvenim pitanjima. Drugim riječima, to je sposobnost organizacija da stvaraju i održavaju ekonomski uspjeh u kontekstu odgovornosti prema okruženju.

U skladu s postojećim trendovima možemo tvrditi da će korijen strategije i konkurentskih prednosti u godinama koje dolaze biti sposobnosti organizacija da svoje ekonomske aktivnosti provode na održiv način koji ne ugrožava okoliš i tako sebi dugoročno osiguravaju resursnu bazu potrebnu kako za kratkoročan, tako i za dugoročan uspjeh.

Znanstvenici su gotovo jedinstveni u stavu da su ljudski potencijali jedan od značajnijih izvora konkurentskih prednosti organizacija, te na takav način dolaze u samo srce strateškog usmjerenja organizacija. Na njima se temelji konkurentska prednost, a stvaranje vrijednosti i vrijednost gospodarskih subjekata rezultat su strateške upotrebe ljudskih potencijala.

2. Koncept održivog razvoja

Održivi razvoj postao je općeprihvaćena paradigma 21. stoljeća. Ekonomski rast, društvena jednakost i briga za održivim kapacitetom prirodnih sustava čine okosnicu te paradigme. Iako se svaki od ovih elemenata održivog razvoja odavno izučava zasebno, tek je 1992. godine na konferenciji Ujedinjenih naroda o okolišu i razvitku (engl. *United Nations Conference on Environment and Development* – UNCED) u Rio de Janeiru došlo do konsenzusa političara, nevladinih organizacija i poslovnih vođa kako se niti jedan od ta tri problema ne mogu riješiti bez uzimanja u obzir ostala dva (Keating, 1993.).

Od tada do danas koncept održivog razvoja razvijao se na različite načine. U praksi je istovremeno nailazio na podršku, kao i na cijeli niz problema koji ozbiljno dovode u pitanje njegov uspjeh na svjetskoj razini. Kao primjere možemo izdvojiti zastoj međunarodnih ugovora o bioraznolikosti i klimatskim promjenama, antiglobalizacijske proteste protiv slobodne trgovine koja je smatrana osnovnim alatom ekonomske održivosti i brojne druge. Ipak, mnoge su vlade inicirale programe nacionalne održivosti u različitim područjima djelovanja, slično kao i vlasti na lokalnim razinama. U rujnu 2015. godine, Ujedinjeni narodi donijeli su Program za održivi razvoj 2030. Programom je utvrđen globalni okvir u svrhu iskorjenjivanja siromaštva i postizanja održivog razvoja do 2030. Kao prvi globalni sporazum u povijesti kojim se utvrđuje univerzalni, sveobuhvatni program za djelovanje, Programom 2030. obuhvaćen je ambiciozan skup od 17 ciljeva održivog razvoja i 169 povezanih ciljeva, uz mobiliziranje svih zemalja i dionika da ostvare te ciljeve i utjecaje na nacionalne politike (Europska komisija, 2015).

Podizanje razine svijesti o važnosti problema održivog razvoja ključ je njegova uspjeha. Ta razina nikada nije bila viša, posebno potaknuta sasvim evidentnim svjetskim problemima održivosti. No, sama svijest o problemu nije dovoljna. Još uvijek nemamo dovoljno znanja o mogućim načinima rješavanja problema. U tom smislu znanost ima ključnu ulogu. Teorijski okvir značajno je evoluirao u navedenom razdoblju. Veliki broj znanstvenika ozbiljno je istraživao navedenu problematiku te su teorijski principi u značajnoj mjeri razvijeni i prilagođeni izmijenjenim svjetskim prilikama.

Koncept održivosti i iz njega izvedena sintagma održivi razvoj prvi put su službeno definirani u tzv. Brundtlandovom izvještaju koji je 1987. godine objavila Svjetska komisija o okolišu i razvoju (Brundtland, 1987.). U Brundtlandovom izvještaju održivi se razvoj definira kao proces koji zadovoljava potrebe sadašnjih generacija bez ugrožavanja mogućnosti budućih generacija da zadovolje svoje potrebe. „Tri stupa“ na kojima počiva ovako definiran održivi razvoj uključuju ekonomska, društvena i okolišna pitanja. Ovako široko definiran koncept omogućio je da svi njegovi elementi budu zastupljeni na jednak način i u jednakoj mjeri. U kratkom roku ti se elementi mogu promatrati zasebno, kao individualno ključni i hitni problemi, no kako bi se dostigao cilj održivosti u dugom roku, svi se moraju istovremeno uzimati u obzir. Štoviše, oni su duboko međusobno povezani i mogu utjecati i poticati jedan drugog.

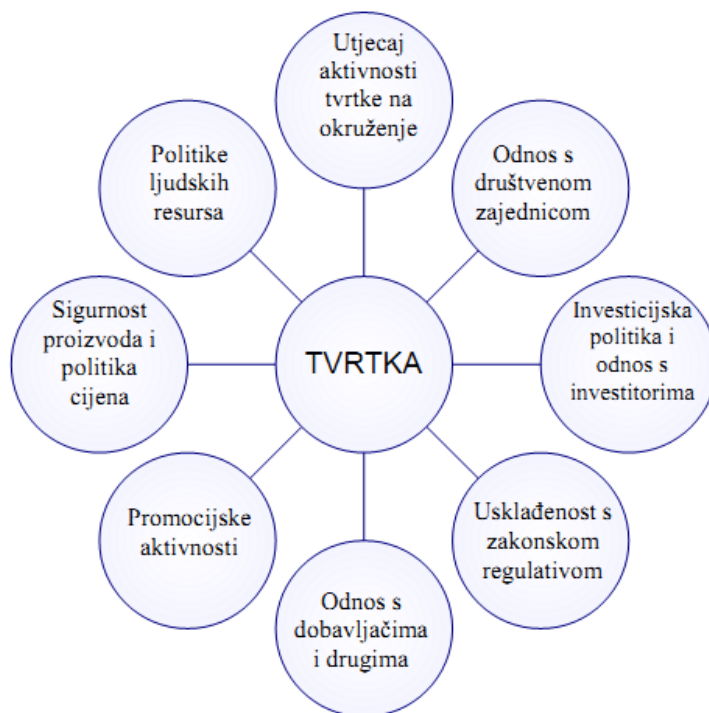
Tijekom vremena javile su se neke kritike ove definicije kako na teorijskoj, tako i na praktičnoj razini (Sneddon, 2006.). Kao posljedica tih kritika, tijekom godina pojavio se niz novih, više preskriptivnih definicija održivog razvoja. Vjerojatno jedna od najpopularnijih govori da je: „Održivost odnos između dinamičnih ljudskih ekonomskih sustava i većih, dinamičnih, ali uobičajeno sporije promjenjivih ekoloških sustava, u kojemu: 1) se opstanak

čovječanstva može beskonačno nastaviti, 2) ljudi mogu napredovati i 3) ljudska kultura se može razvijati; ali u kojemu učinak ljudskih aktivnosti ostaje unutar granica koje će omogućiti da se ne uništi raznolikost, složenost i djelovanje ekoloških sustava“ (Costanza, Daly & Bartholomew, 1991.).

2.1 Održivi razvoj gospodarskih subjekata

Uspjeh koncepta održivog razvoja posebno je vidljiv na razini gospodarskih subjekata gdje je opće prihvaćen kao temeljni preduvjet poslovanja (Holliday, 2001.). Mnogi od njih zapošljavaju posebne djelatnike koji se bave problemima održivog poslovanja, objavljuju godišnja izvješća o održivosti te uključuju održivi razvoj u svoje strategije, izjave o viziji i misiji. Mnogi gospodarski subjekti pokreću inovativne programe fokusirane na razvoj tzv. zelenih tehnologija (Hall & Vredenburg, 2003.) te usvajaju standarde očuvanja okoliša (ISO, 2005). Skupina osviještenih menadžera, nakon samita u Riu osnovala je Svjetski poslovni savjet za održivi razvoj (eng. *World Business Council for Sustainable Development – WBCSD*) s ciljem da olakšaju dijalog s političarima o mogućim načinima doseganja održivosti. Deset godina poslije savjet je brojao oko 150 međunarodnih kompanija, a danas je ta brojka višestruko uvećana te savjet ima predstavništva na svim kontinentima i ogranke u većini zemalja svijeta. Ipak, potrebno je naglasiti, da je većina aktivnosti gospodarskih subjekata u smislu održivog razvoja usmjerena isključivo na poboljšanje ekološke učinkovitosti poslovanja, dok su ostali elementi uvelike zanemareni. Iako je ekološka efikasnost vrijedan dio poslovnih strategija, kao samostalan koncept nije dovoljna (Welford, 1997.).

Od osamdesetih godina 20. stoljeća raste i interes za etičke standarde poslovnih subjekata, a kao odgovor na brojne skandale proizišle iz neetičkih ili neodgovornih akcija nekih kompanija. Rastu društveni i politički pritisci na tvrtke da se ponašaju etički u pogledu velikog broja pitanja od kojih su neka prikazana na slici 1.



Slika 1 Etički aspekti i pitanja društvene odgovornosti gospodarskih subjekata

U ovaj se trend uklopio i koncept održiva razvitka, potičući privredne subjekte da ozbiljno prihvate svoju odgovornost prema okruženju iz sljedećih razloga (Swarbrooke, 1999.):

- ako unište resurse na kojima njihovo poslovanje počiva, ugrozit će budućnost svojega poslovanja
- ako po svojoj želji to ne učine, zakonodavci će biti prisiljeni regulirati njihove aktivnosti
- imaju široku odgovornost prema društvenoj zajednici da se ponašaju kao dobri susjedi.

Kao posljedica, sve više privrednih subjekata pokušava svoje aktivnosti uskladiti s načelima održivog razvoja mjerama smanjivanja zagađenja i otpada, mjerama očuvanja energije, korištenjem recikliranih materijala te usmjerenim zapošljavanjem i osposobljavanjem ljudskih resursa. Na taj način i gospodarski subjekti dokazuju da u pogledu očuvanja okoline mogu biti rješenje problema, a ne njegov izvor. Za mnoge od njih, ovakvo ponašanje predstavlja dio sustavnog odnosa s javnošću, smatrajući etičko ponašanje jednim od mogućih izvora dugoročno održive konkurentske prednosti.

Znanost menadžmenta razvila je teorijski okvir koji podržava uključenje okolišnih i društvenih pitanja u praksu menadžmenta, a održivi razvoj gospodarskih subjekata prihvaćen je kao pozitivan doprinos globalnim problemima kao što su siromaštvo, društvena isključenost, poboljšanje uvjeta rada i negativni utjecaji na prirodni okoliš.

U skladu s opće prihvaćenim konceptom održivog razvoja, moguće je promatrati održivi razvoj gospodarskih subjekata kao pokušaj prilagodbe tog koncepta na korporativnoj razini, usklađivanjem ciljeva stvaranja vrijednosti s okolišnim i društvenim pitanjima. Drugim riječima, to je sposobnost organizacija da stvaraju i održavaju ekonomski uspjeh u kontekstu odgovornosti prema okruženju. Teorija i praksa menadžmenta dovela je do niza različitih definicija ovog pojma. Vrlo jednostavno, održivost gospodarskih subjekata može se definirati kao dugoročna sposobnost organizacije da stvara vrijednost proizvodnjom proizvoda i usluga (Pogutz. 2007). U tom kontekstu moguće je održivost organizacija promatrati i kao sposobnost kreiranja dugoročne održive konkurentske prednosti.

Prema Dow Jones-ovom indeksu održivosti, 'Korporativna održivost je pristup poslovanju koji stvara dugoročnu vrijednost vlasnicima iskorištavanjem prilika i upravljanjem rizicima koji nastaju promjenama u ekonomskoj, društvenoj i prirodnoj okolini'.

Još je jedan zanimljiv pristup koji konceptualizira održivost organizacija uključivanjem različitih oblika kapitala. Ovdje se govori da je korporativna održivost 'sposobnost organizacije da beskonačno nastavlja svoje aktivnosti, vodeći računa o utjecaju na prirodni, društveni i ljudski kapital' (AccountAbility. 1999). Ovdje se utvrđuju tri temeljna oblika kapitala: ekonomski, prirodni i društveni, a održivo poslovanje je ono koje osigurava u dugom roku postojanje svih oblika kapitala u dovoljnim količinama i strukturi. Unutar ovog pristupa, u teoriji također postoje razilaženja u mišljenjima. Postoji naime skupina autora koji smatraju da je moguće nedostatak jednog oblika kapitala zamijeniti nekim drugim oblikom (kao primjer navode se brojni slučajevi supstitucije oskudnih prirodnih resursa umjetno proizvedenim nadomjescima). Drugi pristup tvrdi kako ne postoje supstituti za sve oblike (posebno prirodnog) kapitala te se takvi oblici kapitala moraju sačuvati netaknutima neovisno o drugim oblicima (samo jedan od primjera je uloga šuma i njen utjecaj na sve ostale oblike kapitala).

Tijekom godina javio se i skepticizam u odnosu neodređenost i nejasnoću pojma održivog razvoja čime se dovodi u pitanje i mogućnost njegove primjene i praćenja u poslovanju. Kao odgovor na te kritike društveno odgovorno poslovanje formalizirano je kao koncept koji uključuje ekonomska, pravna, etička i filantropska očekivanja koje je društvo stavilo pred organizacije u određenom vremenskom trenutku (Carroll & Buchholtz. 2003). Drugim riječima, organizacije pored svoje temeljne i pravne odgovornosti (tj. cilja ostvarenja profitabilnosti i pridržavanja zakona) imaju i druga očekivanja koje je pred njih stavilo

društvo. Ta očekivanja odnose se na dobrovoljan doprinos zajednici u kojoj posluju u smislu odgovaranja na društvene norme i druge oblike odgovornog poslovanja.

Slično je i s tzv. stakeholder pristupom teoriji, koji govori da organizacije nemaju odgovornost samo prema vlasnicima, već i prema svim ostalim dionicima svog poslovanja. Ovaj pristup razvio je teorijsku osnovu istraživanjem normativnih, instrumentalnih i deskriptivnih aspekata teorije.

Posljednjih godina koncept održivog razvoja gospodarskih subjekata razvijen je u još nekoliko različitih pravaca ili pristupa, te je stvoren okvir unutar teorije menadžmenta kojim se istražuju odnosi između poslovanja i društva. Na tim temeljima razvijene su definicije koje ćemo na ovom mjestu objediniti kroz onu koju je Europska Unija institucionalizirala svojim Okvirom za društveno odgovorno poslovanje, gdje stoji da je to koncept kojim kompanije integriraju društvena i okolišna pitanja u svoje poslovanje te u interakciji s njihovim dionicima, na dobrovoljnoj bazi (CEC. 2001).

2.2 Strateški pristup održivom poslovanju

Održiva konkurentska prednost je primarni zadatak strateškog djelovanja organizacija prema različitim teorijskim pristupima strateškom menadžmentu: strukturalističkom pristupu, resursnom pristupu, pristupu temeljenom na dinamičkim sposobnostima i mnogim drugima. Perspektiva održivog razvoja dovodi u pitanje da li konkurentska prednost može biti održana tijekom dugog vremenskog perioda. Mnogi autori prihvatili su Porterovo mišljenje prema kojemu su glavni neprijatelji održivosti, pa prema tome i strateškog djelovanja usmjerenost na kratki rok i fokus na uzak prostor djelovanja organizacija. Do promjene paradigme došlo je uslijed promjena okruženja koje su se posebno manifestirale posljednjih godina tijekom izraženo dugog perioda globalne recesije. Istraživanja su pokazala da četiri od pet istraženih organizacija svjesno žrtvuju dugoročno stvaranje vrijednosti kako bi u kratkom roku ostvarili zadane profitne ciljeve (Graham i dr. 2005).

Usmjerenost na kratki rok je način donošenja odluka i operativnog djelovanja organizacija koji je u kratkom roku optimalan, ali pri tom u dugom roku ostvaruje rezultate ispod razine optimalnih. Ovakav način razmišljanja i djelovanja posebno je izražen u uvjetima neizvjesnosti i nesigurnosti, kada zahtjevi za sadašnjim koristima znatno nadmašuju one za budućim. Usmjerenost na kratki rok dovodi do suboptimalnih rezultata kako za organizacije tako i za društvo u cjelini. Strateški pristup poslovanju, jednako kao i pristup održivosti pokušavaju naći ravnotežu između kratkoročnih i dugoročnih koristi. Iako postoje autori u području strateškog menadžmenta koji naglašavaju kratkoročni pristup donošenju odluka, brojni su mišljenja da to može biti potencijalno opasno za budućnost organizacija te da strategije moraju uključivati održivost kako u teorijskom tako i u praktičnom smislu.

Veza između strateškog pristupa poslovanju i pristupa temeljenog na principa održivosti možda je najbolje vidljiva analizom resursnog pristupa. Sam termin 'resursi' u svom sadržajnom smislu može označavati niz različitih koncepata ovisno o teorijskom okviru unutar kojega se promatra (biologija, ekologija, ekonomija ili sociologija).

Unutar koncepta održivog razvoja resursi se promatraju kao sredstva dostupna za razvoj čovječanstva, te uključuju prirodne resurse (prirodni kapital i njegovi izvori), ekonomske resurse (različite oblike ekonomskog kapitala, primjerice financijski, materijalni...) te ljudske resurse (ljudski kapital predstavlja različita znanja, vještine, sposobnosti i iskustvo zaposlenih kojima se oni koriste u poslovnom procesu, te se u kontekstu intelektualnog kapitala javlja zajedno s organizacijskim kapitalom i kapitalom odnosa s klijentima). Prirodni resursi se razlikuju od ostalih što ih čini nezamjenjivima. Često se klasificiraju kao obnovljivi i neobnovljivi prema njihovoj sposobnosti regeneriranja i beskonačnog korištenja. Kada se resursi koriste brže nego što se nadomještaju, odnosno obnavljaju, zalihe se troše i s

vremenom nestaju. Ključ teorije održivog razvoja je upravo u ravnoteži trošenja i obnavljanja resursa.

Znanost menadžmenta promatra resurse na nešto drugačiji način. Resursna teorija je danas najutjecajniji teorijski okvir u znanosti menadžmenta koja pokušava objasniti kako razlike u resursima poduzeća mogu stvoriti konkurentsku prednost. Dvije temeljne pretpostavke ove teorije su: heterogenost resursa (različita poduzeća imaju različite resurse i sposobnosti iz čega proizlazi i njihov različit uspjeh unutar industrije) i njihova imobilnost (razlike u resursima mogu dugo potrajati zbog neprenosivosti i rijetkosti pojedinih resursa ili poteškoća njihova pribavljanja ili imitiranja). Dakle, resursi samo po sebi nisu dovoljni. Oni ne stvaraju vrijednost već su povezani sa sposobnostima organizacija u njihovoj efikasnoj uporabi u dobro osmišljenoj i provedenoj strategiji. Te sposobnosti uključuju sposobnost menadžmenta, organizacijske procese i postupke, organizacijsko znanje i informacije, te znanje, sposobnosti i razinu motiviranosti djelatnika.

Jasno je da nedostatak prirodnih resursa može predstavljati ozbiljno ograničenje i za buduće poslovanje organizacija. Čini se neminovnim da će tržišta i gospodarski subjekti u budućnosti biti visoko ovisni o ekosustavu (prirodi). Drugim riječima, vjerojatno je da će korijen strategije i konkurentskih prednosti u godinama koje dolaze biti sposobnosti organizacija da svoje ekonomske aktivnosti provode na održiv način koji ne ugrožava okoliš (Hart. 1995, 2003).

3. Značaj strateškog upravljanja ljudskim potencijalima za ostvarenje dugoročne održivosti poslovnih organizacija

Sve je veći broj autora koji smatraju da je u suvremenom svijetu glavno sredstvo, a po nekima i jedino održivo sredstvo postizanja dugoročne organizacijske konkurentnosti ili konkurentске prednosti upravo značajno unaprjeđenje aktivnosti upravljanja ljudskim resursima. Kao što Pfeffer (1994., str. 6) navodi: 'Tradicionalni izvori uspjeha – proizvodna i procesna tehnologija, zaštićena ili regulirana tržišta, dostupnost financijskih resursa i ekonomija obujma – još uvijek mogu osigurati povećanje konkurentnosti, ali danas u manjoj mjeri nego u prošlosti, dok su organizacijska kultura i sposobnosti, kao rezultat upravljanja ljudskim potencijalima od relativno većeg značaja.' Pitanje danas više nije što neka organizacija posjeduje, već što ona zna i može učiniti. Inteliktualni kapital danas stvara gotovo 80% ekonomske vrijednosti. Na njemu se temelji konkurentska prednost a stvaranje vrijednosti i vrijednost gospodarskih subjekata rezultat su strateške upotrebe ljudskih potencijala.

Za razliku od tradicionalnih teorija poduzeća u kojima su dominantni resursi bili materijalni: kapital (zemlja, tvornice i oprema), fizički rad (manualnih radnika) i financijski kapital (novac), poslovanje suvremenih organizacija većinom se bazira na neopipljivoj imovini. Dodana vrijednost koju subjekti u poslovnom procesu danas stvaraju proizlazi prvenstveno iz znanja, sposobnosti i vještina ljudi koji su zaposleni u organizaciji ili s njom surađuju kao poslovni partneri ili vanjski suradnici. Kapitalna imovina danas potrebna za kreiranje bogatstva nije više zemlja, niti fizički rad, strojevi, alati ili tvornice – umjesto njih to je intelektualna imovina, odnosno intelektualni kapital.

Ljudskim se potencijalima daje sve veće značenje zbog toga što će oni u budućnosti biti odlučujuća konkurentska snaga. To se može uočiti i u promjenama u terminologiji: pojmovi kadrovi, radnici i radna snaga zamjenjuju se pojmovima suradnici, ljudski resursi, ljudski potencijal i ljudski kapital. Zamjena pojmova nije formalnog karaktera, već ona proizlazi iz shvaćanja važnosti čovjeka i njegova potencijala kao nositelja poslovnog uspjeha i razvoja (Avelini Holjevac. 1998).

Dakle, upravljanje ljudskim potencijalima postaje ne samo najznačajnija poslovna funkcija, nego i specifična filozofija i pristup upravljanju koja ljude smatra najvažnijim potencijalom te

ključnom strategijskom i konkurentskom prednošću. Strateški menadžment ljudskih potencijala definira namjere organizacije o tome kako svoje poslovne ciljeve postići ljudima (Bahtijarević Šiber. 1998).

Kao posljedica svega navedenog, a posebno temeljeno na principima resursnog pristupa strateškom menadžmentu, koncepcija strateškog menadžmenta povezana je s klasičnom koncepcijom menadžmenta ljudskih potencijala unutar nove razvojne faze u razvoju upravljanja ljudskim potencijalima – strateškog menadžmenta ljudskih potencijala (SMLJP). Strateška uloga menadžmenta ljudskih potencijala u organizaciji podrazumijeva integriranje ljudskog čimbenika sa strateškim poslovnim ciljevima radi stvaranja nove vrijednosti i unaprjeđenja konkurentске prednosti organizacije.

Resursni se pristup temelji na uvjerenju da se konkurentska prednost osigurava ako organizacija može dobiti i razviti ljudske potencijale koji omogućuju da uči brže i primjenjuje naučeno djelotvornije nego njezini konkurenti. Ulaganje u ljudske potencijale povećava organizacijsku vrijednost budući ljudski kapital posjeduje najveći potencijal za to da bude izvor održive konkurentске prednosti, odnosno održivog strateškog uspjeha. Ljudski potencijali su strateški vrijedni kao mogući izvor konkurentске prednosti budući posjeduju posebne osobine koje ih čine vrijednima, rijetkima, teškim za imitirati, dinamičnim, itd.

Sve do sada navedeno dovodi do pitanja kako organizacije upravljaju svojim najvrjednijim resursom te što treba učiniti kako bi se dugoročno održala ta resursna baza. Mnoge organizacije u svojim izvješćima naglašavaju predanost održivom načinu poslovanja, iako uvijek nije sasvim jasno da li je to njihovo stvarno opredjeljenje ili samo jedna od izjava usmjerena na dobre odnose s javnošću. Čak i među onima čije je održivi razvoj stvarno opredjeljenje, veliki je broj organizacija koje su usmjerene isključivo na prirodni kapital, odnosno na očuvanje okoliša. Rijetke se one koje imaju odgovore na pitanja što to znači upravljati ljudskim potencijalima na održiv način.

Ozbiljno prihvaćajući održivost ili održivi razvoj kao svoju strategiju organizacije direktno utječu i na svoju buduću praksu upravljanja ljudskim potencijalima, odnosno svoj SMLJP (Cohen i dr. 2012). Rezultati istraživanja pokazali su da mnoge organizacije značaj održivosti za SMLJP vide kao način ostvarivanja jednog ili više navedenih ciljeva (Ehnert, 2009):

- privlačenje i zadržavanje talenata, stvarajući imidž poželjnog poslodavca,
- briga za zdravlje i sigurnost zaposlenih,
- investiranje u znanja i vještine zaposlenih na dugoročnim temeljima razvijanjem ključnih kompetencija i cjeloživotnog učenja,
- podrška zaposlenima u stvaranju ravnoteže između poslovnog i privatnog života ili poslovnog života i obitelji,
- stvaranje povjerenja zaposlenih i dobrih interpersonalnih odnosa,
- društveno odgovorno poslovanje prema zaposlenima i sredini u kojoj posluju,
- ostvarivanje visoke razine kvalitete života za zaposlene i zajednicu u cjelini.

Dokazi o povezanosti održivog razvoja i SMLJR dolaze i od strane konzultantskih kuća. Njihova izvješća govore kako će buduće organizacije koje želi privući talente morati imati snažan fokus na održivi razvoj, zeleni menadžment i društvenu odgovornost. Iako sve organizacije neće postati održive, biti će sve veći broj onih čije će strateško opredjeljenje postati održivi razvoj. Naglašavajući značaj upravljanja ljudskim potencijalima konzultantske kuće preporučuju povezivanje kvalitetne i transparentne strategije održivog razvoja s adekvatnom praksom upravljanja ljudskim potencijalima.

Povezujući sve ove koncepte u teoriji se u posljednje vrijeme sve više počeo prihvaćati i termin 'održivo upravljanje ljudskim potencijalima' koji se tumači kao sve ono što

organizacije trebaju raditi kako bi osigurale dugoročno pribavljanje talentiranih, vještih i motiviranih ljudi (Ehnert, 2009). Radi se dakle o dugoročno orijentiranom pristupu i aktivnostima usmjerenim na društveno odgovorno i ekonomski prihvatljivo privlačenje i odabir, razvijanje, usmjeravanje i održavanje učinkovite radne snage.

Moguće je zaključiti da je strateški uspjeh neminovno vezan uz dugoročno održivi razvoj, a jedan od temeljnih preduvjeta je ostvarivanje sklada sa strateškim upravljanjem ljudskim potencijalima kojim će se osigurati nužno potrebna resursna baza za stvaranje izvora dugoročno održive konkurentske prednosti.

4. Zaključak

Promjena je temeljna značajka suvremenog svijeta. Za ostvarivanje poslovnog uspjeha organizacije trebaju aktivno odgovarati na te promjene, znajući kako iskoristiti prilike i suzbiti prijetnje koje dolaze iz tako dinamične, heterogene i neizvjesne okoline. Strateški pristup upravljanju poslovnim organizacijama čini upravo to – pokušava osigurati dugoročan uspjeh organizacija usklađujući njihovo djelovanje s uvjetima okoline u kojoj posluju, pokušavajući osigurati dugoročno održivu konkurentsku prednost.

Temeljni doprinos koncepta održivog razvoja je u prepoznavanju međusobnog utjecaja koji prirodno, društveno i ekonomsko okruženje imaju jedno na drugo. Ukoliko želimo osigurati zadovoljenje potreba kako sadašnjih generacija, tako i onih budućih neminovno moramo prihvatiti održivi razvoj kao način promišljanja prilikom donošenja odluka. Kratkoročni pristup donošenju odluka kojemu je većina privrednih subjekata danas sklona ima cijeli niz negativnih posljedica na njihovo buduće djelovanje.

Brojna istraživanja pokazuju kako su značajan izvor dugoročne održivosti, na nacionalnoj razini kao i na razini poslovnih subjekata, upravo ljudski potencijali, odnosno ljudski kapital. Ljudski potencijali su također jedan od značajnih izvora dugoročno održive konkurentske prednosti. Svojim specifičnostima osiguravaju ključne sposobnosti koje su dugoročne i teške za imitirati. U tom smislu potrebno je uskladiti strateško djelovanje organizacija s njihovim praksama upravljanja ljudskim potencijalima kako bi se u dugom roku osiguralo ostvarivanje strateških ciljeva.

Na taj način strateški menadžment ljudskih potencijala, kroz prizmu strategije, postaje jedan od temeljnih preduvjeta ostvarenja dugoročne održivosti gospodarskih subjekata.

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The importance of Strategic Human Resource Management for long term sustainability of business organisations

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Abstract. Strategic human resources management includes acceptance of human resources management practices and systems that help business organisations gain their vision and strategic goals, simultaneously ensuring their competitive advantage. As the essence of the long-term

competitive advantage lies in its sustainability, this issue also relates to the concept of sustainable development. Corporate sustainable development is defined in various ways and includes economic, environmental, and societal dimension. Numerous studies have shown that human resources or human capital are a very important source of long-term sustainability, both on a corporate level as well as at the national level. In this paper, through the analysis of previous studies, we point out the importance of strategic human resource management for the long-term business sustainability.

Key words: *sustainable development, Strategic Human Resources Management, social responsibility*

Primjena načela space managementa u prodajnoj praksi

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Sažetak. Space management predstavlja dio *category managementa* koji se bavi upravljanjem kategorijama proizvoda kao poslovnih jedinica s jasnim ciljevima. Ciljevi su implementirati i postaviti strukturirane procese za upravljanje kategorijama proizvoda unutar zadane strategije poduzeća. Trgovine sa suvremenim konceptom poslovanja nastoje prilagoditi svoj prodajni prostor potrebama kupaca u cilju njegove što veće funkcionalnosti. Pravilnim pozicioniranjem proizvoda unutar trgovine osigurava se bolji poslovni rezultat i lakše snalaženje kupaca unutar prodajnog prostora. Osnovni način implementacije space managementa u praksi je definiranje asortimana proizvoda, izgleda prodajnog prostora, rasporeda polica unutar prodajnog prostora te raspored proizvoda na policama s ciljem privlačenja pažnje kupaca. Sam način izlaganja proizvoda ima veliki utjecaj na odluku o kupnji. Ako želi ispuniti svoje ciljeve, trgovac mora učinkovito provoditi strategiju za odabranu kategoriju proizvoda. To znači određeno taktiziranje s pozicioniranjem kategorije na polici, dodatna izlaganja, promociju cijene itd. U radu je provedeno istraživanje u prodajnim prostorima s ciljem uvida koliko se u praksi implementiraju načela space managementa.

Ključne riječi: *space management, category management, kategorije proizvoda, prodajni prostor, pozicioniranje proizvoda*

1. Uvod

Lokacija, ponuda, unutarnje uređenje prostora, cjenovna politika, mjerenja i planiranje bitni su čimbenici prodajnog poslovanja poduzeća, stoga je važno uspostaviti sistem specijaliziran za upravljanje i kontrolu tih čimbenika. Space management (upravljanje prostorom) dio je *category managementa* čija je osnovna vizija dobro opremljen i funkcionalan prodajni prostor uređen suvremenim dizajnerskim karakteristikama što u konačnici rezultira privlačenjem pažnje kupaca i povećanjem prodaje.

Sam način izlaganja proizvoda ima veliki utjecaj na odluku o kupnji što znači da trgovci moraju učinkovito provoditi strategiju za odabrane kategorije proizvoda i taktizirati s pozicioniranjem proizvoda i kategorija na polici, dodatna izlaganja, promociju cijene itd.

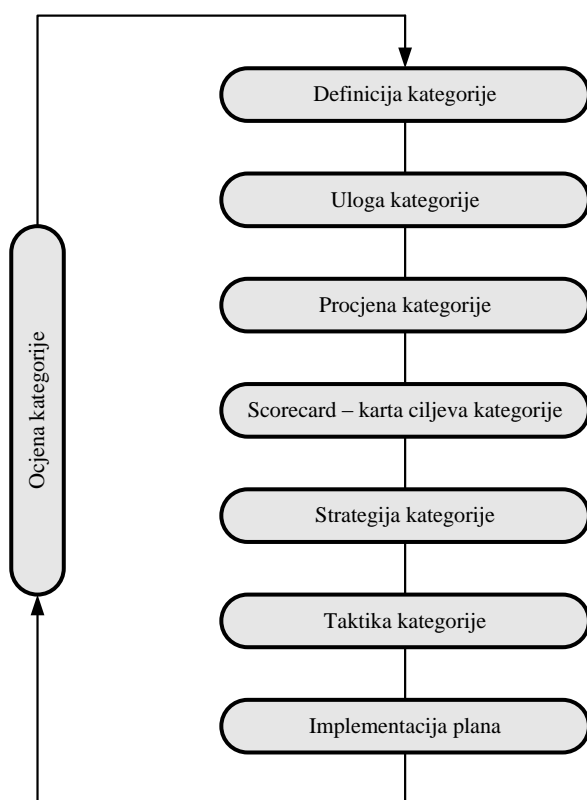
Kao primjeri poduzeća pomoću kojih će se prikazati implementacija space managementa u prodajnoj praksi u radu se analiziraju: Plodine, Takko Fashion, Kaufland, Dm - drogerie markt.

2. Pojam space managementa

Space management (upravljanje prostorom) predstavlja važan segment *category managementa*. Budući da su mnoga istraživanja pokazala da je preko 60 % kupovine tzv.

impulzivna kupovina, uloga space managementa utjecati je svojom poslovnom politikom na odluke kupca. Space management ima za cilj funkcionalno uređenje prodajnog mjesta, optimizaciju zaliha i kao posljedicu maksimiziranje profita.

Category management razvio se na maloprodajnim tržištima krajem osamdesetih godina prošlog stoljeća kao posljedica razvoja tržišta prodaje. *Category* management sastoji se od poslovnih procesa: razvoja i praćenja poslovnih planova za određene kategorije proizvoda. Osnova svega je definiranje proizvoda koji čine određene kategorije i dodjeljivanje uloge kategoriji. Nadalje, potrebno je razraditi potencijalne mogućnosti prodaje i razviti strategiju potražnje. Slijedi određivanje cijena, promocije proizvoda, odgovarajući razmještaj u poslovnom prostoru i na policama te kao rezultat svega pratiti prodajne rezultate određene kategorije proizvoda.



Slika 1. Poslovni proces Category managementa (Izvor: Muller, Singh, 2006: Category Management, Zagreb: Internacionalni centar za profesionalnu edukaciju., str. 196.)

Glavni zadaci *category* managementa su (Segetlija, 2006.; 324.):

- optimiziranje asortimana
- optimiziranje polica
- planiranje i kontrola akcijskih prodaja
- izravna rentabilnost proizvoda
- analiza potrošačke košare.

Kao glavna ograničenja prilikom djelovanja *category* managementa nameću se (Muller, Singh, 2006.): organizacija, ljudi, informacijski sustavi, oslanjanje na proizvođače, nedostatak kreativnosti, vrlo ograničeno poznavanje potrošača, nedostatak znanja o pokretačima kategorije i loša izvedba.

Primjena *category* managementa ima osam koraka (Basuroy, 2001.):

- definiranje kategorije

- uloga kategorije gdje se analiziraju navike kupca
- procjenjivanje kategorije
- strategije kategorije
- taktike kategorije
- implementacija plana
- praćenje rezultata.

Space management ima zadatak: definirati kategorije proizvoda, organizirati bazu podataka o proizvodima i njihovoj prodaji (u kojoj količini i kad), kreirati police, uočiti mogućnosti za bolju prodaju te izradu planograma, tj. novo pozicioniranje proizvoda unutar prodajnog prostora. Kao krajnji cilj space managementa nameće se detaljna analiza novonastalih prodajnih količina, tj. koji proizvodi su najviše prodani, koji proizvodi su najmanje prodani, na kojem mjestu su se nalazili, u koje vrijeme su kupljeni itd.

Svi naponi za ostvarivanje postavljenih ciljeva bit će usmjereni na zadovoljavanje potreba kupaca tako da se postigne konkurentska prednost u odnosu na konkurenciju. Poduzeće može kreirati svoju konkurentsku prednost na strani ponude - gdje poduzeće mora biti svjesno svojih resursa i sposobnosti kroz koje može kreirati svoju jedinstvenost i na strani potražnje - gdje je ključ uspjeha razumijevanje želja i potreba kupaca. U oblikovanju i provedbi strategije diferencijacije potrebno je:

- odrediti tko je stvarni kupac
- odrediti lanac vrijednosti kupca i utjecaj poduzeća na njega
- odrediti kriterije kupnje i njihove rangove
- procijeniti postojeće i potencijalne izvore jedinstvenosti u lancu vrijednosti poduzeća
- identificirati troškove postojećih i potencijalnih izvora diferencijacije
- odabrati konfiguraciju vrijednosnih aktivnosti koja stvara „najvrjedniju“ diferencijaciju za kupca u odnosu na troškove diferencijacije
- provjeriti i testirati održivost diferencijacije i smanjiti troškove u aktivnostima koje utječu na izabrani oblik diferencijacije (Muller, Singh, 2006.).

3. Učinkovito upravljanje prostorom u trgovini

Vanjskim i unutarnjim uređenjem prodavaonice može se stvoriti takva prodajna atmosfera koja će kupca privući, omogućiti mu da kupuje sa zadovoljstvom, motivirati ga da ostane duže, potroši više novca nego što je to prethodno namjeravao, i što je najvažnije, da se u prodavaonicu opet vrati (Mihić, 2006.; 920.).

Trgovine s modernom koncepcijom poslovanja sve veću pažnju pridodaju izgledu prodajnog prostora i izlaganju proizvoda. Neke trgovine i trgovački centri postali su zbog toga i prave turističke destinacije npr. Harrods u Londonu, Laffayet u Parizu, The Mall at Bay Plaza u New Yorku. S obzirom na postojanje većeg broja trgovačkih centara u svjetskim metropolama, teži se individualnosti koja će osiguravati prepoznatljivost što će u konačnici rezultirati povećanjem broja kupaca i povećanjem prihoda.

Osnovni elementi stvaranja atmosfere u prodajnom prostoru su: rasvjeta, glazba, mirisi i uređenje. Svojstva rasvjete kojima se stvara ugođaj su koloritet i osvjetljenje. Miris kod kupca stvara osjećaj elegancije i kupci rado ulaze u trgovine privučeni mirisom. Glazba sporijeg tempa usporava kretanje kupca kroz prodajni prostor, a istraživanja su pokazala kako trgovine sa sporijim tempom glazbe ostvaruju najbolje efekte u prodaji. Izbor glazbe u trgovini mora se prilagoditi segmentu kupaca koji u njoj kupuje i brendu koji prodaje. Boje imaju posebnu ulogu u uređenju izloga i prodajnih prostora; tople boje su pogodne za uređenje izloga u

impulzivnoj kupovini, a hladne boje se koriste u slučajevima duljeg zadržavanja kupaca na jednom mjestu (Muller, Singh, 2006.).

Sama boja, sklad boja i kombinacije boja su bitni za izazivanje i skretanje pažnje potrošača na prodavaonicu ili određeni proizvod. Isto tako boja potpomaže nastajanju odgovarajućih pozitivnih asocijacija kod kupaca pri stvaranju njihove odluke o kupnji. Tako na primjer, crvena i žuta boja mogu pojačati osjećaj za apetit i dobro ih je kombinirati u prodavaonicama hrane (Gutić, Barbir, 2009.; 379.).

Prodavaonica mora biti tako dizajnirana da olakša kretanje kupaca, omogućiti prezentiranje proizvoda i stvoriti ugođaj procesa kupovine na mjestu prodaje. Izgled prodavaonice utječe na opće raspoloženje kupca i povećava opseg kupovine. Postavljanje izložbenih policama i tok kretanja kroz prodavaonicu mogu znatno povećati prodaju. Prostor koji je namijenjen pojedinim proizvodima na policama te mikrolokacija proizvoda na polici također povećava ili umanjuje obim prodaje. Gdje su smješteni proizvodi za djecu, žene, muškarce? Gdje su smješteni proizvodi u okviru makrolokacije – da li na frekventnim putevima prolaska ili na rijetko posjećenim mjestima? (Kesić, 2006.; 129.)

Neka od pravila uređenja prodajnih prostora su (Muller, Singh, 2006.):

- hodnici kojima hodaju kupci moraju biti dovoljno široki
- trgovinu organizirati u smjeru kretanja desno, radi urođenog nagona prema kretanju tijela u desno
- u prodajnom prostoru stvoriti nekoliko fokusnih točaka, kako bi se kupca navelo da prođe cijelom trgovinom
- stvoriti zanimljive kutke u kojima se mogu ponuditi sezonski ili prigodni proizvodi
- odjele formirati u skladu s potrebama kupaca, tzv. tematski odjeli
- ne stavljati previše natpisa i plakata s natpisom akcija jer kupci gube povjerenje u istinitost
- na ulazu u hipermarkete postavlja se odjel voća, povrća i cvijeća radi dojma svježeg
- proizvodi ciljane kupovine (kruh, mlijeko, meso) smješteni su na kraju hipermarketa kako bi kupac prošao veći dio trgovine da bi došao do njih
- najprodavanije proizvode postaviti u sredinu odjela kako bi kupci prošli i pored ostalih proizvoda kako bi došli do traženog proizvoda
- organizacija police prema težini; veći i glomazniji proizvodi pozicioniraju se na dnu police, a manji i lakši na vrhu
- proizvode za djecu pozicionirati niže kako bi ih djeca uočila
- proizvode na promociji postaviti u visini očiju
- dizajn etikete za cijenu mora biti jednostavan
- oko blagajne pozicionirati proizvode impulzivne kupovine.

Uređenost pojedinih odjela u prodavaonici, širina prolaza, općenito prolaznost ili zakrčenost (zatrpanost) prolaza, grupiranje proizvoda po vrstama i namjenama, pozicija proizvoda na policama, natrpanost robe itd. mogu biti bitni elementi u privlačenju i odvlačenju pažnje kod kupaca (Gutić, Barbir, 2009.; 381.).

Vrlo je važno proizvodima koji su najprodavaniji unutar svoje kategorije dati i najveći prostor, ali i najbolju poziciju što se može vidjeti na slici 2. Najprodavanije proizvode potrebno je pozicionirati u području vidokruga potencijalnog kupca u njihovoj razini očiju.

Temeljni cilj planiranja prostora u trgovini je uskladiti opseg pojedine kategorije proizvoda, prodajni asortiman, prostor namijenjen pojedinom artiklu, lokaciju na polici, broj artikala na polici s podacima o prodaji proizvoda. S obzirom na neprestani razvoj informacijske tehnologije, postoje softverska rješenja pomoću kojih se bez premještanja proizvoda može jednostavnije uskladiti prodajni prostor, smještaj proizvoda unutar njega i potencijalna

MORAM SE ISTEGNUTI 5th

VIDIM 4th

MOGU DOHVATITI 3rd

MORAM SE SAGNUTI 2nd

VEĆA PAKIRANJA 1st

34%

78%

http://web.efzg.hr/dok/OIM/OIMprester_MP_Space%20management%20%20Apollo%20software.pdf)

Na temelju rezultata istraživanja o segmentaciji kupaca u supermarketima na osnovi njihova zadovoljstva prodajnim osobljem (Mihić, 2006.; 932.) i njihovog zadovoljstva pojedinim faktorima izdvojenima na osnovi stavova o ponašanju i izgledu prodajnog osoblja i na osnovi uređenja prodajnog mjesta, vlasnicima analiziranih supermarketa i njihovom prodajnom osoblju sugerira se sljedeće:

- Uređenje prostora prodavaonica u cjelini ima značajne efekte na ponašanje potrošača. Ovi se efekti mogu sumirati u sljedećem (Markin et al. 1976.):

- prostor modificira i oblikuje ponašanje potrošača
- prostorni aspekt prodavaonice utječe na potrošača posredstvom osjetila
- maloprodajne prodavaonice slično kao i ostali stimulansi utječe na potrošača posredstvom percepcije, stavova i imidža
- prodavaonice projiciranim dizajnom mogu izazvati kao i ostali stimulansi u procesu komunikacije željene reakcije potrošača.

Pojedinci dolaze u prodavaonicu (prodajni centar) često iz drugih razloga pored kupovnih. To su fizičke aktivnosti, društveni kontakti ili poticanje osjetila kao što su užitak, zadovoljstvo, odmor i sl. Prodajni centar je najbolji primjer za to. Stoga prodavaonica treba svoj imidž uskladiti s imidžom cjelokupnog centra, a sve zajedno uskladiti sa stilom života ciljnog segmenta kojemu je kupovni centar usmjeren (Kesić, 2006.; 130.).

4. Implementacija načela space managementa u odabranim trgovinskim poduzećima

4.1. Hipermarketi Plodine

Plodine d.d. posjeduju 75 prodajnih centara u svim većim gradovima u Republici Hrvatskoj, sa sjedištem i upravom u Rijeci. Plodine stoga imaju značajnu ulogu na tržištu prodaje hipermarketa. Što se tiče uređenja prodajnih prostora, u svim centrima jednaka je kategorija proizvoda, iako prema teritorijalnom načelu poslovanja različiti asortiman sukladno potrebama kupaca na određenom području ima drugačiju poziciju i ulogu. Na ulazu u prodajni prostor nalazi se odjel voća, povrća i cvijeća, a smjer kretanja je u desno. Glazba je sporijeg tempa i odgovara segmentu kupaca koji kupuju u Plodinama. Proizvodi široke potrošnje (brašno, šećer, pelene ...) u pravilu se nalaze uvijek na istom mjestu. Proizvodi namjenske kupovine (brašno, mlijeko, meso ...) nalaze se na kraju trgovine, a neki proizvodi impulzivne kupovine nalaze se oko blagajne. Proizvodi na akciji nalaze se u centralnom dijelu prodajnog prostora jer je tamo najveća koncentracija kupaca.

4.2. Takko Fashion

Takko je s 1 900 poslovnica zastupljen u 16 europskih zemalja te u Rusiji. 17 000 djelatnika u prodaji, odjelu logistike i središnjici u Telgteu, nedaleko od atraktivne vestfalske metropole Münster, brine o željama kupaca. Takkov kupac je obiteljska žena koja uživa u svom aktivnom životu između posla i obitelji (Takko, 2016.).

Sve Takkove trgovine su četvrtastog oblika, veličine do 400 m². Ulaz se nalazi na sredini trgovine, a unutrašnjost prodajnog prostora podijeljena je na ženski, muški i dječji odjel s pododjelima. Svaki od ovih odjela ima svoju stražnju stijenu ispred koje se nalaze tematski stalci kojima su odjeli odvojeni. Trgovine Takka su svijetle i jasno strukturirane. U trgovinama se koristi LED rasvjetni sustav. Prevladavaju svijetlo siva i krem nijansa boje. Budući da su žene najveći segment kupaca, smjer kretanja u desno namijenjen je ženskom odjelu. Na ženskom odjelu nalazi se i stol namijenjen izlaganju proizvoda povoljnih cijena i proizvoda na akciji. Odjeća je pozicionirana na stalcima, vješalicama i stepenastim stolovima što poboljšava dinamiku u pozicioniranju proizvoda. Na tematskim stalcima pozicioniraju se proizvodi zadane teme i povoljnih cijena. Cijene su jasno istaknute, a ispred blagajne nalaze se proizvodi namijenjeni impulzivnoj trgovini npr. čarape.

4.3. Kaufland k.d.

Kaufland grupacija osnovana je u Njemačkoj, gdje su i danas među vodećim trgovinama prehrambenih proizvoda i robe široke potrošnje. 2001. godine Kaufland je otvorio svoju prvu poslovnicu u Hrvatskoj. Poslovnice Kauflanda postoje i u Češkoj, Slovačkoj, Poljskoj,

Rumunjskoj te Bugarskoj. Ponuda Kauflanda sastoji se od 20 000 proizvoda (Kaufland, 2016.).

Ponuda proizvoda u Kauflandu proteže se od vlastitih robnih marki do poznatih brendova. Svi Kaufland centri su sličnog oblika i identično uređeni kako bi se postigla standardiziranost. Prodajni centri dobro su osvijetljeni, s glazbom koja odgovara širem segmentu kupaca. Unutarnje elemente prostora čine police s proizvodima, rashladne vitrine, hladnjaci, police s kruhom i odjel s mesom. Kretanje kupaca i položaj odjela navodi na desno. Kupci imaju prostora za kretanje i razgledavanje. Na ulazu u trgovinu nalazi se odjel voća i povrća. Proizvodi planske kupovine (kruh, mlijeko, meso) nalaze se na kraju trgovine. Novi proizvodi i proizvodi na akciji pozicioniraju se na privremenim mjestima izlaganja kao što su promotivni štandovi. Proizvodi koji su na akciji pozicionirani su u sredini prodajnog prostora, na posebnim policama. Sezonski proizvodi su dodatno istaknuti, a oko blagajne nalaze se proizvodi impulzivne kupovine.

4.4. Dm – drogerie markt

1973. otvorena je prva dm prodavaonica u Njemačkoj (Karlsruhe), 1976. prva dm prodavaonica u Austriji (Linz), a 1996. prva dm prodavaonica u Hrvatskoj (Zagreb). Danas je dm s 154 filijale zastupljen po cijeloj Hrvatskoj. Upravno-distributivni centar u Zagrebu središte je za cijelu Hrvatsku, kao i poveznica za susjedne zemlje u jugoistočnoj Europi. Asortiman dm-a obuhvaća više od 15 500 proizvoda iz područja zdravlja, ljepote, dječje njege i hrane, domaćinstva, fotousluga i dodatnog asortimana. Asortiman je upotpunjen i s 22 dm marke (DM, 2016.).

Najveći dio prodajnog prostora u dm-u zauzimaju police s proizvodima koje su raspoređene po odjeljcima i kategorijama proizvoda. U svakom odjeljku proizvodi su pozicionirani prema visini cijene, od najskupljih na najvišim policama do jeftinijih na nižim policama.

U dm-u se za pozicioniranje proizvoda na akciji i promotivne ponude koriste gondole (samostojeće konstrukcije za izlaganje robe), a smještene su na početku polica i u prolazima. Istu namjenu imaju i škarasti stolovi, no oni su smješteni isključivo na početku police. Proizvodi na akciji koji su većih dimenzija (npr. pelene, wc papir) uglavnom se izlažu na paletama koje su raspoređene za to na predviđenim lokacijama. Neposredno u blizini blagajne smještene su samostojeće police na kojima su izloženi proizvodi različitih kategorija. Njihove cijene su pretežno redovne, a cilj im je potaknuti kupce na impulzivnu kupovinu. Na samoj blagajni nalaze se police s proizvodima namijenjenim impulzivnoj kupovini. Kupci na blagajni dobiju i preporuku za proizvode od samih djelatnica što dodatno potiče njihovu odluku na kupnju. Osim pozicioniranja proizvoda, velika pažnja u prodajnim prostorima dm-a poklanja se i isticanju cijene artikala. Kartice s cijenama, osim same cijene, sadržavaju informacije i pogodnosti vezane uz samu kupnju.

5. Zaključak

Sam Walton, osnivač Wal-Marta rekao je: „Postoji samo jedan boss: kupac. On može najuriti svakog iz kompanije – od predsjednika pa nadalje i to jednostavno ako odluči potrošiti svoj novac negdje drugdje.“

Prodajni prostor može biti glavni razlog dolaska kupaca u određeno prodajno mjesto u kojem će se on osjećati ugodno, a da sam prostor bude funkcionalno uređen. Koncept space managementa pruža i mogućnost individualnog pristupa uređenju prostora svojom estetikom što može dominirati kupovnim doživljajem. Osnovna pitanja kojima se bavi space management su: treba li povećati ili smanjiti asortiman, treba li alocirati pojedini proizvod, kako pozicionirati proizvode unutar kategorije i odjela. Pozicioniranje proizvoda se odnosi i

na odluke i aktivnosti čija je namjera stvaranje određene koncepcije o proizvodu u svijesti kupaca. Primjenom informacijske tehnologije i uporabom planograma postiže se optimizacija zaliha, povećanje profita i zadovoljenje potreba kupaca.

Uvidom u neke od prodajnih prostora (Plodine, Takko, Kaufland, dm) može se analizom doći do zaključka kako oni u svojim prodajnim prostorima uspješno implementiraju načela space managementa.

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Application of space management principles in sales practice

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Abstract. Space management is the part of category management focused on the category management of products as units with clearly defined goals. The goal is to implement and

establish structured processes for product category management within the company's strategy.

Stores with a modern business concept strive to adapt their retail space to customers' needs in order to make it as functional as possible. The right product positioning within a store guarantees better business results and allows the customer to navigate the retail space more easily.

In practice, space management is primarily implemented by defining the product range, retail space appearance, shelf layout within the store, and the placement of products on the shelves in order to draw customers' attention. The very manner in which products are placed can strongly impact the buying decision process. If merchants want to achieve their goals, they need to ensure that the strategy for a specific category of products is efficiently implemented. This implies certain tactical decisions regarding the positioning of a product category on the shelf, additional displays, promotional pricing, etc.

This paper provides an analysis of research conducted in various stores in order to determine the extent to which the principles of space management are implemented in practice.

Key words: *space management, category management, product categories, retail space, product positioning*

CIET
2016

Track 3

Information Technology,
Electrical Engineering and
Mechanical Engineering

Transformator s jezgrom od amorfnog materijala u distribucijskoj mreži

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Sažetak. U radu je napravljena analiza transformatora s jezgrom od amorfnog materijala u usporedbi sa klasičnim transformatorom. Prednosti transformatora s jezgrom od amorfnog materijala su mali gubici u jezgri, mala struja magnetiziranja, veća energetska učinkovitost i duži životni vijek. Procjenjuje se da gubici u jezgri čine više od 70 % ukupnih gubitaka u transformatoru te oko 25% svih tehničkih gubitaka u mreži. Smanjenjem gubitaka doprinijelo bi većoj energetske učinkovitosti te samim time povećala bi se ekonomičnost pogona. Transformator s jezgrom od amorfnog materijala ima oko 50 % niže gubitke u jezgri u odnosu na najbolje klasične transformatore

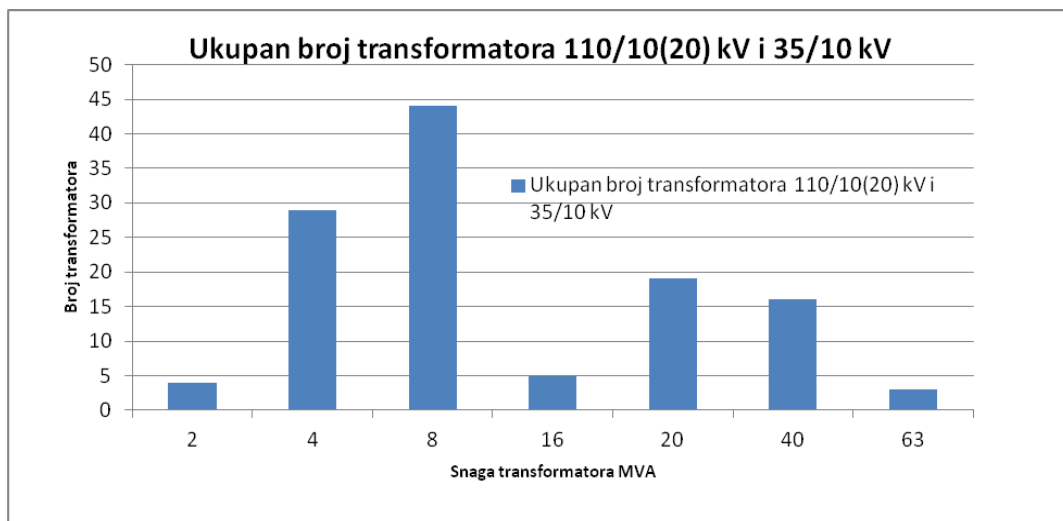
Ključne riječi: Distribucijski transformator, amorfnja jezgra, gubici u jezgri, energetska učinkovitost

1. Uvod

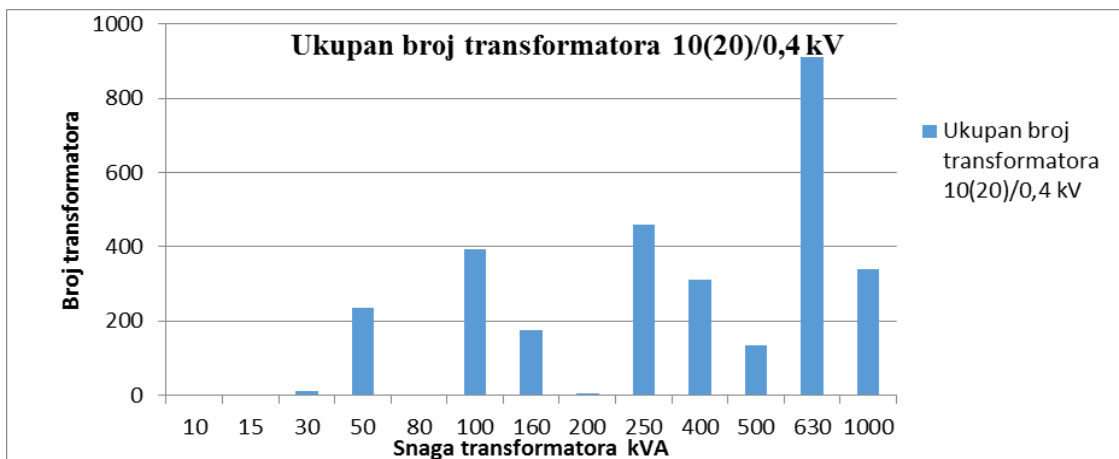
U radu su prikazana mjerenja i proračuni čiji je cilj prikazati učinak zamjene klasičnog transformatora sa energetske učinkovitijim transformatorom. Energetske učinkovitiji transformatori imaju različit sklop i sastav jezgre od klasičnog transformatora i njihova svrha je ušteda u gubicima kako u ekonomskom tako i tehničkom segmentu. Razmatrana je trafostanica Dugopolje - 4 snage 250 kVA u kojoj je ugrađen transformator s jezgrom od amorfnog materijala. Prikazat će se rezultati mjerenja električnih i magnetskih polja te buke, odnosno utjecaj trafostanice Dugopolje - 4 na okoliš. Provest će se i proračun isplativosti zamjene klasičnog transformatora sa transformatorom s jezgrom od amorfnog materijala.

2. Postojeće stanje

Gubici električne energije predstavljaju znatan udio u ukupnim gubicima u elektroenergetskom sustavu. Prema procjenama gubici u jezgri čine više od 70 % ukupnih gubitaka u transformatoru te oko 25 % svih tehničkih gubitaka u mreži. Smanjenju gubitaka doprinosi primjena energetske učinkovitijih transformatora. Broj distribucijskih transformatora na području Elektrodalmacije Split iznosi oko 3100, a njihova razdioba prikazana je na slikama 1 i 2.

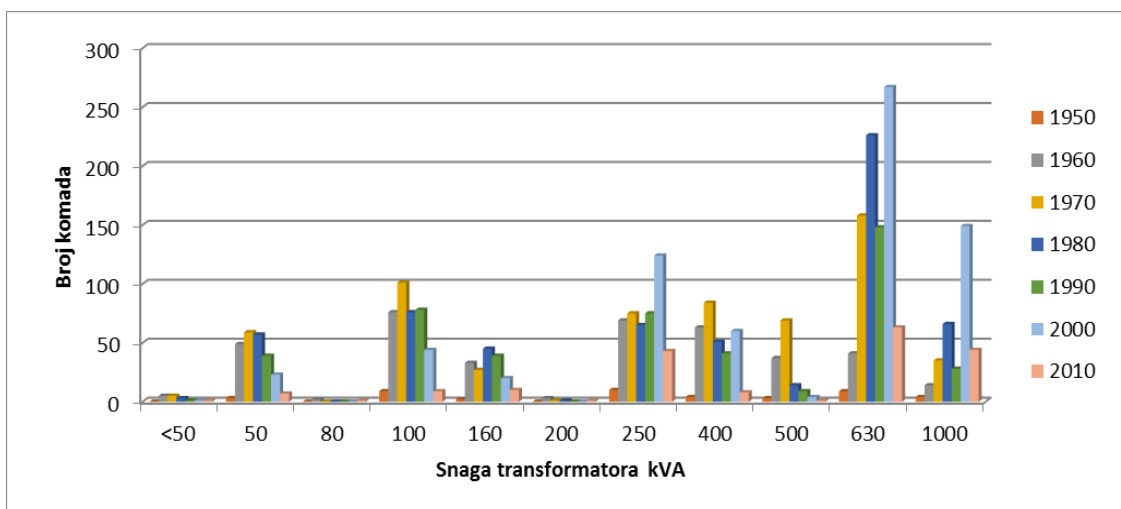


Slika 1 Ukupan broj transformatora napona 110/10(20) i 35/10 kV



Slika 2 Ukupan broj transformatora napona 10(20)/0,4 kV

Broj transformatora snage 250 kVA iznosi 460 jedinica što čini 15 % instalirane snage distribucijskog područja, dok transformator snage 630 kVA iznosi 912 jedinica što čini 31 % instalirane snage distribucijskog područja. Velik broj transformatora je podopterećen što dodatno pridonosi gubicima. Na slici 3 prikazana je starosna dob transformatora.



Slika 3 Starosna dob transformatora napona 10(20)/0,4 kV

Najstariji transformator je iz 1951. godine snage 400 kVA, napona 10/0,4 kV.

3. Transformator s jezgrom od amorfnog materijala

Sama proizvodnja transformatora s jezgrom od amorfnog materijala događa se u posebnim uvjetima i na poseban način. Magnetska jezgra ovog transformatora napravljena je od feromagnetskih amorfnih materijala i debljina limova iznosi oko 25 μm . Amorfne slitine razlikuju se od kristalnih slitina u svojim magnetskim i mehaničkim svojstvima (čvrstoća i tvrdoća). Gubici u transformatorima s jezgrom od amorfnog materijala mogu biti podjeljene u dvije komponente:

- gubici u histerezi
- gubici uzrokovani vrtložnim strujama.

Amorfni materijal omogućuje lakšu magnetizaciju materijala što u konačnici dovodi do smanjenja gubitaka histereze.

Gubici vrtložnih struja također su manji kod amorfnog materijala zbog kombinacije tanje debljine lima i visokog električnog otpora od 130 $\mu\Omega\text{cm}$ u odnosu na klasični transformator čiji električni otpor iznosi 51 $\mu\Omega\text{cm}$.

Prednosti ovakvog transformatora su mali gubici u jezgri, mala struja magnetiziranja, veća energetska učinkovitost i duži životni vijek. Ono što odlikuje transformator s jezgrom od amorfnog materijala je to što imaju 50 % niže gubitke praznog hoda u odnosu na najbolje klasične transformatore, a iz perspektive troškova proizvodnje imaju jednaku ili nešto veću cijenu kao i visokoučinski transformatori.

3.1 Transformatorska stanica Dugopolje - 4

TS Dugopolje - 4 izvedena je kao samostojeći objekt tipa „tornjić“. Sadrži transformator s jezgrom od amorfnog materijala tipa AMT250-24X nazivne snage 250 kVA s regulacijom $\pm 2 \times 2.5 \%$ proizveden 2014. g. Novi postojeći transformator s jezgrom od amorfnog materijala prikazan je na slici 4.



Slika 4 Transformator s jezgrom od amorfnog materijala u TS Dugopolje-4

Prema ispitnoj listi dani su podaci transformatora AMT 250-24X koji su prikazani u tablici 1 i ispitani su prema IEC 60076.

Tablica 1 Tehnički podaci transformatora sa amorfnom jezgrom

Snaga	250 kVA	
Oznaka spoja	Dyn5	
Frekvencija	50 Hz	
Razred izolacije	A	
Naponi	VN=10kV± 2x2.5 %	NN= 420V
Ukupna masa	1258 kg	
Gubici i struja praznog hoda	V _{ef} =420 V, I=0,72A, W _g =126 W	
Gubici praznog hoda	150 W	
Gubici opterećenja	2750	
Ukupni gubici	2900 W	

U tablici 2 prikazana je ispitna lista klasičnog transformatora 8EuTBN ispitano prema IEC 76.

Tablica 2 Tehnički podaci klasičnog transformatora

Snaga	250 kVA	
Oznaka spoja	Dyn5	
Frekvencija	50 Hz	
Razred izolacije	A	
Naponi	VN=10kV± 2x2.5 %	NN= 420V
Ukupna masa	1050 kg	
Gubici i struja praznog hoda	V _{ef} =420 V, I=1,34A, W _g =440 W	
Gubici praznog hoda	425 W	
Gubici opterećenja pri 75 C	3250 W	
Ukupni gubici	3675 W	

Prema podacima iz tablice 1 i 2 uočava se da klasični transformator ima gubitke jezgre 425 W, dok transformator s jezgrom od amorfnog materijala ima gubitke jezgre koji iznose 150 W. Zaključuje se i da transformator s jezgrom od amorfnog materijala tipa AMT 250-24X ima 35 % niže gubitke jezgre u odnosu na transformator sa klasičnom jezgrom tipa 8EuTBN.

3.2 Utjecaj transformatora s jezgrom od amorfnog materijala na okolinu

Utjecaj TS Dugopolje - 4 na okolinu ispitana je kroz analizu električnih i magnetskih polja te buke.

Magnetsko polje (B), izraženo u μT , svojom indukcijom djeluje na okolinu te se stvara u području oko vodiča kada teče struja. Magnetsko polje ovisi o jakosti struje i raste s opterećenjem trafostanice koje je tijekom mjerenja bilo manje od nazivnog.

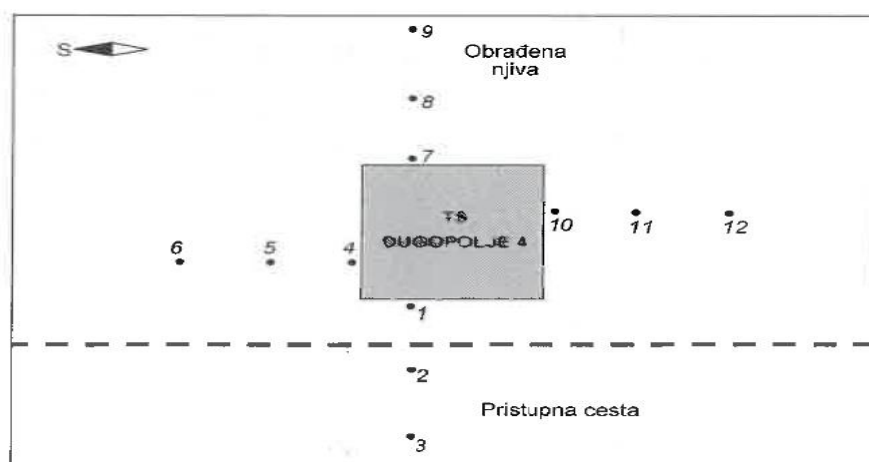
Jakost električnog polja (E), izraženo u V/m, direktno je ovisna o iznosu napona koji uzrokuje električno polje. Prema međunarodnoj organizaciji za zaštitu od neionizirajućih zračenja-ICNIRP izdana je preporuka za granične vrijednosti magnetskog polja. U tablici 3 prikazane su granične vrijednosti razine jakosti električnih polja i magnetskih polja.

Tablica 3 Granične razine jakosti električnih polja i gustoća magnetskog toka

Područje zaštite	Jakost el. polja E (V/m)	Magnetsko polje B (μT)
Područje profesionalne izloženosti	5000	100
Područje povećane osjetljivosti	2000	40

Trafostanica Dugopolje - 4 nalazi se na javnom području, a najbliže područje profesionalne izloženosti (obrađena njiva) udaljena je 1 m od trafostanice, dok su područja povećane osjetljivosti toliko udaljena da se u njima elektromagnetska (EM) polja trafostanice ne mogu izdvojiti od polja ostalih izvora EM polja mrežne frekvencije. Zbog toga su EM polja mjerena na 12 lokacija u neposrednom okolišu trafostanice i to na 3 lokacije sa svake strane trafostanice gdje su preglednim mjerenjima utvrđene najviše razine magnetskog polja.

Mjerne lokacije smještene su na udaljenostima 0,2 m, 1 m i 2 m od trafostanice prema slici 5. Na svakoj lokaciji mjereno je na tri mjerna mjesta postavljena na visinama 0,5 m, 1m i 1,5 m iznad tla.

**Slika 5** Skica smještaja trafostanice s 12 označenih mjernih lokacija

Izmjerene vrijednosti djelovanja magnetskog i električnog polja na okolinu prikazani su u tablici 4.

Tablica 4 Rezultati mjerenja

Rezultati mjerenja							
Lokacija	Visina	B(μT)	E(kV/m)	Lokacija	Visina	B(μT)	E(kV/m)
1	0,5m	1,296	0,002	7	0,5m	1,000	0,002
	1m	0,998	0,006		1m	1,086	0,007
	1,5m	1,054	0,012		1,5m	1,364	0,012
2	0,5m	0,335	0,004	8	0,5m	0,119	0,006
	1m	0,287	0,005		1m	0,148	0,014
	1,5m	0,303	0,010		1,5m	0,194	0,010
3	0,5m	0,147	0,005	9	0,5m	0,071	0,013
	1m	0,157	0,007		1m	0,075	0,018
	1,5m	0,158	0,012		1,5m	0,091	0,000

4	0,5m	0,859	0,001	10	0,5m	0,275	0,000
	1m	0,991	0,003		1m	0,506	0,000
	1,5m	0,822	0,006		1,5m	0,824	0,000
5	0,5m	0,148	0,005	11	0,5m	0,064	0,000
	1m	0,142	0,008		1m	0,067	0,000
	1,5m	0,141	0,018		1,5m	0,082	0,001
6	0,5m	0,072	0,011	12	0,5m	0,036	0,000
	1m	0,072	0,015		1m	0,035	0,000
	1,5m	0,063	0,028		1,5m	0,036	0,000
Mjera nesigurnosti ±10%							
Granične razine B= 40/100/1000 (μT) E= 2/5/10 kV/m							

Najviša razina magnetskog polja od $1,364 \mu\text{T}$ izmjerena je na lokaciji 7 uz samu trafostanicu, na visini 1,5 m iznad tla gdje se s visinom polje mijenja pa bi prostornim usrednjavanjem dobivena razina izloženosti ljudi homogenom polju na toj lokaciji bila nešto niža od ove vrijednosti. Iz rezultata mjerenja vidi se da magnetsko polje trafostanice slabi sa udaljenošću od trafostanice, tako da na ostalim područjima tijekom mjerenja polja trafostanice nije premašilo ovu razinu.

Izmjerene vrijednosti jakosti električnih polja, od kojih je najveća $0,028 \text{ kV/m}$, dolaze prvenstveno od priključnih vodova trafostanice.

Prema dobivenim rezultatima mjerenja očigledno je da su izmjerene vrijednosti EM polja znatno niže od propisanih te udovoljavaju zahtjevima Pravilnika o zaštiti od elektromagnetskih polja.

3.3 Buka transformatora

Buka transformatora najviše ovisi o indukciji i vrsti lima. Veća indukcija izaziva veću buku. U tablici 5 definirane su najveće dozvoljene vrijednosti zvučne snage koje su usko povezane s razinama gubitaka jezgre te ih definira ista oznaka (E_0 , D_0 , C_0 , B_0 i A_0).

Tablica 5 Gubici jezgre i nivo zvučne snage $L_{WA}(\text{dB(A)})$

Nazivna snaga	E_0		D_0		C_0		B_0		A_0		Napon kratkog spoja
	P_0	L_{WA}	P_0	L_{WA}	P_0	L_{WA}	P_0	L_{WA}	P_0	L_{WA}	
kVA	W	dB(A)	W	dB(A)	W	dB(A)	W	dB(A)	W	dB(A)	%
50	190	55	145	50	125	47	110	42	90	39	4
100	320	59	260	54	210	49	180	44	145	41	
160	460	62	375	57	300	52	260	47	210	44	
250	650	65	530	60	425	55	360	50	300	47	
315	770	67	630	61	520	57	440	52	360	49	
400	930	68	750	63	610	58	520	53	430	50	
500	1100	69	880	64	720	59	610	54	510	51	
630	1300	70	1030	65	860	60	730	55	600	52	
630	1200	70	940	65	800	60	680	55	560	52	6
800	1400	71	1150	66	930	61	800	56	650	53	
1000	1700	73	1400	68	1100	63	940	58	770	55	
1250	2100	74	1750	69	1350	64	1150	59	950	56	
1600	2600	76	2200	71	1700	66	1450	61	1200	58	
2000	3100	78	2700	73	2100	68	1800	63	1450	60	
2500	3500	81	3200	76	2500	71	2150	66	1750	63	

Da bi se postigli gubici razine A_0 potrebno je da se u transformatorima ugrade najbolji limovi po pitanju gubitaka debljine 0,23 mm. Transformatori s jezgrom od amorfnog materijala postižu gubitke jezgre razine $A_0/2$.

U tablici 6 dan je pregled intenziteta buke nekih karakterističnih izvora.

Tablica 6 Intenziteti različitih zvukova

Izvor buke	Intenzitet zvuka
Šuštanje lišća	10 dB
Vrlo tihi šapat	20 dB
Dnevna soba	40 dB
Razgovor	66 dB
Prometna ulica	75 dB
Unutrašnjost autobusa	80 dB
Podzemna željeznica	90 dB
Bučna tvornica	100 dB
Mlazni avion	120 dB

Prema Pravilniku o najvišim dopuštenim razinama buke u sredini u kojoj ljudi rade i borave granična vrijednost razine buke za dan iznosi $L_{day}=55$ dB, dok najveća dopuštena vrijednost razine buke za noć iznosi $L_{night}=40$ dB [5].

Mjerenje buke u okolišu vrši se prema normama HRN ISO 1996-1:2004 i HRN ISO 1996-2:2008 te odabirom mjernih uređaja koji se uklapaju u Pravilnik i tehničku specifikaciju. Emisija buke transformatora s jezgrom od amorfnog materijala mjerila se na udaljenostima 1m, 5m, 10m, 15m, 20m, 25m i 30m te rezultati su prikazani u tablici 7.

Tablica 7 Rezultati mjerenja ekvivalentne razine buke i usporedba s dopuštenom razinom

Izvori buke		MJEŠTO MJERENJA	Izmjerena ekvivalentna razina buke(dB)	Povišena razina buke zbog položaja mikrofona	Prilagođenje		Ocjenska razina buke u dB	Propisane najviše razine buke u dB
Isključeni	Uključeni				Tonalna prilagodba	Impulsna prilagodba		
+		MM1(#)	41,6	0	0	0	41,6	45
	+	MM2(#)	42,2	0	0	0	42,2	42,6
	+	MM3(#)	41,8	0	0	0	41,8	42,6
	+	MM4(#)	41,6	0	0	0	41,6	42,6
	+	MM5(#)	41,6	0	0	0	41,6	42,6
	+	MM6(#)	41,6	0	0	0	41,6	42,6
	+	MM7(#)	41,6	0	0	0	41,6	42,6

Gdje su MM1 (#) - udaljenost na 1 m, MM2 (#) - udaljenost na 5 m, MM3 (#) - udaljenost na 10 m, MM4 (#) - udaljenost na 15 m, MM5 (#) - udaljenost na 20 m, MM6 (#) - udaljenost na 25 m, MM7 (#) - udaljenost na 30 m.

Prilikom mjerenja za period dana na mjernom terminalu trafostanice očitana su sljedeća opterećenja po fazama $I_1 = 37,8$ A, $I_2 = 71,8$ A, $I_3 = 53,2$ A. Prema analizi mjerenja buke za TS Dugopolje - 4 rezultati mjerenja zadovoljavaju zahtjeve iz Pravilnika o najvišim dopuštenim razinama buke u sredini u kojoj ljudi rade i borave.

4. Isplativost zamjene transformatora

Da bi se napravio proračun isplativosti zamjene postojećeg transformatora sa energetskim učinkovitijim transformatorom [7] nužno je odrediti godišnje troškove transformatora prema sljedećem izrazu:

$$W_{loss} = (P_0 + P_k \times L^2) \times 8760$$

Pri čemu su:

W_{loss} – godišnji gubici energije u kWh

P_0 – gubici praznog hoda u kWh

P_k – gubici opterećenja u kWh

8760 – broj sati u godini

Za izračun cijene troškova gubitaka potrebno je da gubici budu sagledavani prema trenutku kupovine da bi se mogli staviti u istu perspektivu sa kupovnom cijenom i zato potrebno je izračunati ukupne kapitalizirane troškove gubitaka TCC_{loss} (eng. Total Capitalized Cost) .

$$TCC_{loss} = W_{loss} \times \frac{(1+i)^n - 1}{i \times (1+i)^n} \times C \times 8760$$

Kako bi se napravio proračun ekonomske analize transformatora potrebno je izračunati troškove životnog vijeka TCO (eng. Total Cost of Ownership). U jednoj formuli izračunava se trošak kupovine transformatora kao i njegovog korištenja i održavanja, zatim se uspoređuju uzimajući u obzir vremensku promjenjivost vrijednosti novca.

U praksi može se napraviti pojednostavljenje. Dok svaki transformator ima svoju kupovnu cijenu i faktore gubitaka, drugi troškovi poput instalacije, održavanja i demontiranja, bit će slični za slične tehnologije, tako da se ti navedeni elementi mogu izostaviti iz proračuna. Ukoliko se uspoređuju različite tehnologije, primjerice suhi transformator i uljni transformator, tada će se ti elementi uzeti u obzir. U proračunu sagledavat će se kupovna cijena i troškovi gubitaka. Cjelokupni trošak posjedovanja zadan je sljedećim izrazom :

$$TCO = PP + A \times P_0 + B \times P_k$$

Pri čemu je :

TCO - kapitalizirani troškovi transformatora [HRK]

PP - kupovna cijena transformatora [HRK]

A - Cijena gubitaka u praznom hodu [HRK/W]

P_0 - gubici praznog hoda [W]

B - Cijena gubitaka po opterećenju [HRK/W]

P_k - gubici opterećenja [W]

Svaki priključeni transformator na mrežu proizvodi gubitke praznog hoda P_0 i gubitke zbog tereta P_k . Gubici praznog hoda nastaju usljed histereze i vrtložnih struja u jezgri kad je transformator pod naponom, odnosno 8760 sati u godini i ne ovisi o opterećenju. Gubici tereta proporcionalni su kvadratu struje tereta ($P_k \sim I^2$). P_0 i P_k predstavljaju gubitak energije pa je važno pri nabavljanju novog transformatora voditi računa o troškovima gubitaka koje transformator proizvodi tijekom svog životnog vijeka.

Faktor A i B ovise o opterećenju transformatora i cijeni električne energije. Izbor faktora A i B kompliciran je budući da ovise o opterećenju transformatora koje je nepoznato, kao i cijeni energije koje su sklone promjenama.

Sljedeći izraz zadan je za izračun faktora A i B:

$$A = \frac{(1+i)^n - 1}{i \times (1+i)^n} \times C_{kWh} \times 8760$$

$$B = \frac{(1+i)^n - 1}{i \times (1+i)^n} \times C_{kWh} \times 8760 \times \left(\frac{I_l}{I_r} \right)^2$$

Gdje su:

i – kamatna stopa [% / godini]

n – radni vijek [godina]

C_{kWh} – cijena kWh [kn/kWh]

8760 – broj sati u godini

I_l – struja opterećenja

I_r – nazivna struja

Ove formule pretpostavljaju da su cijena energije i opterećenja konstantni tokom radnog vijeka transformatora.

Za izračun isplativosti zamjene postojećeg transformatora sa transformatorom s jezgrom od amorfnog materijala obrađen je transformator snage 250 kVA kojih na promatranom području ima 460 te čine 15 % instalirane snage distribucijskog područja.

4.1 Proračun isplativosti zamjene transformatora 250 kVA sa energetske učinkovitijim transformatorom

Za izračun isplativosti transformatora zamjene transformatora imamo sljedeće parametre :

Klasični transformator

$S = 250$ kVA

$U = 10/0,4$ kV

$P_0 = 425$ W

$P_k = 3250$ W

PP = 45 000 HRK

Transformator s jezgrom od amorfnog materijala

$S = 250$ kVA

$U = 10/0,4$ kV

$P_0 = 150$ W

$P_k = 2750$ W

PP = 69 000 HRK

Za izračun godišnjih gubitaka koji se računaju prema W_{loss} transformatora snage 250 kVA, napona 10/0,4 kV uzeti su u obzir gubici praznog hoda $P_0 = 425$ W, gubici kratkog spoja $P_k = 3250$ W, te srednje opterećenje transformatora $L = 0,6$.

$$W_{loss} = (P_0 + P_k \times L^2) \times 8760 = (425 + 3250 \times 0,6^2) \times 8760 = 13\,972,2 \text{ kWh}$$

Cijena troškova gubitaka TCC_{loss} navedenog transformatora uz kamatu $i = 6$ %, životni vijek $n = 30$ godina i prosječnu cijenu energije $C_{kWh} = 0,5$ kn/kWh :

$$TCC_{loss} = W_{loss} \times \frac{(1+i)^n - 1}{i \times (1+i)^n} \times C = 13972,2 \times \frac{(1+0,06)^{30} - 1}{0,06 \times (1+0,06)^{30}} \times 0,5 = 96\,163 \text{ HRK}$$

Ukupan trošak posjedovanja TCO računa se uz kamatnu stopu $i = 6 \%$, procijenjeni životni vijek $n = 30$ godina i prosječnu cijenu energije $C_{kWh} = 0,5$ kn/kWh. Faktor A iznosi 6,88 HRK/W te faktor B iznosi 1,25 HRK/W. Gubici praznog hoda novoga transformatora iznose $P_0 = 150$ W, gubici kratkog spoja iznose $P_k = 2750$ W.

$$TCO = PP + A \times P_0 + B \times P_k = 69000 + 6,88 \times 150 + 1,25 \times 2750 = 73\,470 \text{ HRK}$$

Ušteda zamjene starog transformatora 250 kVA sa energetske učinkovitijim transformatorom u periodu od 30 godina iznosi :

$$\Delta = TCC_{loss} - TCO = 96163 - 73470 = 22\,693 \text{ HRK}$$

Ukupan broj instaliranih transformatora snage 250 kVA čini oko 15 % instalirane snage distribucijskog područja, to je ukupno 460 jedinica koje bi se postepeno mogle zamjeniti sa energetske učinkovitijim transformatorima. U ovom slučaju cijena transformatora s jezgrom od amorfnog materijala je za 35 % skuplja od klasičnog transformatora koja će u slučaju serijske proizvodnje sigurno biti povoljnija.

5. Zaključak

U radu je prikazano tehnološko rješenje TS Dugopolje - 4. Napravljena je analiza učinka ugradnje transformatora s jezgrom od amorfnog materijala u TS Dugopolje - 4 te utjecaj na okoliš. Mjerenjem magnetskih i električnih polja utvrđeno je da izmjerena vrijednost udovoljava zahtjevima Pravilnika o zaštiti elektromagnetskih polja te nema nikakav utjecaj na okoliš i na ostala područja boravka ljudi.

Transformator s jezgrom od amorfnog materijala ima nešto veću buku od klasičnog transformatora, ali mjerenjem utvrđeno je da buka transformatora s jezgrom od amorfnog isplativosti zamjene transformatora sa novim vidljivo je da ušteda opravdava investiciju. Investiranje u energetske učinkovite transformatore znači smanjenje gubitaka, smanjenje utjecaja na okoliš, produženje životnog vijeka i povećanje energetske učinkovitosti.

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Transformer with amorphous core in distribution network

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Abstract. This paper contains an analysis of a transformer with core of amorphous material compared with classical transformer. The advantages of transformers with core of amorphous material are low core losses, low magnetizing current, higher energy efficiency and longer lifetime. It is estimated that no-load losses account for more than 70% of all losses in transformer and approximately 25% of all technical losses generated in electrical network. By reducing the losses it would contribute to greater energy efficiency and thus it would increase the economy drive. Transformers with core of amorphous material have 50% lower core losses in comparison to the best classical transformers.

Key words: *Distribution transformer, amorphous core, core losses, energy efficiency*

Razvoj aplikacije za autentifikaciju i autorizaciju korisnika uporabom tehnologije radio frekvencijske identifikacije

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Sažetak. Većina današnjih sustava za kontrolu pristupa i evidenciju radnog vremena temelji se na radio frekvencijskoj identifikaciji (RFID). Ovi sustavi koriste čitače RFID kartica, mrežnu tehnologiju Ethernet i protokol TCP/IP za komunikaciju s centralnim poslužiteljem. Na poslužitelju se nalazi baza podataka o svim korisnicima sustava, pravima pristupa (autorizacijske razine), a autentifikacija korisnika se obavlja pomoću beskontaktna kartice. U ovom radu opisuje se tehnologija RFID i navode njene najčešće primjene kao i sklopovlje upotrebjeno za izgradnju uređaja. Na kraju rada prikazana je izrađena web aplikacija za prikupljanje i obradu podataka te administriranje sustava. Razvijena aplikacija namijenjena je za kontrolu pristupa učionicama i laboratorijima te evidentiranje studenata i nastavnika. Uređaj je izrađen korištenjem platforme Arduino Uno, a web aplikacija primjenom programskog jezika PHP i baze podataka MySQL.

Ključne riječi: *RFID, Arduino, Ethernet, Authentication, Authorization*

1. Uvod

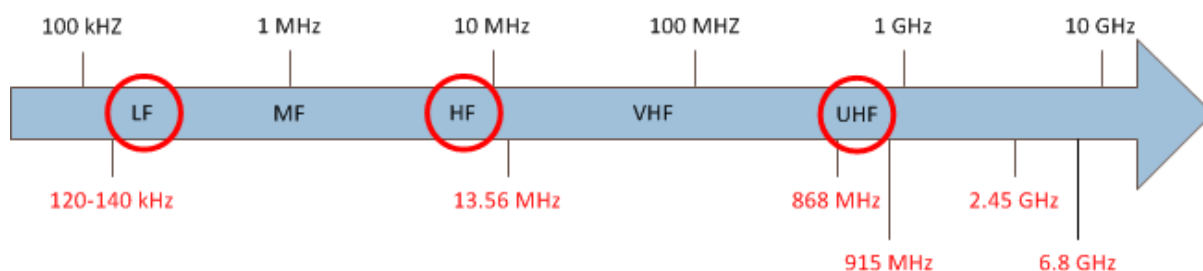
Zakonske odredbe propisuju da svaka pravna osoba mora voditi evidenciju o prisustvu djelatnika na radnom mjestu i na zahtjev ovlaštene osobe dužna ju je predložiti. Ukoliko se radi o malim tvrtkama vođenje evidencije obično preuzima jedna osoba unutar organizacije. Kod velikih organizacija koje uz veliki broj djelatnika imaju i smjenski rad obično se pribjegava digitalnom vođenju evidencije. Visoka učilišta pak propisuju obvezu prisustva nastavi za studente i vođenje interne evidencije. Ovaj proces oduzima vrijeme nastavniku ukoliko se vodi ručno, a ukoliko se studenti sami potpisuju, tada je vrlo često i nevjerodostojno te zahtjeva napredniji pristup.

U ovom radu ćemo prezentirati izradu sustava za autentifikaciju i autorizaciju korisnika korištenjem RFID tehnologije, a glavna namjena će mu biti digitalno vođenje evidencije o prisutnosti studenata na predavanjima kao i evidencija radnog vremena nastavnog osoblja. Sam sustav sastoji se od dvije ključne komponente, fizičkog sklopovlja čitača i aplikativne podrške u obliku web aplikacije koja se oslanja na relacijsku bazu podataka. Princip rada sustava jednostavan je i temelji se na korisničkoj prijavi korištenjem RFID kartice prilikom ulaska u laboratorij ili predavaonicu za studente, odnosno nastavnike. U tu svrhu, nastavno osoblje će zadužiti RFID kartice, a studenti za prijavu koriste ISAK kartice, odnosno službenu studentsku ispravu poznatiju pod nazivom e-Indeks koja je već u upotrebi na velikoj većini visokoškolskih ustanova u Republici Hrvatskoj.

S obzirom na vrlo visoke cijene komercijalno dostupnih sustava, ne računajući troškove ugradnje i održavanja, želimo pokazati kako visoka učilišta mogu sama razviti sustav za ove potrebe, pri čemu studenti izravno sudjeluju u razvoju te time unaprijeđuju svoje tehničke vještine i znanja na polju elektronike, informacijskih i komunikacijskih sustava.

1.1 Tehnologija RFID

Tehnologija RFID (eng. Radio Frequency Identification) je tehnologija bežičnog prijenosa podataka pomoću radijske frekvencije. Već više desetaka godina ta se tehnologija primjenjuje u različitim granama djelatnosti, a zadnjih godina dobila je globalni zamah, ponajviše zahvaljujući činjenici da je sve češće susrećemo ugrađenu u mobilne uređaje novije generacije. RFID komunikacija temelji se na stvaranju elektromagnetskih valova u odašiljačima i njihovom otkrivanju na udaljenom prijemniku [1]. Bitno je naglasiti da RFID tehnologija za komunikaciju ne zahtijeva uspostavu vizualnog kontakta između prijemnika i odašiljača, no njen domet ovisi o više faktora, a ponajviše o korištenom frekvencijskom području. Izbor radne frekvencije uvelike ovisi o radnim karakteristikama sustava pa se u skladu s tim frekvencija rada odabire ovisno o namjeni i radnoj okolini. Frekvencije su regulirane posebnim pravilnicima za standardizaciju i regulaciju RF spektra, pri čemu različiti dijelovi svijeta koriste različite dijelove RF spektra, no za praktičnu primjenu RFID tehnologije koriste se tri osnovna područja i nekoliko frekventnih pojaseva (slika 1.).



Slika 1 Frekvencijski spektar dodjeljen tehnologiji RFID

S obzirom na to da se RFID tehnologija najčešće koristi u svrhu identifikacije osoba ili objekata, najčešće korištena metoda je pohranjivanje jedinstvenog identifikatora u obliku serijskog broja ili neke druge informacije na mikročip koji zajedno s antenom čini RFID transponder. Transponder komunicira s čitačem putem radio signala (jednosmjerno ili dvosmjerno), a čitač je povezan sa kontrolerom ili računalom za komunikaciju s centralnom bazom podataka u kojoj su pohranjeni podaci bitni za rad sustava.

Tablica 1 Komunikacijske tehnologije NFC i RFID

	NFC	RFID
Vrsta mreže	PAN	PAN
f (MHz)	13.56	0.125-0.134 13.56 860-960 2450 - 6800
Brzina prijenosa (kbit/s)	106-424	400
Doseg	<10 cm	<6 m
Potrošnja	veoma niska	veoma niska
Topologija	P2P	P2P
Primjena	usluge plaćanja, evidencije	evidencije

Tehnologija RFID temelji se na normama ISO/IEC 14443 i ISO/IEC 18000-3. Norma ISO/IEC 14443 definira kartice koje se koriste za pohranu podataka. Druga norma, ISO/IEC 18000-3, specificira komunikaciju RFID koju koriste uređaji NFC (eng. Near Field Communication) kratkog doseg, a danas je sve više prisutna u mobilnim telefonima i tabletima [2]. Glavne karakteristike komunikacijskih tehnologija NFC i RFID dane su u tablici 1. [3]. Iz tablice 1 vidljivo je da su glavne razlike između ove dvije tehnologije u frekvencijskim područjima rada i komunikacijskom dosegu. Naime, komunikacijski doseg kod tehnologije NFC iznosi do 10 cm dok kod tehnologije RFID on iznosi do 6 m.

1.2 Primjene RFID tehnologije

Zbog niza prednosti koje RFID sustavi imaju nad drugim sustavima za identifikaciju oni danas omogućuju izrazito velik broj primjena. Bez obzira na svoje komparativne prednosti, korištenje RFID sustava ostavlja i određeni prostor za eventualne mogućnosti zlorabe. Iz tog razloga se kontinuirano usavršavaju nove metode i algoritmi zaštite koji se implementiraju u sustave bazirane na RFID tehnologiji.

Na slici 2 prikazane su neke od tipičnih aplikacija gdje se primjenjuje ova tehnologija. Uobičajena primjena tehnologije RFID još od samih početaka bila je upravo identifikacija osoba i kontrola prolaska, pri čemu su korisnici identificirani prislanjanjem kartice na čitač. Vrlo brzo se uvidjelo da se tehnologija RFID može koristiti i za ostale namjene, tako da je američka vojska počela označavati nuklearni materijal, a masovnije primjenu doživjela je za naplatu cestarina. U razvijenijim zemljama RFID se koristi na aerodromima kako bi se olakšalo praćenje putne prtljage i tako smanjile šanse njenog gubitka. Uobičajena primjena RFID tehnologije je i u biometrijskim putovnicama, gdje se u internu memoriju transpondera pohranjuju biometrijske karakteristike vlasnika kao što su otisci svih prstiju i ostalih osobnih podataka, a također rezultira i nemogućnošću izrade falsifikata putovnice. Ova tehnologija je svoju primjenu pronašla u mnogim knjižnicama i tako ubrzala proces izdavanja i vraćanja knjiga te istovremeno onemogućila otuđenje. U medicini, često se koristi za označavanje pacijenata te uzoraka tkiva i krvi u bankama krvi i laboratorijima. U rodilištima majka i beba označavaju se jednokratnim narukvicama u kojima je implementiran transponder.



Slika 2 Primjena tehnologija RFID

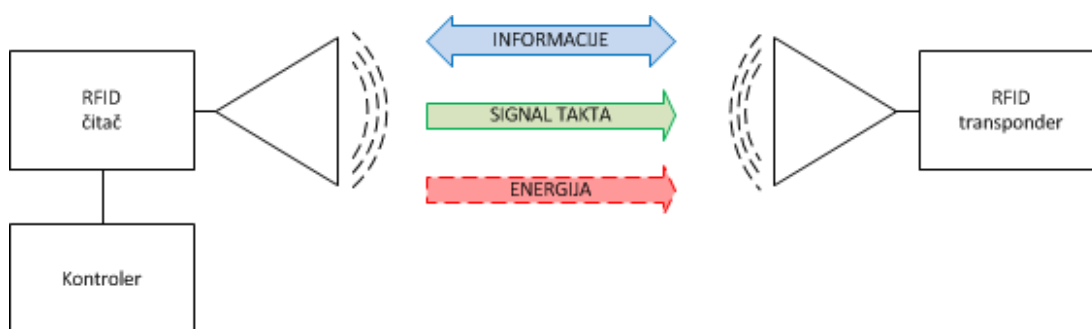
Osim za evidenciju životinja u zoološkim vrtovima i laboratorijima, RFID tehnologija pronašla je svoju primjenu i u označavanju životinjskih jedinki u divljini, a mnoge zemlje uvele su zakonske obveze čipiranja kućnih ljubimaca kako bi se u slučaju napuštanja ili gubitka lakše došlo do vlasnika. U logistici se koristi za praćenje poštanskih pošiljki te robe na skladištu. Posljednjih godina eksperimentira se s primjenom ove tehnologije u velikim trgovačkim lancima tako da se pri prolasku ispred RFID čitača automatski očitaju svi kupljeni

proizvodi i obračuna ukupan iznos robe koju korisnik treba platiti. Nove primjene se pronalaze svakodnevno budući da RFID tehnologija pruža izuzetno siguran i jedinstven način identifikacije.

1.3 Osnovne komponente RFID sustava

Svaki sustav baziran na RFID tehnologiji (slika 3) sastoji se od tri ključne komponente:

- kontroler - vrši funkciju baze podataka i upravljanja sklopovljem
- čitač - sastoji se od antene, radio frekvencijskog sklopovlja te upravljačkog sklopovlja za komunikaciju s kontrolerom i
- transponder - sastoji se od poluvodičkog integriranog sklopa, integrirane antene, a ponekad i baterije te sadrži kodirane podatke.



Slika 3 Osnovne komponente RFID sustava

Kao medij za prijenos podataka između transpondera i čitača koristi se zračno sučelje. Čitač s kontrolerom ili centralnim računalom može biti povezan žično ili bežično ovisno o okruženju i namjeni samog sustava. Komunikacija između transpondera i čitača na zračnom sučelju je uglavnom zaštićena posebnim kriptografskim algoritmima.

Kontroler RFID je uređaj koji upravlja radom cijelog sustava, a njegova glavna uloga je povezivanje većeg broja RFID čitača na zajedničku komunikacijsku infrastrukturu te uspostava centraliziranog podsustava za obradu informacija. Ulogu kontrolera najčešće obavlja osobno računalo, radna stanica ili mikroračunalo. U velikim sustavima može postojati više kontrolera koji su obično zasnovani na mikroračunalima, a koji su zatim vezani na centralno računalo ili poslužitelj koji raspolaže centralnom bazom podataka.

Čitač RFID je elektronički uređaj koji omogućuje komunikaciju, odnosno prijenos podataka između transpondera i kontrolera odnosno centralnog računala. Ovisno o namjeni postoje razne izvedbe čitača koje se razlikuju po fizičkoj izvedbi i kompleksnosti sklopovlja. Jednostavniji modeli čitača omogućuju komunikaciju sa samo jednom vrstom transpondera pri čemu se obično koristi samo jedan frekventni pojas i jedan komunikacijski protokol, dok oni složeniji imaju mogućnost komunikacije korištenjem više protokola te omogućuju selekciju podataka, provjeru i ispravljanje eventualnih grešaka u komunikaciji.

Osnovne funkcije koje ostvaruju RFID čitači su:

- čitanje podataka s RFID transpondera
- pisanje podataka na RFID transponder
- prijenos podataka prema kontroleru i
- napajanje pasivnih transpondera.

Osnovni dijelovi RFID čitača su antenski sklop, RF modul za komunikaciju s transponderom te upravljačko sklopovlje koje služi za komunikaciju sa centralnim kontrolerom ili računalom. Antena i RF modul igraju veliku ulogu kod čitača, budući da osim moduliranja i

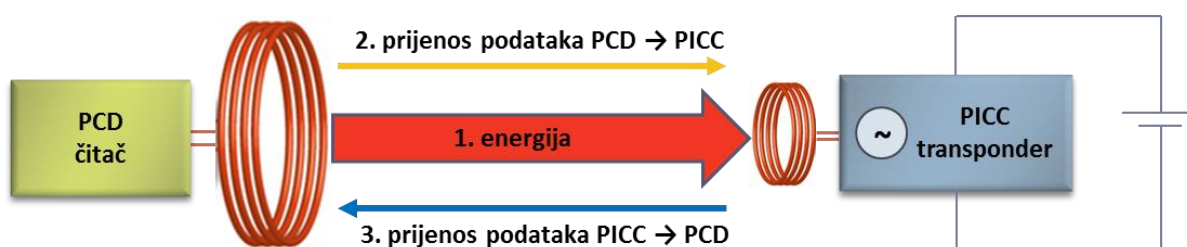
demoduliranja podataka na radijskom sučelju imaju zadatak i generirati elektromagnetsko polje za napajanje pasivnih transpondera. Većina modernih RFID čitača primjenom naprednih tehnika modulacije i korištenjem takozvanog „*anti-collision*“ algoritma ima mogućnost prepoznavanja i očitavanja više transpondera koji se istovremeno nalaze u dometu čitača bez njihove međusobne interferencije prilikom komunikacije. Antikolizijski mehanizam temelji se na principu da čitač prvo identificira sve transpondere koji se nalaze u njegovom dometu, a zatim inicira komunikaciju sa svakim transponderom pojedinačno.

Čitači uglavnom sve naredbe za rad primaju od centralnog kontrolera ili nadređenog računala, pri čemu kontroler odnosno računalo inicira proces i šalje čitaču zapovijed da aktivira RF sučelje. Antena RFID čitača emitira radio signal koji zatim aktivira transponder. Ovisno o primljenom signalu, transponder zatim šalje podatke prema čitaču ili prima podatke od čitača te ih zapisuje u svoju internu memoriju. S obzirom na to da se najčešće radi o podacima male veličine, koji se uglavnom kreću u rasponu od par bajtova do par kilobajta, komunikacija s transponderom je veoma kratka pa je moguće očitati veliki broj transpondera u relativno kratkom vremenu.

Transponderi RFID, poznati i kao „*tagovi*“, su sklopovi koji sadrže jedinstveni identifikator obično u obliku serijskog broja. Sama riječ *transponder* izvedena je od riječi *transmitter/responder* prema namjeni samog uređaja koji na zahtjev čitača odgovara traženim podatkom.

Dolaze u više formi i oblika, što ponajviše ovisi o njihovoj finalnoj primjeni. Najčešće dolaze u formatu kartica, privjesaka, narukvica, ušnih markica ili naljepnica. Međutim postoje i varijante u obliku staklenih ampula malih dimenzija koje se ugrađuju pod kožu životinja ili ljudi, u svrhu identifikacije. Transponderi mogu imati oblik naljepnica, etiketa ili pločica pri čemu se RF zavojnica nalazi na papiru ili foliji zajedno s memorijskim mikročipom.

Transponderi se međusobno razlikuju po frekvenciji, obliku, veličini, komunikacijskom protokolu, komunikacijskom dosegu i načinu pohranjivanja podataka. Neovisno o izvedbi i frekvenciji sve transpondere karakterizira činjenica da se sastoje od tri osnovna dijela (slika 4): antene, mikročipa i kućišta. Antena je izvedena u obliku bakrene zavojnice. Njezina svrha je napajanje čipa kod pasivnih varijanti transpondera te omogućavanje komunikacije s čitačem. Mikročip se najčešće napaja energijom primljenog signala, no postoje i transponderi opremljeni vlastitim izvorom napajanja. Nakon što transponder primi signal od RFID čitača jedinstveni identifikator kodira se u povratni signal koji se šalje natrag prema RFID čitaču.

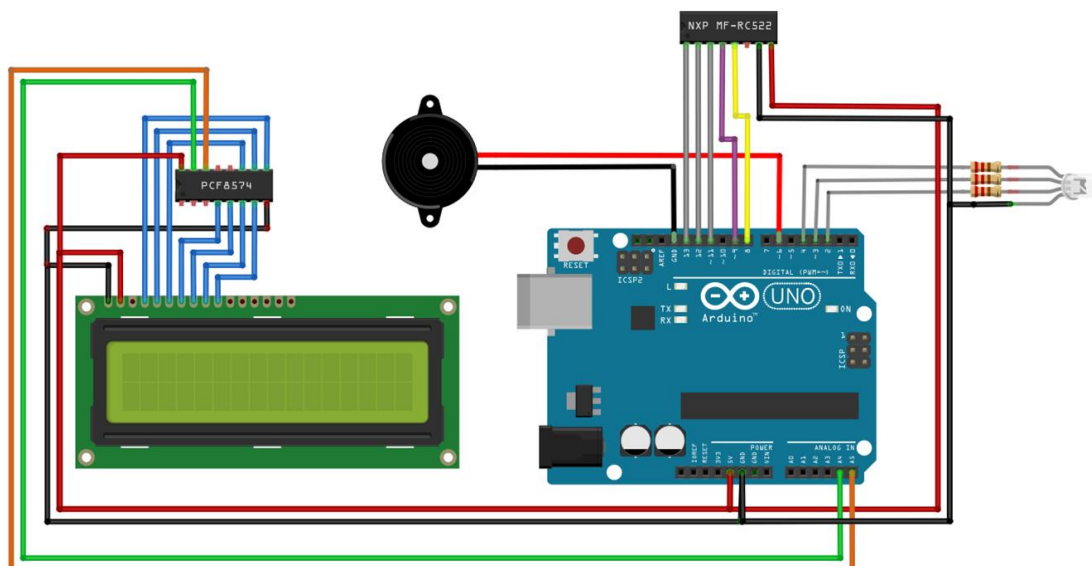


Slika 4 Prikaz komunikacije čitača sa transponderom

Unutar interne memorije mikročipa sadržani su podaci koji se mogu razlikovati po količini i sadržaju. Osnovne varijante transpondera raspolažu samo sa jedinstvenim identifikatorom transpondera, dok složenije varijante raspolažu većom količinom memorije te mogu pohraniti veću količinu podataka.

2. Implementacija sklopovlja

Shematski prikaz izrađenog uređaja prikazana je na slici 5, a na shemi nije prikazan Ethernet modul zbog bolje preglednosti slike. Uređaj se sastoji od Arduino Una R3 koji koristi Atmega328P mikroračunalo [4]. Ovo mikroračunalo raspolaže s 32 KB Flash memorije, 2 KB SRAM i 1 KB EEPROM memorije.



Slika 5 Shematski prikaz realiziranog uređaja

Mrežna povezanost ostvarena je korištenjem Ethernet shiela s Wiznet W5100 [5] chipsetom te je moguće ostvariti brzinu od 100 Mbit/s. Programska biblioteka razvijena za ovaj modul omogućuje komunikaciju korištenjem TCP, UDP, ICMP, IGMP, IPv4, ARP, PPPoE i Ethernet protokola, a implementirana je podrška i za DHCP odnosno dinamičku dodjelu IP adresa. Komunikacija s ATmega328P mikroračunalom izvedena je preko SPI sabirnice, dok se komunikacija s web poslužiteljem odvija korištenjem postojeće mrežne infrastrukture.

Za očitavanje kartica korišten je RFID modul NXP MF-RC522 [6] koji radi na frekvenciji od 13.56 MHz, te omogućuje komunikaciju s ISO/IEC 14443A/MIFARE karticama, odnosno MIFARE S50, S70, Pro, UltraLight i DESfire tipovima kartica. Modul RFID je s mikroračunalom povezan korištenjem SPI sabirnice, ali ovisno o potrebi ima mogućnost spajanja i putem I2C odnosno UART sučelja.

Alfanumerički 16x2 LCD Hitachi HD44780 služi za prikaz poruka prema korisniku. Ovaj modul raspolaže isključivo paralelnim komunikacijskim sučeljem koje može komunicirati korištenjem kodnih riječi širine četiri ili osam bita. Odlučili smo se za korištenje dodatnog modula zasnovanog na integriranom krugu PCF8574 koji omogućuje spajanje LCD-a sa mikroračunalom putem I2C sabirnice, pri čemu se koriste samo dvije komunikacijske linije, budući da se radi o serijskom protokolu. Time se omogućuje eventualno proširenje sustava u budućnosti. Također, za korištenje ovog načina komunikacije, korištena je odgovarajuća programska biblioteka. Za dodatnu zvučnu i svjetlosnu signalizaciju, sustav je opremljen piezo zujalicom i RGB LED čime se omogućuje fleksibilnije korištenje sustava i veća korisnička orijentiranost samog sustava. Na slici 6 prikazan je kompletan uređaj prilikom testiranja svih funkcionalnosti, dok je na slici 7 prikazan gotovi uređaj u kućištu povezan na mrežu.



Slika 6 Provjera funkcionalnosti sustava



Slika 7 Uređaj u kućištu povezan na mrežu

Programski kod za uređaj napisan je u programskom jeziku C++. Korišteno je Arduino IDE razvojno sučelje prikazano na slici 8. Također, na slici 8 vide se upotrebljene programske biblioteke koje omogućavaju komunikaciju Arduina s ostalim modulima kao i predefinirane konstante koje se koriste za signalizaciju korisniku putem RGB LED i piezo zujalice.

```

RFID | Arduino 1.6.6
File Edit Sketch Tools Help

RFID

/* Ethernet-based RFID reader with WizNet W5100 and NXP MFR522 */
#include <Ethernet.h>
byte mac[] = {0xDE, 0xAD, 0xBE, 0xEF, 0xFE, 0xED};
IPAddress ip(192, 168, 1, 101);
IPAddress server(192, 168, 1, 100);
EthernetClient client;

#include <SPI.h> // SPI bus support
#include <RFID.h> // RFID MFR522 module support
#define SS_PIN 8 // chip select pin
#define RST_PIN 9 // reset pin
#define BUZZER 6 // buzzer pin
RFID rfid(SS_PIN, RST_PIN);

#include <Wire.h>
#include <LiquidCrystal_I2C.h> // I2C LCD module support
LiquidCrystal_I2C lcd(0x27, 16, 2); // 16x2 char LCD

enum colors { // Enumerate LED colors
  RGB_RED,
  RGB_GREEN,
  RGB_BLUE
};

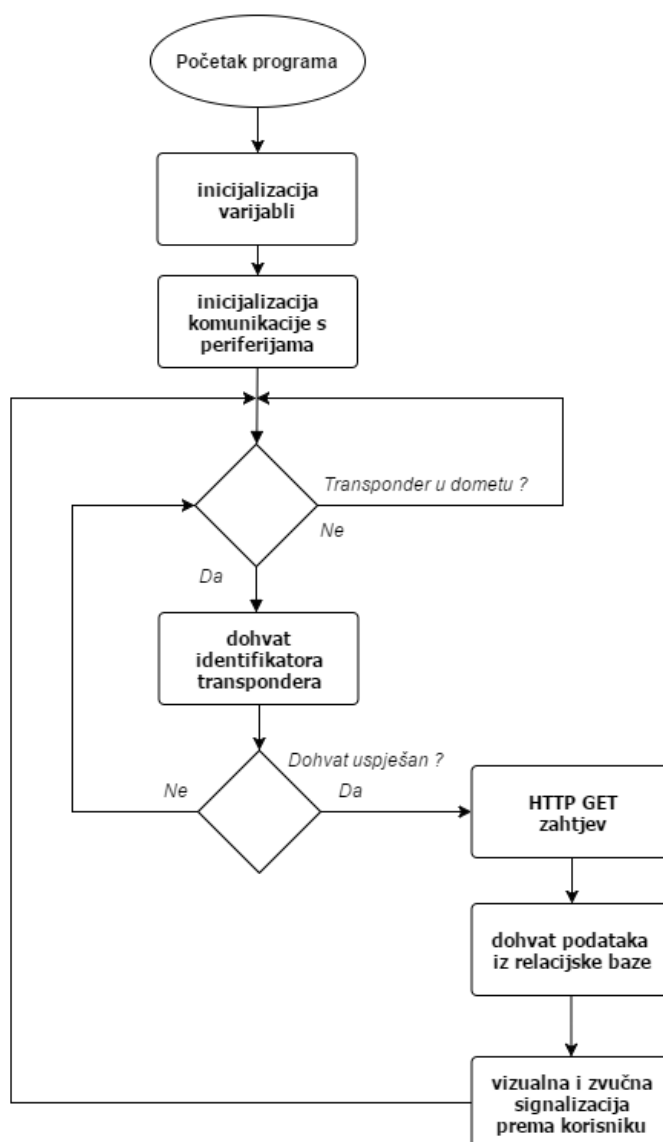
// Enumerate buzzer tones
enum tones {
  INIT_OK,
  GRANTED,
  DENIED,
  CHECK
};

// global variables
int i = 0;
int color; // color status
int sound_tone; // tone status
int card_found; // card status
  
```

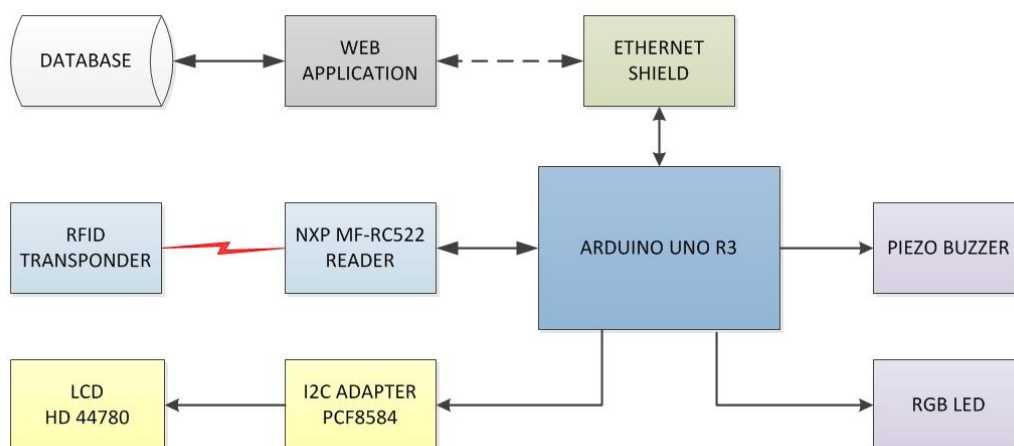
Slika 8 Arduino razvojno sučelje, korištene biblioteke i predefinirane konstante

Programski kod svakog Arduino programa sastoji se od tri glavna dijela: inicijalizacije varijabli, funkcije *setup()* i funkcije *loop()*. Na samom početku programa potrebno je inicijalizirati sve varijable korištene u programu pri čemu je nužno uzeti u obzir da se radi o mikroracunalu s ograničenom količinom programske memorije te je potrebno voditi računa o optimizaciji i tipovima korištenih varijabli. Funkcija *setup()* poziva se isključivo jednom, prilikom pokretanja uređaja, a unutar nje vršimo inicijalizaciju komunikacije s perifernim uređajima. Nakon toga se poziva funkcija *loop()* unutar koje je smješten programski kod koji se vrti u beskonačnoj petlji. Kod programa za Arduino platformu prikazan je blok dijagramom na slici 9, a on obavlja sljedeće funkcionalnosti:

1. Komunikaciju s modulom čitača RFID - provjerava je li transponder u dometu čitača RFID te u trenutku kada se transponder približi čitaču uspostavi komunikaciju i isčitava serijski broj transpondera.
2. Komunikacija s web poslužiteljem - uređaj šalje upit centralnom poslužitelju korištenjem HTTP GET zahtjeva slanjem jedinstvenog identifikatora uređaja u mreži i serijskog broja transpondera, a web poslužitelj kada zaprimi zahtjev vrši njegovu analizu i šalje povratnu informaciju uređaju.
3. Signalizacija korisniku – ovisno o uspješnosti zahtjeva uređaj obavještava korisnika zvučnim i vizualnim signalom te prikazuje poruku na zaslonu LCD displeja.
4. Stanje čekanja - po završetku komunikacije s web poslužiteljem uređaj prelazi u stanje čekanja u kojem se ništa ne događa dok se ne uoči transponder u dometu čitača.



Slika 9 Blok dijagram implementiranog koda



Slika 10 Prikaz arhitekture kompletnog sustava

Na slici 10 prikazana je arhitektura kompletnog sustava koji pored samog uređaja uključuje i komunikaciju s poslužiteljem putem razvijene aplikacije.

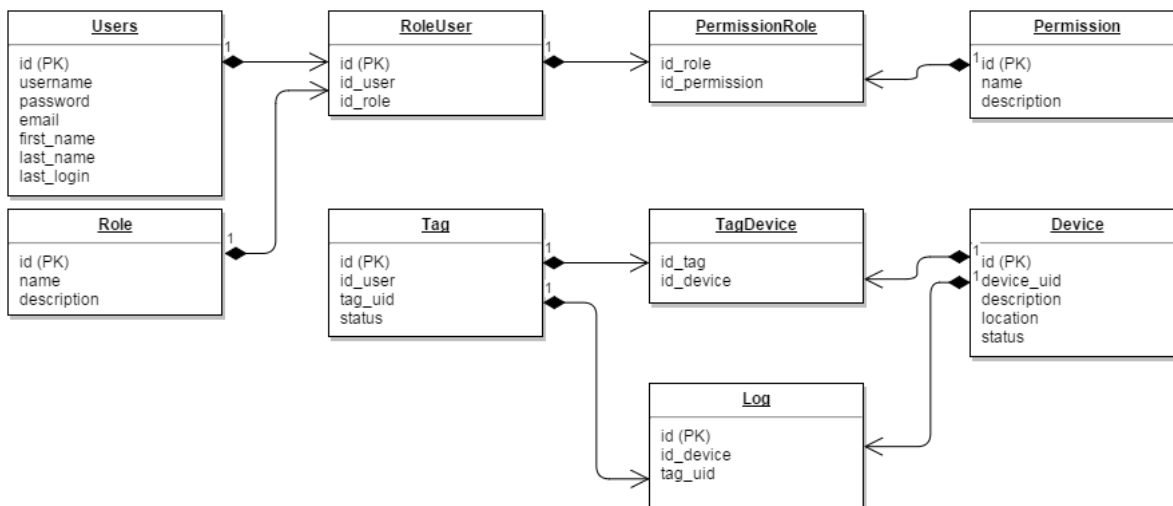
3. Aplikacijska podrška

Osim hardverskog sklopa, druga neizostavna komponenta sustava je web aplikacija koja se sastoji od korisničkog web sučelja te baze podataka u kojoj su pohranjeni svi podaci bitni za funkcioniranje sustava. Web aplikacija je napisana u programskom jeziku PHP, korištenjem Laravel 5 razvojnog okvira [7], dok je korisničko sučelje dizajnirano korištenjem Bootstrap komponenti. Za pohranu podataka korištena je MySQL relacijska baza podataka [8].

U odnosu na desktop aplikacije web temeljeno rješenje pruža daleko veću fleksibilnost, nije potrebna instalacija dodatnog softvera prije uporabe te je moguće ostvariti pristup sustavu sa bilo koje lokacije neovisno o instaliranom operacijskom sustavu ili tipu platforme (računalo, tablet, mobilni telefon). Korisnik se u aplikaciju prijavljuje korištenjem odgovarajućih podataka za pristup, a ovisno o dodjeljenim ovlastima (autorizacijske razine) ima mogućnost pristupa samo određenim dijelovima aplikacije.

Sve web komponente koje su korištene za izradu aplikacije su javno objavljene pod *open-source* licencom kako bi se aplikacija u budućnosti po potrebi mogla nadograđivati. S obzirom na to da se radi o web aplikaciji podrazumijeva se da će ista biti instalirana na web poslužitelju pa je stoga neophodno osigurati da poslužitelj ima instaliranu podršku za PHP i MySQL, pri čemu odabir operativnog sustava nije ključan.

Na slici 11 prikazana je struktura razvijene baze podataka. Za rad s aplikacijom nužno se prijaviti upisivanjem korisničkog imena i lozinke. Ovisno o dodjeljenim pravima u sustavu korisnik može pristupiti pregledu, unosu ili izmjeni podataka o studentima i nastavnicima. Korisnik može upravljati sustavom ovisno o dodijeljenim dozvolama u sustavu. Moguće je definirati više korisničkih uloga s različitim razinama prava upravljanja. Sama aplikacija omogućuje upravljanje korisnicima, grupama korisnika i njihovim ovlastima, upravljanje zapisima te ima mogućnost ispisa odnosno izvoza podataka kako bi se evidencije po potrebi mogle koristiti u drugim aplikacijama.



Slika 11 Struktura razvijene baze podataka

Kako je zamišljeno da svaki laboratorij posjeduje vlastiti čitač u aplikaciju je ugrađena mogućnost upravljanja čitačima tako da je skaliranje sustava iznimno jednostavno. Preduvjet za korištenje sustava je evidentiranje svih korisničkih RFID kartica u aplikaciji, a u tu svrhu koristi se modul upravljanje karticama gdje se evidentira serijski identifikator pojedine kartice i osobni podaci o korisniku. U slučaju gubitka kartice vrlo lako je moguće korisniku izdati novu karticu te ju je potrebno dodjeliti korisniku upisivanjem njezinog serijskog broja.

Pristup podacima pohranjenim u bazu podataka obavlja se putem web aplikacije. Na slici 12 prikazan je primjer liste korisnika koji su se prijavljivali na sustav.

SecuRFID - Admin Istrator

Početna / Zapisi / Zapisi

Zapisi

10 records per page

ID	TAG ID	LOKACIJA	STATUS	VRIJEME	OPCIJE
1	Marko Marković	Glavni ulaz	USPIJEŠNO	2014-06-27 09:02:46	Q
2	Marko Marković	Glavni ulaz	USPIJEŠNO	2014-06-27 09:03:57	Q
3	Ante Antić	Glavni ulaz	NEUSPIJEŠNO	2014-06-27 09:03:58	Q
4	Marko Marković	Glavni ulaz	USPIJEŠNO	2014-06-27 09:03:59	Q
5	Ivo Ivić	Glavni ulaz	USPIJEŠNO	2014-06-27 09:03:59	Q
6	Marko Marković	Glavni ulaz	USPIJEŠNO	2014-06-27 09:03:59	Q
7	Ivo Ivić	Glavni ulaz	USPIJEŠNO	2014-06-27 09:04:42	Q
8	Ivo Ivić	Glavni ulaz	USPIJEŠNO	2014-06-27 09:08:44	Q
9	Ivo Ivić	Glavni ulaz	USPIJEŠNO	2014-06-27 09:08:55	Q
10	Marko Marković	Glavni ulaz	NEUSPIJEŠNO	2014-06-27 09:09:54	Q

Showing 1 to 10 of 36 entries

Previous 1 2 3 4 Next

Slika 12 Prikaz liste zapisa

4. Zaključak

Kroz ovaj rad pokazano je kako se korištenjem relativno jeftinih modula dostupnih na tržištu može razviti uređaj za autorizaciju i autentifikaciju korisnika uz odgovarajući stupanj sigurnosti. Razvijeno rješenje nekoliko je puta jeftinije od komercijalno dostupnih uređaja na tržištu. Korištenje softvera izdanog pod *open-source* licencom omogućuje transparentnu nadogradnju kao i lakši razvoj dodatnih funkcionalnosti koje se mogu implementirati ovisno o potrebi. Sustav je dizajniran na način da ima izrazito jednostavno horizontalno skaliranje te je princip dodavanja novih uređaja i korisnika izuzetno jednostavan. Zbog relativno malih poruka (upita) moguće je posluživati veliki broj udaljenih čitača istovremeno.

Jedan od bitnih ciljeva realizacije ovog projekta je bio omogućiti studentima kroz praktičan rad primjenu stečenih teorijskih znanja kao i stjecanje novih znanja. Primjenom ovog principa studenti se bolje pripremaju za tržište rada i stječu znanja koja su odmah primjenjiva kod poslodavca.

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- [4] Arduino službena web stranica, <https://www.arduino.cc/>
- [5] <https://www.arduino.cc/en/Main/ArduinoEthernetShield>
- [6] <http://playground.arduino.cc/Learning/MFRC522>
- [7] <https://laravel.com/docs/master>
- [8] <https://www.mysql.com/>

Application development for users' authentication and authorization using radio-frequency identification technology

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Abstract. Most of today's access control and time attendance systems are based on radio frequency identification (RFID). These systems use RFID readers, Ethernet networking technology and the TCP/IP protocol for communication with the central server. A database, which is located on the central server, contains information about all users and their access levels. Users' authentication is

done by using contactless RFID cards. In the paper, the principles of RFID technology and its most common applications are described, and so is the hardware used for the device construction. Finally, the developed web application for data acquisition and processing and system administration is presented. This application is made for classroom and laboratory access control, and for logging the time attendance of students and teachers. The device is based on the Arduino Uno platform, and the programming language PHP and a MySQL database were used in the making of the application.

Keywords: *RFID, Arduino, Ethernet, Authentication, Authorization*

Širokopojasni prijenos podataka elektroenergetskim vodovima

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Sažetak. U radu se razmatra širokopojasna telekomunikacijska tehnologija za prijenos podataka elektroenergetskom infrastrukturom. Objašnjava se princip komunikacije elektroenergetskim vodovima (*Power Line Communications*, PLC) i navode se prednosti uporabe ove tehnologije. Naglasak je na odabiru modulacijske sheme za projektiranje PLC sustava i na rješavanju problema elektromagnetske usklađenosti (*electromagnetic compability*, EMC) u skladu s europskim normama. Shema multipleksiranja s višestrukim podnosiocima u frekvencijskoj domeni (*Orthogonal Frequency Division Multiplexing*, OFDM) optimalna je za prijenos širokopojasnih podataka velikim brzinama po vodovima elektroenergetske mreže koristeći frekvencije ispod 100 MHz. Daje se pregled zastupljenosti PLC-a u elektroprivredama te komercijalizacija ove tehnologije u svijetu. Opisuju se prednosti PLC-a u odnosu na druge tehnologije i predviđa se smjer razvoja ove tehnologije.

Ključne riječi: komunikacije elektroenergetskim vodovima (PLC), elektromagnetska usklađenost, modulacije.

1. Uvod

Širokopojasna komunikacija elektroenergetskim vodovima (*Broadband over Power Lines*, BPL) je novija tehnologija koja osigurava prijenosni kapacitet veći od 2 Mbit/s. Postoji niz pilotskih, ali i komercijalnih instalacija BPL-a, kojima se primarno pruža pristup internetu. Neki od implementiranih sustava koriste se i za davanje usluga podrške elektroenergetskoj djelatnosti.

Osim brzog pristupa internetu, razmatra se i govorna komunikacija preko interneta (*voice over IP*). Implementirani BPL sustav omogućava: stalni pristup internetu, pristup postavljanju i skidanju podataka pomoću *HomePlug* modema, uspostavu lokalne mreže brzine veće od 3 Mbit/s po nižim mjesečnim cijenama nego što su za druge širokopojasne usluge. Jednostavna je instalacija opreme i aktivacija usluge. Uz to, nije potrebno dodatno ožičenje u kućanstvu. Postoji automatsko otkrivanje pada i potvrda povratka napajanja, daljinski nadzor i operacije s mogućnošću daljinskog isključenja i uključanja kupaca, učinkovitiji programi upravljanja opterećenjem na mjernom mjestu te automatsko očitavanje brojila.

Izlazak na energetska tržišta s telekomunikacijskom uslugom, predstavlja velik izazov za elektroprivredu jer traži poboljšanje financijskih rezultata, pouzdanosti i sigurnosti, kao i pružanja što boljih usluga korisnicima. Širokopojasni PLC stvara novi izvor prihoda time što nudi širokopojasni pristup internetu, telefoniji i drugim uslugama, postojećim korisnicima električne energije.

Mnogi PLC pokušaji uspješno su dovršeni u Europi, što dokazuje održivost rješenja alternativnih telekomunikacijskih mreža, koristeći već postojeću infrastrukturu.

2. Europske norme i standardi

U komunikacijskim sustavima postoje propisani pravilnici i norme za preciziranje tehničkih svojstva komunikacijskih jedinica, bez obzira na proizvođača. Jedna od prepreka implementaciji i upotrebi PLC tehnologije je spor i dugotrajan razvoj međunarodnih normi i standarda te razlika u standardizaciji. Parametri koji su najvažniji u standardizaciji su najveća dozvoljena snaga prijenosa i dozvoljeni frekvencijski pojas kako bi se ograničila interferencija s drugim telekomunikacijskim uslugama i spriječilo gušenje ovog malog signala unutar elektroenergetske mreže. Europska zajednica za elektrotehničku standardizaciju (CENELEC) izdala je regulative koje su usko vezane uz komunikaciju na niskonaponskim električnim instalacijama. [1] Prema istim određene su sljedeće norme:

- EN50065-1 norma regulira osnovne zahtjeve, frekvencijske pojaseve i elektromagnetske smetnje
- EN50065-4-2 norma regulira niskonaponski filter i zaštitne mjere
- EN50065-7 - regulira impedancije uređaja.

Pri projektiranju PLC modema važno je definirati frekvencijski opseg za prijenos signala. Primjerice, u Sjevernoj Americi se ne koristi radio frekvencijski pojas od 150 do 350 kHz te je prema tome FCC razvio standard koji dozvoljava frekvencijski pojas u rasponu od 100 do 450 kHz. Istovremeno, u Japanu se koriste frekvencije od 10 kHz do 450 kHz. Prema CENELEC-u na europskom tržištu definiran je EN50065-1 standard koji dozvoljava uže područje, od 3 do 148.5 kHz (tablica 2.1.).

Tablica 2.1 Podjela frekvencija prema CENELEC EN50065-1 [1]

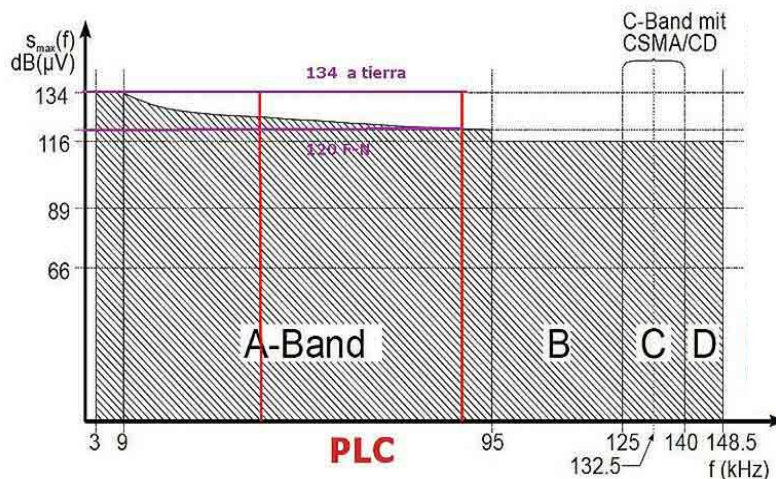
Pojas	Frekvencije	Namjena
	(3 - 9) kHz	Aplikacije distributera
A	(9 - 95) kHz	Aplikacije distributera i njihovih suradnika
B	(95 - 125) kHz	Privatne aplikacije (unutar objekta) bez ograničenja
C	(125 - 140) kHz	Privatne aplikacije (unutar objekta) uz korištenje protokola
D	(140 – 148.5) kHz	Privatne aplikacije (unutar objekta) bez ograničenja

Maksimalni izlazni nivoi (naponi) u rasponu od 9 kHz do 150 kHz za jednofazne uređaje prikazani su u tablici 2.2. Mjerenje mora biti učinjeno u skladu sa CISPR 16 publikacijom, koja uključuje detektor kvazi vrhunca te mjerenje u trajanju jedne minute na određenim točkama na CISPR umjetnoj mreži.

Tablica 2.2 Raspodjela frekvencija i maksimalnog prijenosnog nivoa prema CENELEC EN50065-1 [1]

Frekvencijski pojas	Maksimalni prijenosni nivo	Način primjene
(9 - 95) kHz	134 dB [μV]	
(95 – 148.5) kHz	116 dB [μV]	uređaji opće namjene
(95 – 148.5) kHz	134 dB [μV]	posebni uređaji (industrijske aplikacije)

CENELEC norma (slika 2.1.) ne definira modulacijsku shemu ni brzinu prijenosa, ali uski frekventni pojas može rezultirati smanjenjem kapaciteta komunikacijskog kanala i brzine prijenosa podatka. Također, veća je vjerojatnost da se uslijed šumova i slabljenjem signala dodatno smanji brzina ili u potpunosti prekine prijenos podatka.



Slika 2.1 Frekvencijski pojas i razina signala po EN50065

Izvor: [http://blog.bioelectrica.es/nuevos-contadores-de-la-luz-analisis-de-electromog/\(10.02.2016.\)](http://blog.bioelectrica.es/nuevos-contadores-de-la-luz-analisis-de-electromog/(10.02.2016.))

3. Obrada signala i multipleksni sustavi

Pod pojmom modulacije ili moduliranja smatra se proces mijenjanja električnog signala koji sadrži informaciju prijenosa. Kod moduliranja mijenja se jedan ili više parametara pomoćnog signala ovisno o signalu koji prenosi informaciju. Pomoćni signal zove se prijenosni signal ili nositelj. Veliki je broj modulacijskih tehnika koje se koriste ili su se koristile u PLC tehnologijama. Među njima prevladavaju amplitudna digitalna (*Amplitude Shift Keying*, ASK) i frekvencijska digitalna modulacija (*Frequency Shift Keying*, FSK).

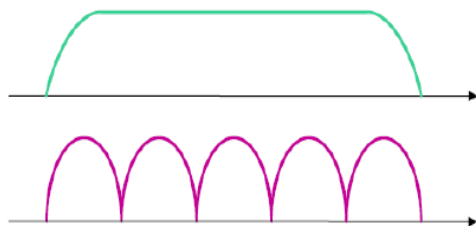
Korištenje navedenih modulacija rezultira brzinom prijenosa signala do 19.2 kbps (kilobita po sekundi), ali zbog prigušenja i smetnji na energetske mreži postiže se brzina prijenosa od svega nekoliko kbps. Važno je napomenuti da navedene modulacije u potpunosti zadovoljavaju sve CENELEC norme. Maksimalne brzine prijenosa koje se mogu ostvariti iznose 200 kbps. Dakle, izbor modulacije nije jednostavan i prvenstveno ovisi o konkretnoj aplikaciji. Najčešće korištene modulacije su ortogonalno frekvencijsko multipleksiranje (*Orthogonal Frequency Division Multiplexing*, OFDM) i raspršeni spektar s izravnim nizom (*Direct-Sequence Spread Spectrum*, DSSS).

Frekvencijska modulacija s ortogonalnim multipleksiranjem (*Orthogonal Frequency Division Multiplexing*, OFDM) omogućava veliku brzinu prijenosa podataka zadržavajući pri tome složenost i točnost prenesenih podataka. Kod prijenosa podataka velikim brzinama problem za prijenos predstavljaju propadi u kanalu te zbog toga nije moguće obnoviti podatke upotrebom običnog, jednostavnog prijemnika. [10]

Nadalje, ta činjenica rezultira potrebom da se koriste složeni prijemnici koji se koriste složenim računskim postupcima u svrhu procjene prijenosnog kanala, tj. Ujednačavanja, da bi se uz pomoć procjene obnovile informacije. OFDM modulacija pojednostavljuje problem ujednačavanja na način da pretvara frekvencijski selektivni kanal u „ravni“ kanal. [6] Prednost OFDM modulacije je činjenica da umjesto jednog istodobno koristi više nositelja (slika 3.1.).

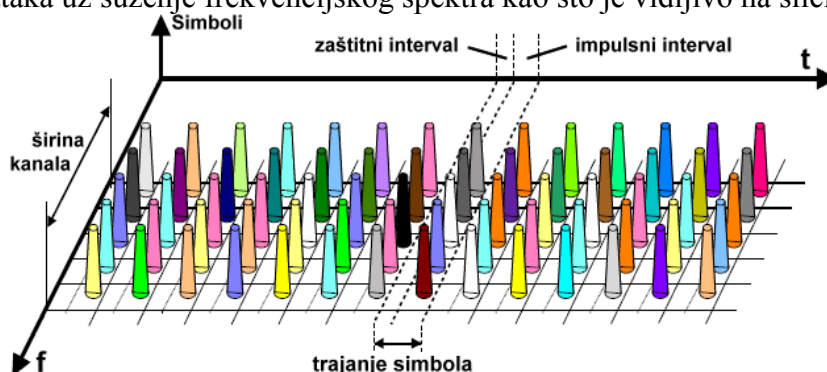
Serijski slijed podataka velike brzine prijenosa razdijeli se na nekoliko paralelnih sljedova i svaki od tih paralelnih sljedova manje je brzine i zasebno modulira jednog od više nosilaca. Nastali modulirani signali zauzimaju manju širinu pojasa i svaki od nastalih moduliranih signala smješta se u zasebni pojas. Podaci se prenose na paralelni način uz pomoć više nosilaca. Zbog relativno male širine pojasa svakog od više moduliranih signala, promjene frekvencijske prijenosne karakteristike komunikacijskog kanala unutar pojasa svakoga

moduliranog signala male su, što rezultira zanemarivim smetnjama između simbola. OFDM modulacija se također koristi u sustavima za brzi prijenos podataka telefonskom linijom (*Asymmetric Digital Subscriber Line*, ADSL), a predviđena je i za digitalnu televiziju.



Slika 3.1 Prikaz OFDM modulacije - korištenje više nosioca umjesto jednog [4]

Dakle, možemo reći da OFDM modulacija kojom se više signala različitih kompleksnih frekvencija (međusobno sinkronih i ortogonalnih) kombinira u jedan i tako povećava propusnost podataka uz suženje frekvencijskog spektra kao što je vidljivo na slici 3.2.



Slika 3.2 OFDM presjek

Izvor: <http://www.informatics.buzdo.com/extras/dvb.htm> (01.06.2015.)

Tehnika raspršenog spektra (*Direct Sequence Spread Spectrum*, DSSS) predstavlja modulaciju signala koji nosi informaciju na način da koristi pseudo slučajni niz koji je nezavisan od signala informacije. Rezultat je raspršivanje spektra signala na šire frekvencijsko područje od početne širine spektra signala. Prije prijenosa spektar signala se „raspršuje“ dok se na prijemnoj strani sažima (skuplja). Raspršivanje signala uz pomoć pseudo slučajnog niza omogućuje korištenje medija za prijenos elektromagnetskih valova od strane većeg broja korisnika zbog male snage signala.

Zanimljiva je i spoznaja da zbog velikog broja mogućih različitih pseudo slučajnih kodova, prisluškivanje nije moguće, što je interesantno u mnogim sektorima, a posebice za vojne primjene. Prednost DSSS tehnike činjenica je da je raspršeni spektar otporniji na uskopojasni šum i ometanje signala te da je takav spektar slabije primjetan od uskopojasnog. DSSS metoda izvediva je u analognoj i digitalnoj domeni.

3.1. Odabir modulacijske sheme za projektiranje PLC sustava

Prigušenje kanala i šum određuju kapacitet koji se koristi za komunikacije. Procjena kapaciteta kanala za elektroenergetske *linkove* ukazuje isplativim prijenos podataka puno većim brzinama od dosadašnjih. Da bi se razvili sustavi s velikim kapacitetom kanala potrebno je pažljivo odabrati modulacijsku shemu i prilagoditi je za optimalni PLC sustav jer se povećanje brzine podataka ne može ostvariti povećanjem pojasne širine ili dodjeljivanjem novih frekvencijskih područja. To znači da se samo uporabom sofisticiranijih modulacijskih shema može poboljšati iskoristivost spektra ili odgovarajućom adaptacijskom strategijom povećati otpornost na impulsni šum i povećati brzina prijenosa podataka. Prvo je potrebno

usporediti parametre modulacijskih shema koje dolaze u obzir za pronalaženje optimalnog rješenja za PLC sustav. To su:

- tehnike raspršenog spektra (*Spread Spectrum Techniques, SST*)
- shema s jednim širokopojasnim nosiocem, bez ujednačivača (ekvalizatora)
- shema s jednim širokopojasnim nosiocem i ujednačivačem
- shema s više širokopojasnih nosioca i s ujednačivačem
- shema višestrukog prijenosa s frekvencijskom raspodjelom (kanala) i ortogonalnim nosiocima (*Orthogonal Frequency Division Multiplexing, OFDM*).

Kriteriji odabira najpogodnije modulacijske sheme su:

- iskoristivost spektra - izražena brojem bitova u sekundi koji se mogu ubaciti u 1 Hz pojasne širine primjenom određene modulacije, tj. $bit/(s \cdot Hz)$
- maksimalna brzina prijenosa podataka $Mbit/s$
- otpornost na kanalna izobličenja
- otpornost na impulsni šum
- svojstva fleksibilnosti i prilagodbe
- cijena sustava
- elektromagnetska kompatibilnost (EMC).

Tehnike raspršenog spektra odlikuju se imunošću na selektivno prigušenje i na sve vrste uskopojasnih smetnji (interferencija) uzrokovanih djelovanjem neželjenih signala u komunikacijskom sustavu, malom iskoristivošću spektra (što je nepovoljno zbog ograničenih spektralnih resursa, pa je u PLC tehnologiji cilj postići maksimalnu iskoristivost spektra) i niskom spektralnom gustoćom snage što je pogodno s gledišta elektromagnetske kompatibilnosti (tablica 3.1.). Osim toga, višestruki pristup mediju može se ostvariti s kodiranom raspodjelom po vremenu i frekvenciji, CDMA (*Code Division Multiple Access*), bez globalne koordinacije ili sinkronizacije.

Tablica 3.1 Usporedba različitih metoda prijenosa za komunikaciju elektroenergetskim vodovima [9]

Modulacijske sheme	spektralna učinkovitost [b/(sHz)]	maksimalna brzina prijenosa podataka [Mb/s]	otpornost na kanalna izobličenja	otpornost na impulsni šum	svojstva fleksibilnosti i prilagodljivosti	troškovi sustava	EMC
SST	< 0.1	~ 0.5	-	0	--	--	+
shema s 1 širokopojasnim nos. bez ekv.	1 - 2	< 1	--	+	--	++	--
shema s 1 širokopojasnim nos. s ekv.	1 - 2	~ 2	+	+	0	-	-
shema s više širokopojasnih nos. s ekv.	1 - 4	~ 3	+	0	0	-	0
OFDM	>> 1	> 10	++	0	++	-	+

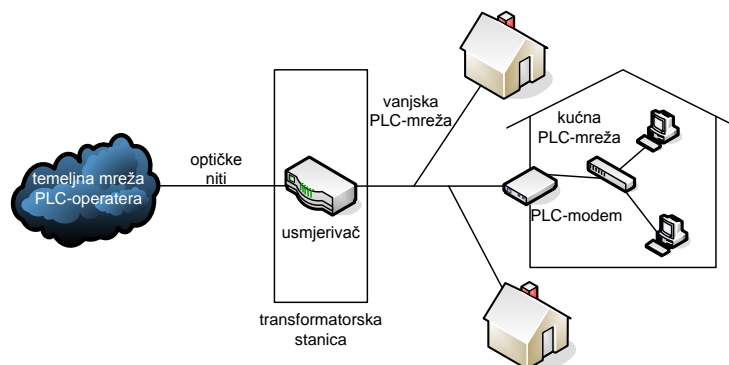
4. Širokopojasna komunikacija elektroenergetskim vodovima

Komunikacije vodovima elektroenergetske mreže su zanimljive operatorima elektroenergetske mreže jer je osnovna ideja da se širokopojasni podaci optičkim nitima prenose iz mreže do transformatorskih stanica odakle se dalje razvode vodovima elektroenergetske mreže do krajnjih korisnika, kao što je prikazano na slici 4.1.

PLC mreža između transformatorske stanice i PLC modema na području korisnika naziva se vanjska (*outdoor*) PLC mreža dok se ona u kući krajnjeg korisnika naziva unutarnja (*indoor*). Komunikacija preko elektroenergetske mreže zahtijeva velike brzine i domet prijenosa (*Broadband Power-line, BPL*). BPL radi na principu slanja podataka pomoću radiovalova preko elektroenergetskih vodova.

Signal se pretvara u bežični signal i s električnog stupa usmjeren je prema modemu koji se nalazi u korisnikovom domu. BPL daje umreženi dom bez potrebe za novim ožičavanjem.

Visokobrzinski pristup internetu elektroenergetskim vodovima, kako je pokazalo istraživanje FCC-a, pruža korisnicima usluge poput e-pošte, internet telefoniranja i drugih usluga. [3]



Slika 4.1 Topologija pristupne mreže realizirana PLC-om

Razlikujemo dvije vrste BPL tehnologija: pristupni BPL (*Access BPL*) implementiran nad vanjskom PLC mrežom i BPL unutar zgrade (*In-building BPL*) implementiran nad kućnom PLC mrežom.

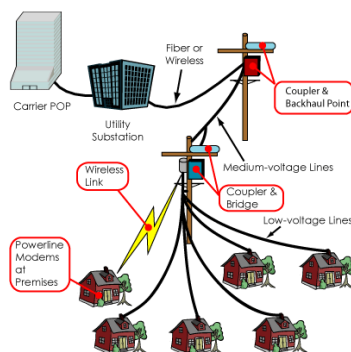
Danas pristupni BPL podržava prijenos podataka brzinom do 45 Mbita/s u oba smjera. Pristupni BPL, slično kao i mreža kabela televizije, predstavlja dijeljeni medij te je potrebno ograničiti broj korisnika pristupnog BPL-a po svakoj transformatorskoj stanici kako bi se agregatna brzina dijelila s manjim brojem. Osnovna mana pristupnog BPL-a je nedostatak standarda i normi na svjetskoj razini. [3]

Širokopojasni PLC (*Broadband over Power Lines, BPL*) u realizaciji nailazi na probleme premoštenja transformatora, interferenciju, neprilagođenost električnih vodova za prijenos visokofrekventnih signala, sigurnost itd. Elektroenergetski transformatori namijenjeni su transformaciji napona frekvencije 50/60 Hz, uz funkciju frekvencijskog filtra. Prema tome, transformatori ne propuštaju signale koji su frekvencije od nekoliko desetaka MHz što je ključni razlog zašto transformatore treba premostiti za visokofrekventne signale. Taj postupak zahtijeva značajna financijska sredstva. Npr., u Europi se s jednog transformatora napaja i do nekoliko stotina domaćinstava, u SAD-u se s jednog transformatora napaja od jednog do deset domaćinstava, dok Japan koristi jedan transformator za 30 kućanstava. Dakle, jasno je da bi u Europi prijenos sa srednjenaponske mreže na niskonaponsku mrežu do krajnjeg korisnika ekonomski gledano bio najisplativiji.

Nadalje, pojavljuje se problem atenuacije (pojava slabljenja jakosti zvučnih ili elektromagnetskih signala zbog pretvaranja dijela njihove energije u druge oblike energije) visokofrekventnih signala i izrazitih šumova. Činjenica je da vodovi nisu oklopljeni i iz tog razloga se ponašaju kao antene. BPL koristi frekvencije na kojima je pozicioniran kratkovalni radio i niži dio visokofrekvencijskog područja (*Very High Frequency, VHF*) što je razlog zbog kojeg bi BPL potencijalno mogao stvarati smetnje radioamaterima, vojsci i aviokompanijama. [4] Ta činjenica je razlog odustajanju od uvođenja BPL tehnologije. Jedan od načina da se riješi radio interferencija je upotreba mikrovalnih frekvencija u rasponu od 2 do 20 GHz i brzine od 216 Mbit/s. To je rezultiralo izbjegavanjem interferencije s frekvencijama radioamatera, ali može se dogoditi interferencija s frekvencijama radio astronoma od 13 MHz do 275 GHz i brojnim industrijskim i medicinskim uređajima (*Industrial Scientific and Medical, ISM*). [4]

Napon visokonaponskih vodova kreće se između 155 i 765 kV što je neprikladno za prijenos podataka jer je previše „bučan“, tj. rezultira šumovima. Struje koje teku vodovima ne vibriraju na konstantnoj frekvenciji i direktno uzrokuju pojavu interferencije, šumovi će se pojavljivati na istoj frekvenciji koju koristi signal što će oštetiti ili u potpunosti uništiti signal koji je prvobitno poslan.

BPL topologija zaobilazi ovaj problem na način da u potpunosti izbjegava visokonaponske vodove. Sustav šalje podatke i signale optičkim kabelima na prihvatljivije srednjenaponske vodove vrijednosti 7200 V. Nakon što se signal prebaci na srednjenaponske vodove podaci mogu putovati daleko, sve do faze degradacije. Kako bi se to spriječilo ugrađuju se posebni uređaji na vodove koji su služe kao „repetitori“. Repetitori uzimaju signal i ponavljaju ga u novoj seriji prijenosa, pojačavajući ga za sljedeću etapu prijenosnog puta. Uređaj na slici 4.2. (*coupler*) omogućuje signalu prijenos vodom izbjegavajući transformator koji transformira naponsku razinu s 7200 V na 240 V, uobičajen za kućanstva. Jednostavno ne postoji način da signali male snage prođu kroz transformator i zato se koristi navedena spojnica (*coupler*) koja šalje signal izbjegavajući transformator.



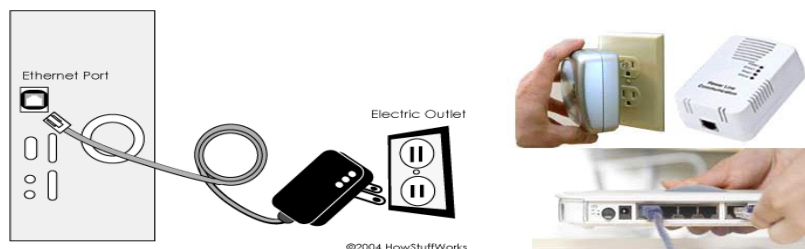
Slika 4.2 BPL topologija mreže

Izvor: http://spvp.zesoi.fer.hr/seminari/2006/DokmanicIvan_BroadbandOverPowerlines.pdf
(25.02.2016.)

Zahvaljujući spojnicama signali i podaci se mogu prebacivati između srednjenaponskih (SN) i visokonaponskih (VN) vodova do krajnjeg korisnika. Međutim, potrebno je prikazati na koji način se signal implementira unutar domaćinstva.

Tu ulogu preuzima dalekovodni modem (*Powerline modem*, BPL modem), uređaj koji se priključi u utičnicu i ima zadatak da primi signal s niskonaponskih vodova. BPL modemi koriste silikonske čipove koji su posebno dizajnirani da uspješno obrađuju radno opterećenje električne struje i iz nje izvuku „čisti“ signal i podatke koji su poslani.

Upotrebom novih tehnika modulacije i prilagodljivih algoritama realizacije, BPL modemi su sposobni kontrolirati signal i upravljati šumom elektroenergetskog voda na širokom spektru. BPL modemi (slika 4.3.) su približno veličine običnog mrežnog adaptera. Priključeni su na kućnu utičnicu, a klasičan Ethernet kabel povezan sa stolnim računalom ili laptopom završava konekciju do krajnjeg korisnika. Naravno, podržana je i bežična konekcija s modemom.



Slika 4.3 Prikaz BPL modema i njegove konekcije

Izvor: http://spvp.zesoi.fer.hr/seminari/2006/DokmanicIvan_BroadbandOverPowerlines.pdf
(25.02.2016.)

Ispituje se širokopojasni pristup internetu putem postojeće niskonaponske mreže, širokopojasni prijenos elektroenergetskim vodovima (*broadband power lines*, BPL). To je sustav koji korisnicima pruža pristup internetu velikom brzinom preko NN utičnice, što je

pokazao pilot-projekt u rezidencijalnoj četvrti Greenway Plaza. Sustav nudi jedan i po put brži pristup internetu od onog kojeg pružaju kabelski modemi.

Najnovija istaživanja pokazuju da su električni vodovi sposobni prenijeti digitalne podatke približno istim brzinama kao i DSL (*digital subscriber line*), koji koristi već postojeće telefonske linije.

DSL tehnologija zahtijeva sustav preklopnika, posebnu vrstu uređaja koji se ugrađuju kao poveznica ADSL modema i ostatka sustava telekomunikacijskog operatera – tzv. DSLAM, koju telekomunikacijski operater mora ugraditi u svoju mrežu da bi se omogućio protok veće količine podataka preko bakrenih parica, a udaljenost kućnog priključka znatno utječe na kvalitetu prijenosa (s većom udaljenošću brzina prijenosa pada). Međutim, u odnosu prema klasičnim bakrenim paricama, električne instalacije za opskrbu kućanstava električnom energijom prisutna je u kućama pa se komunikacijska infrastruktura, tzv. „strujni internet“ brzo razvija, posebice u rurarnim sredinama gdje nema širokopojasnog pristupa.

PLC tehnologiju možemo podijeliti s obzirom na razinu napona elektroenergetske mreže na: niskonaponski PLC (do 400 V), srednjenaponski (do 35 kV), visokonaponski (iznad 35 kV) i na PLC na električnim instalacijama zgrade.

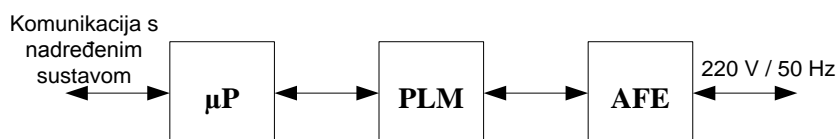
Tablica 4.1 Klasifikacija PLC-a prema načinu primjene [5]

Kriterij	Klasifikacija PLC-a
Naponski nivo EE voda na kojem se primjenjuje	Niskonaponski (NN) PLC (na vodovima napona do 400 V)
	Srednjenaponski (SN) PLC (na vodovima napona do 50 kV)
	Viskonaponski (VN) PLC (na vodovima napona od 50 kV do 400 kV)
	PLC na električnim instalacijama zgrade
Područje primjene	Za energetske PLC usluge (TK usluge za potrebe elektroprivredne djelatnosti)
	Za pristupne PLC usluge (TK usluge u pristupnim mrežama)
	Za kućne PLC usluge
Brzina komunikacije	Uskopojasni PLC (brzina prijenosa informacija reda veličine do stotinjak kbit/s)
	Širokopojasni PLC (brzina prijenosa informacija reda veličine do Mbit/s)

Što se tiče podjele s obzirom na komunikacijske brzine razlikujemo uskopojasni PLC (brzina prijenosa informacija i podataka reda veličine do stotinjak kbit/s) i širokopojasni PLC (brzina prijenosa informacija i podataka reda veličine izraženih u Mbit/s).

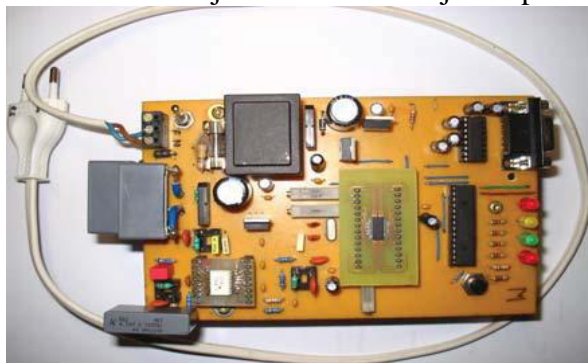
Uskopojasni PLC radi u frekvencijskom opsegu do 140 kHz. Frekvencijski opsezi 9 - 95 kHz, 125 - 140 kHz dodijeljeni su za uskopojasni PLC od strane CENELEC-a. Koristi se za: daljinsko očitavanje brojila (*Automatic meter reading*, AMR) električnih, plinskih, vodovodnih; kontrolu udaljenih uređaja (ulične rasvjete); nadzor i kontrolu proizvodnje i potrošnje električne energije; dinamičko tarifiranje; automatizaciju domova i poslovnih zgrada (automatizaciju regulacije grijanja i klima uređaja, regulaciju osvjetljenja u sobama, osiguranje i alarmiranje i dr.). Koristi se u sustavima s jednostavnim upravljanjem pomoću kratkih naredbi pa se time umanjuje važnost brzine prijenosa modema kao najvažnijeg parametra. [2]

Danas je na tržištu prisutan veliki broj različitih modema s dva različita pristupa za obavljanje procesa modulacije i demodulacije. Jedni za modulaciju i demodulaciju koriste specijalni integrirani krug prikazan na slici 4.5.



Slika 4.5 Shema PLC modema

Mikroprocesor (μP) ima funkciju komunikacije prema nadređenom sustavu (npr. upravljačko računalo) i upravljanje modemom (*Power Line Modem*, PLM) koji pretvara digitalni signal u analogni i obratno definiranim modulacijskim/demodulacijskim postupkom.



Slika 4.6 Uskopojasni PLC modem

Izvor: TG_1_2_2009_Sumiga_Hudjek_Koristenje_energetskih_vodova_u_svrhu_komunikacije.pdf

Analogni start (*Analog Front End*, AFE) je sklop koji se nalazi između PLM i energetske mreže i služi za galvansko odvajanje signala od visokog napona. Dakle, odlazni signal injektira se na elektroenergetski da bi se, što je više moguće, očistio (isfiltrirao) dolazni signal za točniju pretvorbu u digitalni oblik.

Drugi način realizacije modulacije i demodulacije je da modemi koriste digitalne signale (*Digital Signal Procesore*, DSP) tako da softver obavlja proces modulacije i demodulacije. Razlika u ova dva pristupa je u tome što DSP zamjenjuje mikroprocesor dok programski algoritmi obrade signala povećavaju fleksibilnost modema.

Uskopojasni modemi koriste se u SAD-u i Europi dugi niz godina. Glavne prednosti su im jednostavnost u realizaciji te činjenica što su usklađeni sa zakonskim regulativama i normama. Najveći nedostatak je relativno uzak frekvencijski pojas i mala brzina komunikacije.

Širokopojasni PLC još uvijek je u fazi ispitivanja i nije potpuno standardiziran. Radi u frekvencijskom opsegu od 1.6 do 30 MHz i predstavlja dijeljeni medij što znači da smanjuje brzinu po korisniku. Širokopojasni PLC treba omogućiti: pristup internetu i prijenos podataka jako velikim brzinama, video za zahtjev (VoD), govornu komunikaciju preko IP protokola (VoIP) i kućne PLC usluge (štednja energije, alarmni sustavi, upravljanje kućanskim aparatima).

IPTV (*Internet Protocol Television*) služi za distribuciju TV programa u stvarnom vremenu korištenjem širokopojasnih IP mreža. VoD (*Video on Demand*) koristi se za distribuciju video sadržaja preko širokopojasnih IP mreža na zahtjev korisnika i u vrijeme koje korisnik postavi. VoIP predstavlja integraciju konvencionalnih telefonskih servisa s različitim (*Internet Protocol*) aplikacijama zasnovanim na IP protokolu.

Potražnja za širokopojasnim modemima raste i zbog razloga što se na ovaj način mogu ponuditi raznolike usluge za korisnike. Sklopovski i programski su složeniji od uskopojasnih modema i omogućavaju puno veće brzine rada. Tradicionalna telekomunikacijska pristupna mreža sastoji se, uglavnom, od kabela s neoklopljenim upredenim paricama (*Unshielded Twisted Pair*, UTP). Više od 95 % takvih lokalnih petlji, u Hrvatskoj i u svijetu, sastoji se od jedne upredene parice koja podržava tradicionalnu fiksnu analognu govornu telefonsku uslugu (*Plain Old Telephone Service*, POTS) [8].

Paralelno s razvojem interneta tijekom devedesetih godina prošlog stoljeća razvijen je i koncept širokopojasne digitalne mreže integriranih usluga (*Broadband Integrated Services Digital Network*, B-ISDN).[7] Granica između uskopojasne (*narrowband*) i širokopojasne

komunikacije postavljena je na 2 Mbit/s (u SAD-u na 1,5 Mbit/s), tj. na brzinu veću od brzine primarnog pristupa ISDN-u (*ISDN Primary Rate Access*, ISDN PRA).

Međutim, naknadno je ta granica pomaknuta prema nižim brzinama, tj. na 144 kbit/s koliko iznosi podatkovna brzina osnovnog pristupa ISDN-u (*ISDN Basic Rate Access*, ISDN BRA).

Na početku 21. stoljeća širokopojasni pristup internetu (engl. *broadband Internet access*) postao je jedna od ključnih smjernica suvremenih telekomunikacija. Širokopojasni pristup internetu nije više isključivo mjera tehnološke razvijenosti nekog društva, već govori i o njegovom razvoju u cjelini.

4.1. Širokopojasni pristup vodovima elektroenergetske mreže

Komunikacije vodovima elektroenergetske mreže su posebno zanimljive operatorima distribucijske elektroenergetske mreže poput, npr., Hrvatske elektroprivrede (HEP). Osnovna ideja PLC-a je da se širokopojasni podaci optičkim nitima prenose iz jezgrene mreže do transformatorskih stanica, od kojih se razvode vodovima elektroenergetske mreže do krajnjih korisnika (slika 4.1.1).



Slika 4.1.1 Prikaz integriranih širokopojasnih PLC modema [5]

Već dulje vrijeme postoje standardi za uskopojasni prijenos podataka PLC-om. Prijenosni PLC sustavi, kreirani sukladno tim standardima, uglavnom služe za upravljanje elektroenergetskim postrojenjima na daljinu i rade u niskom području frekvencija (spektar signala seže do 500 kHz). Prijenosne brzine u tim sustavima kreću se do nekoliko desetaka kbit/s.

5. ZAKLJUČAK

Ideja komunikacije preko elektroenergetske mreže nije nova. Prednost korištenja elektroenergetske mreže u komunikacijske svrhe je njena rasprostranjenost. Za razliku od telekomunikacijske mreže koja je dobro rasprostranjena u razvijenim državama, elektroenergetska mreža pokriva gotovo sva naseljena područja i u razvijenim državama, ali i u državama u razvoju. Međutim, nedostatak je što je elektroenergetska mreža projektirana primarno za prijenos električne energije. Za razliku od vodova predviđenih za prijenos informacija nije zaštićena od elektromagnetskog zračenja. Do ozbiljnijeg prijenosa podataka preko elektroenergetskih vodova prihvatljivim brzinama trebalo je pričekati tehnološki razvoj brzih mikroprocesora, digitalnih procesora i specijalnih mikročipova za primjenu modulacijskih tehnika. Oni u stvarnom vremenu ostvaruju složene modulacijske postupke za pouzdan prijenos signala. Dakle, proizvodi se sve više uređaja koji koriste PLC tehnologiju i shodno tome organiziraju se međunarodni skupovi u cilju promoviranja i bržeg širenja i prihvaćanja PLC tehnologije.

Prepreka u razvoju PLC-a je sam medij. Elektroenergetski vodovi su, osim što posjeduju jake smetnje generirane od svih priključenih potrošača, predviđeni za prijenos energije, ali ne i za prijenos telekomunikacijskih signala. Suvremene modulacijske tehnike i protokoli uspješno

rješavaju probleme brzine komunikacije. Modemi kojima se realizira PLC mogu se svrstati u dvije osnovne grupe: jednostavnije uskopojasne (*Narrowband*) koje imaju manje brzine prijenosa uglavnom za upravljačke podatke i širokopojasne (*Broadband*) koje velikim brzinama prenose različite vrste upravljačkih i korisničkih informacija.

U ovom se radu analizira i procjenjuje pogodnost četiri modulacijske sheme (tehnike raspršenog spektra, sheme s jednim širokopojasnim nosiocem bez ujednačivača, sheme s jednim širokopojasnim nosiocem sa ujednačivačem, sheme s više širokopojasnih nosilaca s ujednačivačem za uporabu u PLC sustavima. Usporedbena analiza tih shema obavljena je na osnovi sljedećih kriterija: spektralne iskoristivosti, maksimalne brzine prijenosa podataka, otpornosti na kanalna izobličenja, otpornosti na impulsni šum, svojstva fleksibilnosti i adaptivnosti, cijene sustava i elektromagnetske kompatibilnosti. Rezultati ove analize pokazuju da shema OFDM ispunjava ključne zahtjeve koji se postavljaju na PLC sustav (velika spektralna iskoristivost, velike brzine prijenosa i otpornost na kanalna izobličenja). Stoga predloženo PLC rješenje sadrži dvije transmisijske tehnike temeljene na dva različita fizička sloja: jedna se temelji na *wavelet* – *OFDM PHY*, a druga na *Fast Furier Transform* – *OFDM PHY*.

Projektiranje PLC komunikacijskog sustava za veće podatkovne brzine zahtijeva u prvom redu poznavanje karakteristika kanala kao što su prijenosna funkcija, otpornost na interferenciju i kapacitet kanala. Drugim riječima, pri projektiranju treba prvo postaviti/odabrati odgovarajući model kanala elektroenergetskog voda. Međutim, projektiranje komunikacijskog kanala za prijenos po elektroenergetskomvodu na visokim frekvencijama veoma je zahtjevno (takvi kanali nikad prije nisu bili projektirani).

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Broadband data transmission through power lines

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Abstract. This paper considers the broadband telecommunications technology used to transfer data via existing electrical power infrastructure. The paper explains the principle of communication via power lines (Power Line Communications, PLC) and closely examines the benefits of using this technology. The emphasis is on selecting a modulation scheme for the design of PLC systems and finding the solution for problems with electromagnetic compatibility (electromagnetic compability, EMC) in accordance with European standards. The paper concludes with the scheme of multiplexing multiple applicants in the frequency domain (Orthogonal Frequency Division Multiplexing, OFDM), optimized for broadband transmission of high-speed data lines on the electricity network using frequencies below 100 MHz. The representation of the PLC in power systems and companies is shown in a practical overview alongside with an insight into the commercialization of technology in the world. The paper also points out the advantages of PLC in relation to other technology, and considers the direction of its future development..

Key words: *communication power lines (PLC), electromagnetic compatibility, modulation*

Komunikacija elektroenergetskim vodovima: tehnologija Internet stvari

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Sažetak. Internet stvari (*Internet of Things*, IoT) je globalna infrastruktura za informacijsko društvo. Svaki element Interneta stvari naziva se *stvar* i treba imati jedinstvenu IP adresu. Stvari mogu biti objekti stvarnog svijeta ili virtualni objekti. U radu se analiziraju neke od predloženih definicija Interneta stvari. Objašnjava se značenje i identifikacija *stvari*. Razmatranja u ovom radu su usredotočena na tehnologiju komunikacije elektroenergetskim vodovima (*Power line Communication*, PLC) koja može također biti upotrijebljena pored već postojećih bežičnih komunikacijskih tehnologija (Wi-Fi, ZigBee, Bluetooth, 6LowPAN i drugo) za podržavanje aplikacija IoT -a. Ova razmatranja uključuju: osnovnu ideju, frekvencijsko područje sustava i njegove aplikacije. Potom se razmatraju norme za PLC (IEEE 1901) koje definiraju prijenos podataka preko elektroenergetskih vodova. Rad obuhvaća dvije osnovne norme: niskofrekvencijsku uskopojasnu (*Low - Frequency Narrowband*, LF-NB) i širokopojasnu (*Broadband over Power Line*, BPL).

Ključne riječi PLC, Internet stvari, komunikacijska tehnologija, aplikacija, PLC norme

1. Uvod

Razvoj informacijske i komunikacijske tehnologije (*Information and Communication Technology*, ICT) rezultirao je, između ostalog, značajnim razvojem, proizvodnjom i primjenom bežičnih osobnih uređaja kao što su pametni telefoni, osobna računala, tableti, dlanovnici i drugo. Budući da su ovi uređaji dizajnirani za rad putem IP mreža, broj uređaja povezanih na Internet eksponencijalno raste. Tako je 2011. broj povezanih uređaja bio veći od broja ljudi [5]. Predviđa se da će do 2020. približno 100 milijardi objekata (stvari), označenih na jedinstven način, biti povezano s Internetom [5]. Povezivanje milijarde različitih objekata zahtjevan je zadatak za istraživače s izrazitim utjecajem na ljude u smislu poboljšanja kvalitete njihova života. To je dovelo do potrebe definiranja novog koncepta Interneta poznatog pod nazivom Internet stvari (*Internet of Things*, IoT) i budući Internet (*Future Internet*).

Naziv Internet stvari prvi put spominje David Brock [1]. Nakon simpozija *Electronic Product Code* u Chicagu 2003. koriste ga znanstvenici i stručnjaci u konceptu u kojem su stvari (fizikalni objekti) stvarnog svijeta bežično integrirane s objektima virtualnog svijeta informacijske tehnologije.

Vizija Interneta stvari uključuje dodjeljivanje identifikatora kao što su IP adresa i radiofrekvencijska identifikacijska elektronička oznaka (*Radio Frequency Identification*

electronic tag, RFID electronic tag) svakoj pojedinoj stvari, putem vlastitog jedinstvenog identifikatora (*Unique Identification, UID*). Naziv IoT, prema tome, odnosi se na umreženo povezivanje različitih fizikalnih objekata (npr. senzor, uređaj, brod, stablo, kuća, pas, stol, knjiga, odijelo, jelo, lijek i dr.) s virtualnim objektima informacijske tehnologije. Povezivanje objekata temelji se na uporabi bežičnih i žičnih komunikacijskih tehnologija i normi za podržavanje aplikacija IoT.

Razmatranja u ovom radu usredotočena su na tehnologiju komunikacije elektroenergetskim vodovima (*Power Line Communication, PLC*) i norme za podržavanje aplikacija IoT-a. U drugom dijelu rada analiziraju se različite definicije Interneta stvari, objašnjava se značenje i načini identifikacije stvari kao i neke aplikacije IoT-a. Povijesni podaci razvoja komunikacije elektroenergetskim vodovima, osnovna ideja, frekvencijsko područje rada i napredne modulacijske sheme PLC-a prezentirane su u trećem dijelu rada. Četvrti dio rada donosi kratke opise dviju osnovnih normi PLC-a (niskofrekvencijska uskopojasna i širokopojasna) kao i primjera aplikacija koje se temelje na tim normama. Na kraju rada dani su zaključci.

Cilj rada je ukazati na mogućnost uporabe tehnologije PLC-a za podržavanje aplikacija Interneta stvari na dobrobit krajnjih korisnika i operatora elektroenergetske mreže, primjerice Hrvatske elektroprivrede (HEP-a).

2. Internet stvari: definicije i aplikacije Interneta stvari, značenje i identifikacija stvari

Polazi se od analize različitih definicija Interneta stvari postavljenih iz konceptijskog i infrastrukturnog gledišta. Objašnjava se što je *stvar* i tehnologije označavanja stvari: radiofrekvencijska identifikacija (RFID) / elektronički kôd proizvoda (*Electronic Product Code, EPC*). Potom se navode primjeri aplikacija IoT-a.

2.1. Definicije Interneta stvari

Naziv Internet stvari prvobitno se odnosio se na arhitekturu koja sadrži sljedeće elemente [2]:

- pasivne radiofrekvencijske identifikacije (*Passive Radio Frequency Identification, RFID*), odnosno labele s “*read only*” čipovima u kojima su pohranjeni jedinstveni identifikatori svakog pojedinog objekta (stvari),
- čitače RFID uključene u lokalni (računalni) sustav, koji čitaju i prenose identitete (uobičajeno serijski broj) objekata preko radijskih linkova,
- lokalni sustav, temeljen na povezivanju protokolom IP, koji prikuplja informacije o stvarima kodirane kodom EPC koristeći protokol ONS (*Object Naming Service*),
- servere EPCIS (*EPC Information Services*) koji obrađuju dolazne zahtjeve ONS i vraćaju datoteke PML (*Physical Markup Language*), primjerice, dokumente XML koji nose značajne informacije vezane na RFIDs.

Ovo viđenje Interneta stvari pokazuje da se na Internet stvari gleda samo s tehnološkog, infrastrukturnog gledišta i da ono ne pokriva sve aspekte Interneta stvari. Iz radova koji opisuju IoT vidi se da su predložene definicije IoT-a u sadašnje vrijeme mnogo opširnije i sadržajnije.

Navedimo predloženu definiciju u skupu europskih istraživačkih projekata o Internetu stvari. “*Internet stvari povezuje objekte realnog svijeta s virtualnim svijetom*” omogućujući povezivanje u bilo koje vrijeme, na bilo kojem mjestu, za bilo što, a ne samo za bilo koga.

To se odnosi na svijet „gdje fizikalni objekti i bića kao i virtualni podaci i okolina uzajamno djeluju u istom prostoru i vremenu“ [3] (slika 1). Iz ove se definicije vidi da ona ne sadrži detaljan opis infrastrukture. IoT je definiran kao koncept.



Slika 1 Prikaz Interneta stvari

Izvor: <http://www.stantontelecom.com/smart-home-and-care-technology/> (15.11.2015.)

Postoje različite definicije Interneta stvari, različitih eksperata i udruga koje se mogu svrstati u dvije skupine obzirom na gledište iz kojega su postavljene. To uključuje:

infrastrukturno gledište, pri čemu se IoT definira kao infrastruktura koja pruža mnogobrojne tehnološke mogućnosti,

pojmovno (konceptijsko) gledište, gdje se IoT ne smatra tehničkim terminom (ne odnosi se na infrastrukturu IoT-a) već konceptom ili fenomenom.

Infrastrukturno gledanje vidi IoT kao globalni sustav međusobno povezanih računalnih mreža koji koristi TCP/IP Internet Protocol suite za komuniciranje. Konceptijska perspektiva vidi IoT kao svjetsko logičko međusobno povezivanje računala i mreža koje podržava izmjenu informacija između korisnika i djelovanje na osnovu tih informacija (uključuje uređaje, podatke, procese i ljude, tj. pretvara informacije u akcije). Treba napomenuti da su neki eksperti predlagali hibridne definicije IoT-a, pri čemu se na Internet stvari gleda kao na uslužni (aplikacijski) koncept i infrastrukturu, tj. iz hibridne perspektive.

Međutim, Međunarodna telekomunikacijska udruga, Sektor telekomunikacijske normizacije, Studijska skupina 13 (International Telecommunication Union, Telecommunication standardization sector, Study Group 13, ITU-T SG 13) predlagala je kratku definiciju kao koncept umjesto tehničke definicije (dug ili detaljan opis tehnologije), da bi IoT bio lako uključen u različita područja tehnologije i prihvaćen od svih drugih zainteresiranih studijskih skupina [4]. U sadašnje vrijeme ITU-T (Recommendation Y.2060) definira IoT kao “globalnu infrastrukturu za informacijsko društvo koja omogućuje napredne usluge međusobnim povezivanjem (fizikalnih i virtualnih) stvari temeljem postojećih i razvijajućih, interoperabilnih informacijskih i komunikacijskih tehnologija”.

Može se zaključiti da IoT nije tek proširenje današnjeg Interneta. On predstavlja skupinu povezanih inteligentnih sustava, omogućuje donošenje pametnih rješenja i koristi niz tehnologija uključujući tehnologije mjerenja, komuniciranja, umrežavanja, računanja, obrade informacija te inteligentnog nadzora i/ili upravljanja.

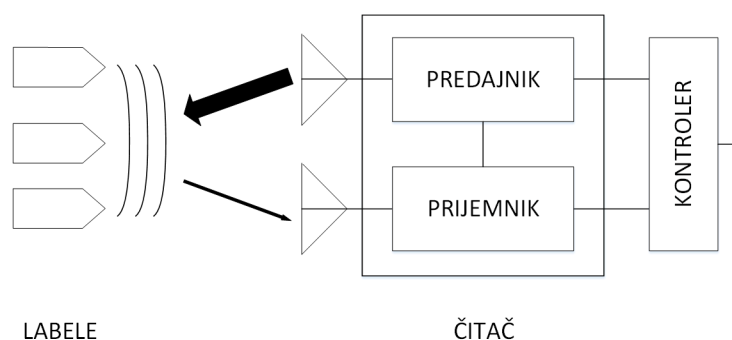
2.1. Značenje i identifikacija stvari

Naziv *stvar* može se odnositi na različite objekte (stvari) ovisno o domeni (društvo, okoliš, industrija) u kojoj se koristi. U društvu, primjerice, u zdravstvenoj njezi upotrebljavaju se pametni fiziološki senzori (stvari) za mjerenje krvnog tlaka i temperature tijela, za praćenje razine glukoze i razine kisika u krvi i sl.. U okolišu, primjerice, u pametnim kućama i zgradama sve više se koristi pametno mjerenje i upravljanje potrošnjom energije; mjerenje, nadzor i podešavanje temperature, vlažnosti i svjetlosti, pri čemu se koriste različiti senzori (stvari). Sve stvari u tim domenama mogu međusobno komunicirati uporabom automatskih uređaja povezanih s bežičnim mrežama (Zigbee, Bluetooth, 6LoWPAN, WiFi).

Svaka stvar treba imati jedinstvenu oznaku (identifikator), a složene stvari sastavljene iz većeg broja dijelova trebaju imati veći broj oznaka, zbog adresiranja, ovjere njihovog identiteta i međusobne komunikacije. Stvari se uobičajeno označavaju s dodijeljenim identifikacijskim brojevima, imenima i/ili lokacijskim adresama. Informacije o stvarima uobičajeno su kodirane uporabom jedinstvene oznake (*Unique Identification*, UID) i/ili elektroničkog koda (*Electronic Product Code*, EPC), pohranjuju se (uobičajeno) u elektroničke oznake (labela) (*Radio-frequency identification*, RFIDs) i čitaju uporabom čitača RFID. EPC je jedinstveni identifikacijski kôd koji koristi, poput bar koda, numerički sustav za identifikaciju proizvoda; općenito se smatra slijedećom generacijom tradicijskog bar koda.

Oznake RFID omogućuju automatsku identifikaciju svega čemu su dodijeljene i djeluju kao elektronički bar kôd. Pasivne oznake RFID, za razliku od aktivnih čitača RFID, nemaju baterijsko napajanje, nego koriste snagu signala čitača RFID. Pasivne oznake RFID upotrebljavaju se u transportu, primjerice, u karticama za naplaćivanje cestarine, u bankovnim karticama, u lancima snabdijevanja robom, u trgovinama na malo. Glavna primjena aktivnih oznaka RFID je u lučkim kontejnerima, u svrhu praćenja brodskog tereta i punjenja kontejnera. U kontejnere su ugrađeni ultrazvučni senzori koji odašilju informacije o razini punjenja i njihovoj težini. Kada se dostigne određena razina punjenja kontejnera postupak se automatski zaustavlja.

Napomenimo da su beskontaktna pametne kartice (*contact smart cards*, SCs) sofisticiranije u usporedbi s labelama RFID. Kartica SC sadrži mikroprocesor (malo računalo) što omogućuje računanje, dvosmjernu komunikaciju uključujući mogućnost šifriranja i druge jake sigurnosne mogućnosti te pohranu informacija. Međutim, kartica SC omogućuje izmjenu informacija na manjim udaljenostima (tipično 5 cm) i skuplja je od labela RFID.



Slika 2 Sustav RFID: uspostava radiokomunikacijskog kanala između RFID čitača i labela

Radiokomunikacijski kanal između RFID čitača i labela u kojoj su pohranjene specifične informacije o proizvodu (datum proizvodnje, rok uporabe, ime proizvođača, zemlja porijekla) uspostavlja se na slijedeći način (slika 2.). Kada labela RFID prolazi unutar definiranog područja čitač generira elektromagnetske valove. Antena integrirana s labelom prima taj signal i aktivira čip u labeli. Pri tom se uspostavlja bežični komunikacijski kanal između čitača i labela omogućujući prijenos podataka pohranjenih u labeli [4].

Tehnologija RFID i senzorska tehnologija sve više se koriste u proizvodnim lancima, zbog povećanja kontrole kvalitete proizvoda, poboljšanja logistike i korisničke usluge. Očekuje se da će RFID i srodne tehnologije biti kamen temeljac dolazećeg budućeg Interneta stvari. Dok su prve aplikacije tehnologije RFID razvijene radi zamjene bar koda u trgovinama na malo i u logistici, razvoj aktivnih komponenata učinit će da ova tehnologija bude mnogo više od jednostavne identifikacijske sheme.

2.2. Aplikacije Interneta stvari

Postoji više aplikacija i usluga IoT-a koje utječu i utjecati će na život ljudi. Njihov se utjecaj ogleda [5]:

- u izgradnji *pametnih kuća* i *zgrada* svijesnih svih zbivanja u njima i oko njih (pretežno glede mjerenja i učinkovitosti potrošnje struje, plina i vode, sigurnosti ljudi i imovine te udobnosti boravka u njima), pri čemu se koriste inteligentna brojila i senzori (stvari) povezani primjerice, u kućnu mrežu (*Home Area Network*, HAN),
- u izgradnji *pametnih gradova* (*smart cities*) što uključuje slijedeće aplikacije: sustav upravljanja prometnim tokom u kombinaciji s dinamičkom kontrolom prometne rasvjete; kontrolu ulične rasvjete; putnički informacijski sustav za javni prijevoz; pasivni nadzor kao što je integrirani javni nadzor koji se temelji na uporabi sustava digitalnog video nadzora visoke razlučivosti, sustava prepoznavanja lica i drugo,
- u zdravstvenoj njezi – posebice starijih i nemoćnih osoba u njihovim domovima i bolnicama uporabom aplikacije “*e – Health*”; ova aplikacija omogućuje praćenje zdravlja (npr. fitnesa) putem umreženih pametnih telefona s RFID senzorskim mogućnostima kao platformom za praćenje vitalnih tjelesnih parametara (temperature, pulsa, krvnog tlaka, razine glukoze i razine kisika u krvi te drugo),
- u pametnom upravljanju proizvodnjom i distribucijom energije, pri čemu se upotrebljavaju pametna mjerila i pametne mreže,
- u industriji uključujući nadzor i upravljanje proizvodnim procesima te kontrolu kvalitete proizvoda,
- u transportu što uključuje uporabu inteligentnog transportnog sustava, odnosno transportne aplikacije kao što je, primjerice, “*e - vehicle*” koja omogućuje navigaciju vozila, sigurnost na cestama te nadzor i upravljanje prometom,
- u obrazovanju, primjerice, u uporabi aplikacije *udaljeni laboratorij*, čime se tehnologija Interneta stvari integrira u nastavni proces; ova aplikacija omogućuje ne samo pristup laboratoriju i upravljanje izvana preko nekog komunikacijskog medija i izvan njegovog radnog vremena, nego i bolje iskorištavanje laboratorijskih resursa kao i povećavanje kvalitete učenja.

Može se nabrojiti još primjera aplikacija IoT-a a i još mnogo novih aplikacija će se razvijati u budućnosti. Mogućnost uporabe postojeće elektroenergetske infrastrukture za podržavanje aplikacija IoT - a dodatna je prednost za krajnjeg korisnika i PLC – operatora. To je također razlog za intenzivniji rad na primjeni tehnologije PLC i u našoj zemlji. Iz navedenih primjera aplikacija IoT-a može se zaključiti da one mogu mijenjati način funkcioniranja društva i uvelike utjecati na kvalitetu života u bliskoj budućnosti.

3. Komunikacije elektroenergetskim vodovima

Tehnologija PLC-a je alternativna pristupna komunikacijska tehnologija koja koristi elektroenergetske vodove za prijenos komunikacijskih signala. Pristupna PLC dopunjava postojeće bežične pristupne komunikacijske tehnologije (WiFi, Zigbee, Bluetooth, Ethernet i drugo) na tržištu. Rezultati ispitivanja relevantnih parametara elektroenergetskog voda u Europi i svijetu pokazuju da se može ostvariti istodoban prijenos komunikacijskih signala i elektroenergetskog vala elektroenergetskim vodovima unatoč izrazitim razlikama između

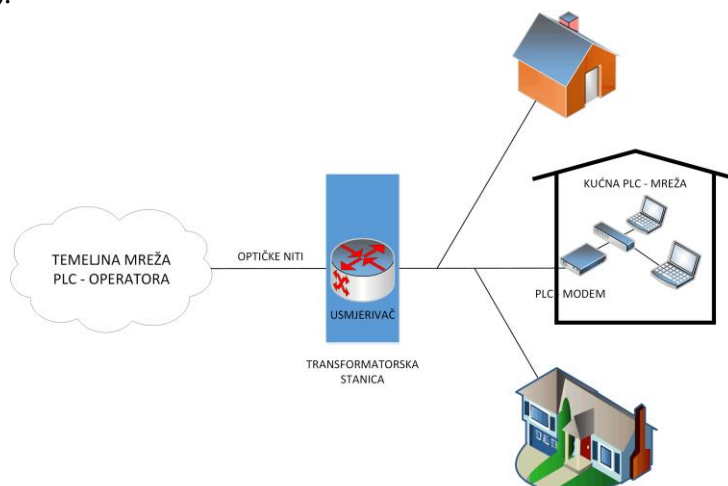
njih. Razlike se ogledaju u topologiji, strukturi i fizikalnim svojstvima elektroenergetskih vodova u usporedbi s konvencionalnim prijenosnim medijima u telekomunikacijama kao što su bakrene parice, koaksijalni i optički kabeli. Razlike postoje i u načinu zaštite tih vodova. Elektroenergetske vodove treba štititi od kratkih spojeva, telekomunikacijske od prenapona. Uporaba elektroenergetskih vodova za prijenos širokopojasnih podataka pruža višestruke prednosti korisnicima i operatorima elektroenergetske mreže.

3.1. Povijesni podaci, osnovna ideja i frekvencijsko područje rada

Razvoj tehnologije PLC-a započeo je sredinom prošlog stoljeća razvojem relejne tehnologije PLC-a. U osmom desetljeću prošlog stoljeća počinje istraživanje mogućnosti uporabe tehnologije PLC-a za podržavanje jednosmjernog prijenosa podataka, a desetak godina poslije kreću i prva ispitivanja dvosmjernog prijenosa podataka. Kronološki slijed razvoja ove tehnologije bio je slijedeći:

- 1950. tehnologija PLC-a se primjenjuje, ali u početku podržava samo uskopojasne aplikacije za udaljeno relejno upravljanje, primjerice, javnom rasvjetom; komunikacija je jednosmjerna, frekvencija 10 Hz, a izlazna snaga predajnika 10 kW,
- sredinom 1980-ih godina počinju istraživanja mogućnosti uporabe elektroenergetskih vodova za jednosmjerni prijenos podataka u frekvencijskom području između 5 i 500 kHz,
- 1997. kompanije Ascon u Švicarskoj i Norweb u Velikoj Britaniji izvršile su prva ispitivanja dvosmjernog prijenosa podataka preko elektroenergetske mreže,
- 2000. prva ispitivanja dvosmjernog prijenosa podataka primjenom tehnologije PLC-a obavile su kompanije EDF i Ascon u Francuskoj,
- skupina normi IEEE 1901, koja definira prijenos podataka preko elektroenergetskih vodova, objavljena je 2011. – 2012. [4].

Osnovna ideja PLC-a je da se širokopojasni podaci prenose optičkim nitima iz temeljne telekomunikacijske mreže do transformatorskih stanica od kojih se razvode vodovima elektroenergetske mreže do krajnjih korisnika (slika 3.). Mreža PLC-a između transformatorske stanice i PLC modema instaliranog na korisničkom području naziva se vanjska (*outdoor*) ili pristupna (*access*) mreža PLC, a ona u *privatnim/poslovnim* zgradama unutarnja (*indoor*).



Slika 3 Topologija pristupne mreže ostvarene uporabom elektroenergetskih vodova

Prijenos elektroenergetskim vodovima znači istodoban prijenos visokofrekvencijskog niskoenergetskog informacijskog signala i niskofrekvencijskog elektroenergetskog vala na visokim energetske razinama. Da bi se osigurala koegzistencija i odvajanje tih dvaju sustava, frekvencijsko područje koje se koristi za komunikacije treba biti udaljeno od

područja za prijenos elektroenergetskog vala. Tako se frekvencijsko područje od 3-148.5 kHz upotrebljava za podržavanje aplikacija uskopojasne PLC (*Narrowband PLC, NB - PLC*) tehnologije, a od 1-30 MHz za aplikacije širokopojasne PLC (*Broadband PLC, BLC*) tehnologije.

Naziv PLC odnosi se na svaku tehnologiju koja omogućuje prijenos podataka elektroenergetskim vodovima uporabom naprednih modulacijskih shema. U današnje vrijeme u tu svrhu upotrebljavaju se dvije napredne modulacijske sheme:

- Multipleksiranje s frekvencijskom raspodjelom ortogonalnih podnosilaca, (*Orthogonal Frequency Division Multiplexing, OFDM*) gdje se upotrebljava veći broj ortogonalnih podnosilaca umjesto jednog nosioca u kanalu.
- Raspršeni spektar (*Spread Spectrum, SS*) pri čemu se prijenosni signal (val nosilac) raspršuje preko kanala veće pojasne širine u usporedbi s osnovnom pojasnom širinom koja se zahtijeva za prijenos.

Drugim riječima, pri primjeni modulacije SS, koristi se istodobno veći broj frekvencija unutar frekvencijskog pojasa za prijenos jednog signala. Na taj način interferencija, koja se često događa samo na nekim frekvencijama, ima neznatan utjecaj na prijenos signala.

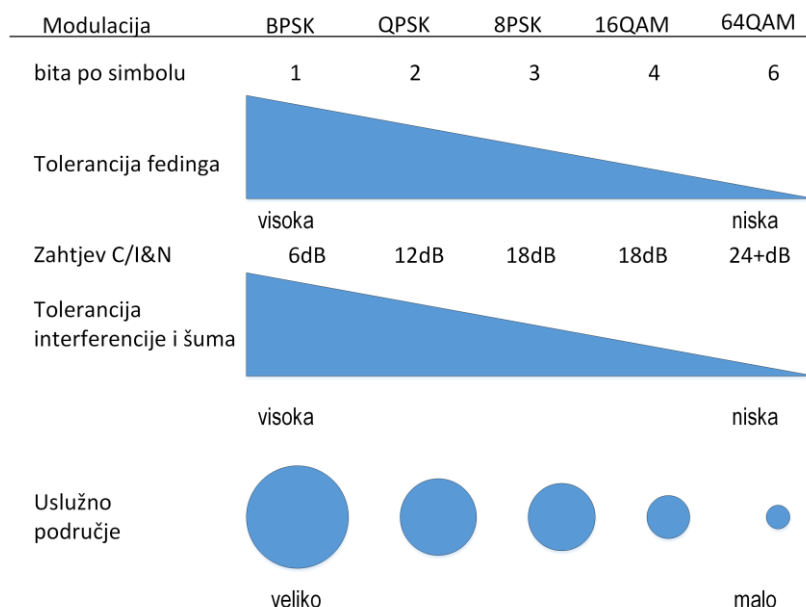
3.2. Digitalne modulacije

Sve digitalne modulacijske tehnike, na neki način manipuliraju istim elementima prijenosnog signala, što uključuje: amplitudu, frekvenciju i fazu. Odabir modulacijske tehnike temelji se na zadovoljavanju unaprijed postavljenih kriterija, pri čemu se ostvaruju željene prednosti na račun "žrtvovanja" drugih prednosti kao što su: zahtijevana pojasna širina, maksimalna podatkovna brzina, složenost digitalnog kruga, robusnost i zahtijevana snaga signala s obzirom na šum i interferenciju u kanalu, da bi prijemnik mogao točno rekonstruirati preneseni informacijski signal. Omjeri koji definiraju zahtijevanu snagu su C/N (*Carrier to Noise*), C/I (*Carrier to Interference*) i energija po bitu u odnosu na šum, E_b/N (*Energy per bit relative to Noise ratio*).

Količina podataka koju treba prenijeti stalno se povećava pa moderna digitalna komunikacijska oprema ima sve veće zahtjeve glede propusnosti kanala. Frekvencijski spektar postaje sve zagušeniji, stoga su potrebne napredne modulacijske tehnike da bi se postigla željena propusnost u uskopojasnim kanalima. Faza i amplituda kao modulacijske karakteristike pri tom se implementiraju na složenije načine da bi se povećala propusnost kanala. Tako se ostvaruje niz složenih digitalnih modulacija: BPSK (BiPhase Shift Keying); QPSK (Quadrature Phase Shift Keying); 8PSK (8 Phase Shift Keying); 16 QAM (16 Quadrature Amplitude Modulation) i 64QAM (64 Quadrature Amplitude Modulation).

Jednostavna modulacija je veoma robusna, ali s robusnošću dolaze oštra ograničenja kapaciteta kanala. Robusnost složenih sustava koji koriste složene modulacije (BPSK, QPSK, 8PSK, 16QAM, 64 QAM) je manja, imaju veći potencijalni kapacitet, ali zahtijevaju veću gustoću snage signala na prijemniku, da bi prijemnik točno rekonstruirao preneseni informacijski signal. Složena modulacija također zahtijeva veću snagu za učinkovito pokrivanje istog područja signalom u usporedbi s jednostavnom modulacijom, ali osigurava veću propusnost u danom kanalu (slika 4.). Ako se odabere odviše složena modulacija (primjerice, 64 QAM) sustav može imati oštra ograničenja glede područja pokrivanja, odnosno veoma malo uslužno područje.

U najgorem slučaju učinkovita komunikacija je nemoguća preko željenog područja pokrivanja svakog predajnika, zbog velikih pogrešaka u prijenosu [6].



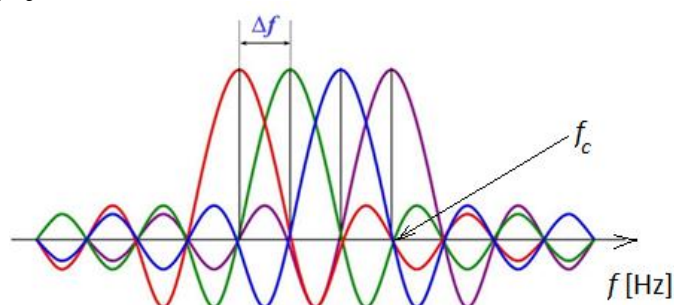
Slika 4 Usporedba modulacija: BPSK, QPSK, 8PSK, 16QAM i 64QAM

Izvor: http://cdserv.wbut.ac.in/81-312-0046-9/Ebook/Olexa_eBook.pdf

U modemu PLC-a, instaliranom u kući korisnika (slika 3.), uobičajeno se upotrebljavaju napredne modulaicijske sheme OFDM i SS.

3.2.1. Multipleksiranje s frekvencijskom raspodjelom ortogonalnih podnosilaca

U prijenosu podatkovnog signala primjenom modulaicijske sheme OFDM upotrebljava se veći broj ortogonalnih podnosilaca s pripadnim uskim frekvencijskim pojasevima umjesto jednog uskopojasnog nosioca unutar kanala (slika 5.). To znači da se raspoloživi frekvencijski pojas kanala dijeli na veći broj podkanala, pri čemu svaki podkanal ima svoj vlastiti modem (modulator/demodulator). Takav se prijenos može ostvariti, ako je zadovoljen uvjet ortogonalnosti podnosilaca, odnosno ako je frekvencijski razmak Δf između dva susjedna podnosioca jednak recipročnoj vrijednosti trajanja (T) simbola OFDM, $\Delta f = 1/T$. Napomenimo da se u prijenosu podatkovnog signala binarni informacijski simboli ("0" i "1") prvo preslikavaju u OFDM simbole uporabom OFDM modulatora u svakom podkanalu, a potom OFDM simbole moduliraju podnosiocima. Svaki se ortogonalni podnosilac može neovisno modulirati primjenom, primjerice, signala QPSK ili QAM što ovisi o odabranoj podatkovnoj brzini prijenosa.



Slika 5 OFDM: prikaz raspodjele podnosilaca u frekvencijskoj domeni

Izvor: <http://www.revolutionwifi.net/revolutionwifi/2015/3/how-ofdm-subcarriers-work>

Iz slike 5. se vidi, da se frekvencijski spektri podkanalnih podnosilaca prekrivaju, ali su razmaci Δf između podnosilaca jednaki. To znači da je uvjet ortogonalnosti podnosilaca zadovoljen. Iz slike 5. također se vidi da snaga informacijskog signala na centralnoj frekvenciji (f_c) pojasa podnosioca u svakom podkanalu poprima vršnu vrijednost kada je

snaga susjednih signala u promatranom podkanalu jednaka nuli. Može se zaključiti da su osnovne prednosti primjene OFDM-a:

- velika spektralna učinkovitost, što vodi većim prijenosnim brzinama,
- velika fleksibilnost glede prilagodbe raspoloživoj pojasnoj širini kanala,
- manja osjetljivost na višestazni *fading* (*multipath fading*), tj. na slučajan, statistički, vremenski ovisan efekt dodatnog slabljenja signala na propagacijskoj stazi; to je veoma korisno u tipičnom zemaljskom propagacijskom okolišu s različitim preprekama na propagacijskoj stazi gdje dolazi do refleksija signala; prenošeni signal zbog toga stiže u prijemnik stazama različitih duljina što ima za posljedicu izobličenje prijemnog signala.

Kako se svaki ortogonalni podnosilac može neovisno modulirati, modulacija se može odabrati za svaki podnosilac (podkanal) ovisno o *fedingu* u okolišu propagacijske staze. Implementacija ove fleksibilnosti dodaje složenost sustavu, ali omogućuje maksimalnu propusnost kanala, zbog mogućnosti dinamičkog prilagođavanja frekvencijskom *fedingu* kanala. Što je tehnologija prijenosa i prijema sofisticiranija svaki bit postaje uži, a time pojasna širina sve veća.

Tehnika OFDM-a primjenjuje se i u bežičnim telekomunikacijskim mrežama temeljenim na normama IEEE 802.11a, IEEE 802.11g, IEEE 802.16 i IEEE 802.20. Napomenimo da proizvođači opreme temeljene na vlasničkim OFDM rješenjima nude različite razine složenosti opreme što ovisi o proizvođaču i namjeni opreme. Treba naglasiti da se u implementaciji OFDM-a u opremi temeljenoj na normama IEEE 802.11a i IEEE 802.11g koristi ista modulacija na svim podnosiocima. OFDM, zbog svoje fleksibilnosti i spektralne učinkovitosti, sve više se koristi kao osnova normiranih žičnih i bežičnih podatkovnih komunikacijskih tehnologija kao i vlasničkih normi proizvođača.

4. Norme komunikacija elektroenergetskim vodovima

Donošenje opće prihvaćenih normi koje pokrivaju IoT i PLC tehnologije izrazito je važno, jer vlasnička rješenja i norme fragmentiraju industriju. Normizacija uređaja, mreža i aplikacija omogućuje globalna rješenja za bešavni rad i smanjuje troškove. U ovom dijelu rada prezentirane su dvije osnovne PLC norme iz grupe normi IEEE 1901: širokopojasna (*Broadband over Power Line*, BPL) i niskofrekvencijska uskopojasna (*Low Frequency Band*, LF – NB).

4.1. Širokopojasna norma i niskofrekvencijska uskopojasna norma

Skupina PLC normi IEEE 1901, objavljena 2010 - 2012. , specificira prijenos podataka preko elektroenergetskih vodova, odnosno podržava aplikacije IoT-a. Postoje dvije osnovne norme: širokopojasna (BPL) i niskofrekvencijska uskopojasna (LF - NB).

Norma BPL IEEE 1901 dizajnirana je za uporabu u širokom području aplikacija IoT-a kao što su: pametna energija (Smart Energy, SE), transport, privatne i poslovne lokalne mreže (Local Area Networks, LAN-s) i drugo. Umreženi proizvodi sukladni s normom IEEE 1901 omogućit će podatkovne brzine veće od 500 Mb/s u aplikacijama lokalnih mreža kao i udaljenosti do 1500 m u aplikacijama prve/posljednje milje. Tehnologije specificirane s normom IEEE 1901 koriste napredne modulacijske tehnike OFDM i SS za prijenos podataka preko standardnih elektroenergetskih vodova bilo kojeg napona na prijenosnim frekvencijama manjim od 100 MHz. Tako će PLC biti, između ostalog, dopuna bežičnim lokalnim mrežama (Wireless Area Networks, WLAN-s) i omogućiti linkove kroz zidove i druge radiofrekvencijske prepreke kao i veće udaljenosti u usporedbi s normalnim dosegom bežičnih mreža. U hotelima i drugim višekatnim zgradama PLC će biti također dopuna bežičnoj mreži prenoseći multimedijske podatke preko većih udaljenosti i osiguravajući bežični završetak komunikacijskog linka posljednjih nekoliko metara [7].

Norma IEEE P1901.2 za LF – NB PLC objavljena je 2012. Ova je norma dizajnirana radi specificiranja sigurne komunikacije elektroenergetskim vodovima na podatkovnim brzinama do 500 kb/s i prijenosnim frekvencijama manjim od 500 kHz. Norma IEEE P1901.2 podržava aplikacije pametne mreže kao što su kućno umrežavanje (home area networking), rasvjeta, komunikacije solarnim pločama (solar – panel communications) i drugo. Ova norma osigurava koegzistenciju s BPL uređajima minimizirajući izvanpojasne emisije na frekvencijama većim od 500 kHz [8].

5. Zaključak

U radu se razmatra tehnologija komunikacije preko elektroenergetskih vodova kao jedna od pristupnih komunikacijskih tehnologija za podržavanje aplikacija Interneta stvari. Polazi se od analize različitih predloženih definicija Interneta stvari postavljenih iz infrastrukturnog i/ili pojmovnog (konceptijskog) gledišta. Zaključuje se da Internet stvari nije tek proširenje današnjeg Interneta, nego globalna infrastruktura za informacijsko društvo. Potom se objašnjava značenje termina *stvar*, načini označavanja stvari i tehnologija radiofrekvencijske identifikacije koja je široko prihvaćena u društvenoj, okolišnoj i industrijskoj domeni, zbog točnosti i brzine prikupljanja identiteta stvari. Diskutiraju se različite aplikacije Interneta stvari od zdravstvene njege, pametnih kuća / zgrada do pametnih mreža i logistike. Opisuje se dvije tehnologije i norme komunikacije elektroenergetskim vodovima za podržavanja aplikacija Interneta stvari: širokopojasna i niskofrekvencijska uskopojasna. Zaključuje se da mnoštvo aplikacija Interneta stvari može biti dostupno krajnjim korisnicima preko postojeće elektroenergetske infrastrukture. To je dodatna prednost za krajnje korisnike i PLC operatore i razlog za intenzivniji rad na primjeni tehnologije komunikacije elektroenergetskim vodovima i u našoj zemlji.

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Power line communication: tehnologies for the internet of things

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Abstract. Internet of Things (IoT) is a concept in which real-world things (physical objects) are seamlessly integrated with the virtual world of information technology. Each component of the Internet of Things is called a "thing" and should have a unique address. Things could be real world objects or virtual objects. This paper analyzes some of the proposed definitions of IoT. It provides the identification and explains the meanings of things. Considerations in this paper are focused on communication technology over power lines (Power Line Communication, PLC). Both the PLC technology and existing existing wireless communication technologies (Wi-Fi, ZigBee, Bluetooth, 6LoWPAN and others) are suitable for supporting IoT applications. These considerations include the principle and the frequency range of the system and its applications. Subsequently discussed are the PLC standards (IEEE 1901) that define data transmission over power lines. The paper covers two basic PLC standards: Low Frequency Narrow Band (LF-NB) and Broadband over Power Line (BPL).

Key words: *power line communication (PLC), Internet of Things (IoT), communication technology, applications, PLC standard*

Organizacija i postavljanje računala u laboratorijima izradom slike sustava

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Sažetak. U ovom radu prikazana je organizacija i postavljanje računala u laboratorijima namijenjenima za održavanje vježbi na Odsjeku za informacijsku tehnologiju na Sveučilišnom odjelu za stručne studije u Splitu. Zbog ograničenog broja laboratorija u odnosu na broj kolegija, sva računala moraju podržavati cjelokupan skup tehnologija koje se koriste u nastavi Odsjeka. Zbog toga su birana razvojna okruženja s podrškom za široki skup tehnologija, pri čemu se vodilo računa o tome da računala ne budu preopterećena. Kod odabira softvera važna je suradnja s nastavnicima, kao i detaljno isprobavanje instalacije. Kako bi se olakšalo održavanje i nadogradnja laboratorija, sva računala su identično postavljena. Na početku je odabrano računalo na koje je instalirana potrebna programska podrška te je prema njemu izrađena slika sustava (eng. *system image*) koja je kasnije primijenjena na ostatak laboratorija. Na taj način olakšana je ponovna instalacija računala u slučaju kvara, kao i redovita instalacija koja se provodi prije početka svakog semestra.

Ključne riječi: *slika sustava, administracija računalnog laboratorija*

1. Uvod

Nastava laboratorijskih vježbi na Odsjeku za informacijsku tehnologiju Sveučilišnog odjela za stručne studije u Splitu izvodi se na 64 računala raspoređena u pet informatičkih laboratorija. Laboratoriji nisu specijalizirani, a kako se na računalima održavaju vježbe iz pedesetak različitih kolegija, bio je velik izazov napraviti softversku podlogu koja će s jedne strane zadovoljiti potrebe svih kolegija, a s druge strane biti pouzdana i jednostavna za održavanje. Prilikom odabira softvera izuzetno je bitna suradnja nastavničkog osoblja i sistem administratora u svrhu odabira razvojnih okruženja koja će optimalno opteretiti računalo, studentima biti intuitivna za korištenje, a ujedno i pratiti trendove koje postavlja tržište rada. Važnu ulogu u tome ima postupak kloniranja diska, pri čemu se između hardverski sličnih računala prenosi cjelokupna slika diska, zajedno s operativnim sustavom i svim instaliranim programima. Nakon nabave računala, na jedno računalo instalirani su svi potrebni programi, namještene sigurnosne postavke te su napravljena sva namještanja programa specifičnih za pojedinačne kolegije. Na pripremu inicijalnog računala utrošen je velik broj radnih sati te je teško zamisliti okruženje s većim brojem sličnih računala na kojem bi imalo složeniji postupak instalacije trebalo ponoviti na svakom računalu pojedinačno. Stoga je već kod početne instalacije napravljena slika koja je klonirana na ostala računala. Kako se računala intenzivno koriste u nastavi, kraj semestra dočekaju s velikim brojem privremenih studentskih datoteka i zastarjelim softverom. Zato se ispitni rokovi u veljači i rujnu iskoriste za nadogradnje i osvježavanje slike, kako bi računala bila spremna za sljedeći semestar.

2. Priprema računala

Nakon završetka semestra, napravi se uvid u stanje laboratorija. Od računala koja su u kvaru izdvoje se ona koja imaju očigledan hardverski problem, kako bi se detaljnije dijagnosticirala prije mogućeg slanja na servis. Od ispravnih računala odabere se jedno koje će poslužiti kao podloga za daljnju nadogradnju i na njega raspakira slika sustava napravljena na početku prethodnog semestra. Računalo se tako vraća u spremljeno stanje (eng. *snapshot*) na kojem se nikada nije izvodila nastava, a sve radnje koje su se na njemu do tada izvodile, bile su u kontroliranom okruženju. Unatoč oprezu, postoji mogućnost da je računalo u prošlosti bilo kompromitirano pa ga se prije spajanja na mrežu provjerava antivirusnim programom sa svježim definicijama. Uzevši u obzir da svaki put prođe gotovo pola godine od stvaranja slike do trenutka raspakiranja i provjere, antivirusni bi program trebao, s velikom vjerojatnošću, otkriti zloćudne programe koji su u međuvremenu registrirani. Kako bi se osigurala memorijski čista antivirusna okolina i izbjeglo nepotrebno opterećivanje operativnog sustava, koji je podloga za daljnju instalaciju, koristi se posebna distribucija antivirusnog programa u obliku tzv. *rescue* CD-a, tj. namjenskog CD-a sa samostalnim operativnim sustavom i integriranim antivirusnim programom koji omogućava skeniranje računala neovisno o sadržaju tvrdog diska i instaliranom operativnom sustavu. U tu svrhu, zadnjih godina na Odsjeku za IT, koristi se *rescue* CD tvrtke Kaspersky.

Prvi korak u osvježavanju softvera na računalu ažuriranje je Windows operacijskog sustava uz pomoć alata *Windows Update*. Ažuriranje se obavlja ručno, nakon čega se isprobavaju kritične funkcionalnosti operativnog sustava. Sustav automatske nadogradnje ne koristi se kako bi se spriječila mogućnost da problematična zakrpa uzrokuje probleme u radu laboratorija. S obzirom na to da se prilikom nadogradnje Windowsa osvježavaju i pogonski programi (eng. *drivers*), nakon nadogradnje provjeri se stanje hardvera u Windows upravitelju uređaja (eng. *device manager*).

U sljedećem koraku osvježava se instalirani softver i instaliraju se najnovije verzije pomoćnih programa. Nadograđuju se *web* preglednici i dodatci za njih (eng. *plugins*) od kojih se kao problematičan izdvaja dodatak *Flash player*. Prema dostupnim podacima, samo u prošloj godini za navedeni dodatak otkriveno je preko 300 sigurnosnih propusta [1], stoga se *Flash* na računalo ne instalira kao zasebni dodatak, već se koristi verzija *Flash playera* uključena u preglednik *Chrome*. Ta verzija *Flasha* izvodi se u izdvojenom sigurnom sloju preglednika (eng. *sandbox*), čime je značajno smanjen rizik korištenja ovog dodatka [2].

Osim pomoćnih programa, instaliraju se nove i nadograđene verzije alata koji se koriste na vježbama. Pritom se izbjegavaju veće nadogradnje i prelazak na nove verzije razvojnih okruženja koja nisu potpuno kompatibilna sa starim verzijama jer se računala u laboratorijima koriste za rad na projektima i izradu završnih radova, zbog čega velike i nenajavljene promjene alata nisu poželjne. Za sljedeću akademsku godinu priprema se nadogradnja razvojnog okruženja *Microsoft Visual Studio* s verzije 2012 na 2015, pri čemu će zbog velikog broja izmjena i specifičnosti u tablici kompatibilnosti [3], nadogradnja biti izvedena u dogovoru sa svim nastavnicima koji navedeno okruženje koriste u nastavnom procesu.

Nakon što se završi instalacija programa, napravi se detaljno čišćenje sustava. Prvo se isključe nepotrebni programi i servisi koji se pokreću s operativnim sustavom, nakon čega se napravi čišćenje diska. Prvi prolaz napravi se specijaliziranim alatom *CCleaner*, nakon čega se ručno pobrišu nepotrebne datoteke koje su promakle *CCleaneru*, npr. datoteke privremene pohrane (eng. *cache*) raznih programa, instalacijske datoteke nadogradnji, sadržaj privremenih direktorija i slično.

Nakon postavljanja računala, nastavnici trebaju testirati razvojna okruženja i programe specifične za svoj kolegij. U nastavi koristi se velik broj različitih alata pa je moguće da se nakon nadogradnje pojavi softverski problem ili nekompatibilnost koja nije postojala u staroj verziji. U tu svrhu odvoji se nekoliko dana kako bi nastavnici isprobali alate koje koriste na vježbama. Prije testiranja napravi se radna slika diska (eng. *disk image*) koja se vraća na računalo nakon testiranja kako bi se poništile promjene koje su nastavnici možda napravili. Nakon vraćanja radne slike naprave se samo promjene koje su izričito zatražene i nužne.

Na samom kraju obnove sustava promijeni se administratorska lozinka u *Windowsima*. Administratorski račun ne koristi se u uobičajenom radu, a lozinka nije poznata nikome osim nastavnicima koji održavaju laboratorije. Studenti rade na računu s ograničenom razinom prava, a operativni sustav namješten je tako da se prilikom paljenja prijavi na studentski račun bez unosa lozinke.

Posljednji korak u pripremi računala je defragmentacija diska. Instalacijski programi prilikom nadogradnje prepisuju stare verzije datoteka novima, pri čemu dolazi do fragmentacije zapisa na površini diska. S obzirom na to da će pripremljena slika biti raspakirana na više od 60 računala i biti intenzivno korištena kroz cijeli semestar, svaki dobitak na brzini čitanja i zapisivanja na disk važan je.

Ovako pripremljeno računalo spremno je za izradu slike. Kako bi konačna slika bila što manja, u operativnom sustavu isključena je podrška za hibernaciju (veličina hibernacijske datoteke odgovara veličini radne memorije u računalu) i uključena je opcija brisanja stranične datoteke (eng. *pagefile*) prilikom gašenja računala. Stranična datoteka redovito zauzima nekoliko gigabajta prostora na disku, a neće biti potrebna prilikom sljedećeg paljenja (na nekom drugom računalu). Uklanjanjem datoteka *hiberfyls.sys* i *pagefile.dat* konačna datoteka slike smanjena je za više od 5 GB-a.

3. Kloniranje slike diska na računala u laboratoriju

Izradom slike stvara se potpuna i cjelovita kopija svih podataka zapisanih na disku. Za razliku od kopiranja ili arhiviranja datoteka uobičajenim alatima unutar operativnog sustava, kod izrade slike diska spremaju se i svi metapodatci vezani za datoteke, zapisi potrebni za podizanje operativnog sustava (eng. *boot record*) te indeksi i ostali elementi datotečnog sustava koji omogućavaju naknadnu potpunu rekonstrukciju svih zapisa na disku.

Metoda koja obuhvaća izradu slike diska na jednom računalu i njeno preslikavanje na drugo računalo sa sličnim hardverom naziva se kloniranje diska (kloniranje sustava). Navedena metoda koristi se u laboratorijima IT-a od 2001. godine kada su napravljena prva kloniranja softverom *Ghost*. U međuvremenu je na Odsjeku korišteno nekoliko programskih rješenja za kloniranje (*Trinity Rescue Kit*, *CloneZilla*), a od 2015. koristi se program *AOMEI Backupper Standard*. Program je besplatan, a pokazao se pouzdan i jednostavan za korištenje što je važno jer su u proces održavanja laboratorija od nedavno uključeni i studenti koji u sklopu stručne prakse održavaju računala i pomažu u izvođenju procesa opisanog u članku.

Kod stvaranja slike diska, općenito postoje tri pristupa: kopiranje cijelog diska sektor po sektor, pri čemu se stvara potpuna slika diska i svi sektori kopiraju se neovisno o tome jesu li iskorišteni ili nisu. Navedena metoda je najpouzdanija i radi neovisno o datotečnom sustavu na disku, ali izlazna datoteka stvorena tako je najveća. Drugim pristupom kopiraju se samo sektori na koje su zapisani korisni podatci. Na takav način stvara se slika koja sadrži sve podatke potrebne za rekonstrukciju postojećeg stanja sustava uz znatne uštede na prostoru. Treći pristup koristi se za sigurnosnu pohranu (eng. *backup*) i kopiraju se samo datoteke direktno dostupne iz operativnog sustava, pri čemu cjelokupan integritet podataka na disku nije sačuvan, stoga iz takve slike načelno nije moguće oporaviti sustav. Kod stvaranja slike diska na Odsjeku za IT koristi se drugi opisani pristup koji je u programu *AOMEI Backupper*

nazvan *Intelligent Sector Backup*. Originalni disk kapaciteta je 500 GB i podijeljen je na dvije particije na kojima je zauzeto ukupno 59 GB prostora. Podatci se sažimaju srednjom razinom sažimanja (opcija *Normal Compression*), pri čemu je kod kloniranja u veljači 2016. dobivena izlazna datoteka od 34 GB i postignuta razina sažimanja od 62 %. $34 \text{ GB} / (59 \text{ GB} - 4 \text{ GB pagefile}) = 62 \%$.

Prilikom kloniranja, *AOMEI Backupper* pokreće se s *boot* CD-a, bez instalacije na računalo. *Backupper* je relativno novi softverski proizvod kojeg proizvođač često osvježava novim verzijama pa se svaki semestar napravi nekoliko novih CD-a uz pomoć alata *AOMEI Make Disk*. Kod izrade CD-a bira se između sustava zasnovanog na *Linux kernelu* ili na *Windows PE okruženju* (eng. *Windows Preinstall Enviroment*). Program *Backupper* pokrenut iz *Windows PE okruženja* pruža više mogućnosti u odnosu na Linux verziju [4], a kako nije uočena važnija nekompatibilnost ugrađenih *Windows drivera* na CD-u s hardverom u laboratoriju, koristi se *Windows PE* modul. Izrađena slika kopira se na nekoliko vanjskih USB diskova te se klonira na ostala računala u laboratoriju.

4. Naknadno namještanje pojedinačnih računala

Nakon što se na sva računala klonira sadržaj izvornog diska, potrebno je namjestiti mrežne postavke specifične za svako računalo. Na mreži nije instaliran DHCP server pa se na svakom računalu unose podatci o IP adresi, podmreži, zadanom usmjerniku i DNS poslužitelju. Osim toga, namješta se i NetBIOS naziv računala i radna grupa kako bi se olakšao pristup dijeljenim datotekama.

Potom slijedi aktivacija operativnog sustava i ostalih alata čiji sustav licenciranja ne podržava kloniranje. Naime, uobičajen postupak registriranja pojedinačnog softvera sastoji se od unošenja i verifikacije pojedinačnog registracijskog ključa, što kod metode kloniranja diska nije moguće automatizirati. Kloniranjem se svi podatci s izvornog diska, zajedno s registracijskim ključem preslikaju, a korištenje istog ključa na više računala najčešće nije u skladu s licenčnim odredbama proizvođača softvera, tako da je za većinu programa potreban ručan unos ključa za svako pojedinačno računalo. Ipak, dio softvera na Odsjeku registriran je VLK ključevima za količinsko licenciranje (eng. *Volume Licence Key*) koji omogućavaju korištenje istog ključa na različitim računalima, što znatno olakšava instalaciju većeg broja računala metodom kloniranja slike diska.

5. Planovi za unaprjeđenje postupka održavanja i organizacije laboratorija

Budući da se u toku semestra velik broj studenata služi istim laboratorijima, na računalima se stvara puno nepotrebnih datoteka koje stvaraju nered u radnim direktorijima i predstavljaju problem u nastavnom procesu jer studenti mogu koristiti gotova rješenja zaostala na računalima od prethodne grupe. S obzirom na to, bilo bi idealno kada bi se tragovi aktivnosti studenta na računalu poništile nakon završetka rada i kada bi se računalo vratilo u prvobitno stanje nakon odjave iz sustava. Razmatrana su softverska rješenja koja nakon svakog gašenja vraćaju sustav u prethodno stanje, na primjer komercijalni *Deep Freeze* te besplatni *Microsoft Windows Steady State* (više se ne razvija). Iako bi neko od navedenih rješenja olakšalo održavanje sustava i uklanjanje privremenih datoteka, ocijenjeno je da bi korištenje navedenih rješenja moglo uzrokovati veće probleme. Naime, računala u laboratorijima nisu spojena na sustav neprekidnog napajanja pa bi u slučaju nestanka struje za vrijeme vježbi ili ispita došlo do gubitka svih podataka, što se ne može dozvoliti. Jedno od rješenja koje bi se moglo implementirati u budućnosti je skripta ili program koji bi prema zadanim pravilima u pozadini brisao zaostale datoteke.

Kako bi se povećala razina sigurnosti, studentima su postavljena visoka ograničenja u dodijeljenim korisničkim pravima. Zbog postavljenih ograničenja, pojavio se problem

izvođenja vježbi koje zahtijevaju administratorsku razinu upravljanja OS-om (uglavnom kolegiji koji se bave mrežama, hardverom i operacijskim sustavima). Kako bi se olakšalo održavanje vježbi, na računala je instalirana virtualizacijska platforma *VMware* koja omogućava pokretanje virtualnih strojeva specijaliziranih za svaki pojedini kolegij. Dio nastavnika koristi virtualizacijsku platformu i priprema virtualne strojeve prema svojim potrebama. Tako se ostvaruje visoka razina fleksibilnosti kod pripreme i izvođenja vježbi, a kako sve promjene koje studenti naprave na vježbama ostaju na virtualnom računalu, računalo domaćin (eng. *host*) nije ugroženo. Treba razmotriti mogućnost da se razviju specijalizirani virtualni strojevi za sve kolegije jer tako pred nastavnicima ne bi bila ograničenja koja se javljaju kao posljedica dijeljenja jednog sustava između svih kolegija. Osim toga, olakšalo bi se održavanje i nadogradnja te povećala sigurnost laboratorija, a nastavnici bi u nastavu lakše uključivali najnovije tehnologije.

Vezano za postupak kloniranja diska, trebalo bi isprobati PXE modul za stvaranje radnog okruženja prije pokretanja operativnog sustava (eng. *Preboot Execution Environment*) koji je izdala firma AOMEI i koji omogućava jednostavno postavljanje PXE poslužitelja na mreži. Takav poslužitelj olakšava postupak kloniranja jer omogućava pokretanje Windows PE ili Linux podloge s potrebnim alatima preko mreže. Ugrađeni DHCP poslužitelj na zahtjev šalje postavke mreže i PXE okruženja, nakon čega klijent putem TFTP protokola može zatražiti datoteke potrebne za pokretanje priručnog operativnog sustava. Osim toga, moguće je i samu sliku diska prenijeti preko mreže, čime se može dodatno pojednostavniti i ubrzati kloniranje te ukloniti potreba za korištenjem vanjskih diskova. Kloniranje preko mreže za sada se ne koristi u laboratorijima Odsjeka jer pogonski programi ugrađeni u AOMEI *boot* CD ne podržavaju mrežnu karticu na računalima, tako da mreža nakon pokretanja Windows PE sustava nije dostupna. U AOMEI *boot* CD moguće je ugraditi korisničke pogonske programe pa bi se tako mogao riješiti navedeni problem. Opisani postupak isprobat će se prilikom nekog od sljedećih osvježavanja laboratorija.

6. Zaključak

Proces održavanja laboratorija na Odsjeku za IT neprekidno se razvija od osnivanja studija i formiranja prvih računalnih laboratorija do danas. Pritom su oblikovani postupci koji osiguravaju visoku dostupnost računala kroz semestar i brzi oporavak u slučaju softverskog kvara, kao i jednostavno osvježavanje softvera u ciklusima koji su vezani za semestre akademske godine. Kroz sve godine primjene ovog postupka, nije zabilježen ni jedan ozbiljniji prekid u radu laboratorija. Važnu ulogu u tome odigrao je i sustav korisničkih prava koji je s vremenom optimiziran na način da se studentima omogući slobodan rad, a da s druge strane računalo bude zaštićeno od zlonamjernih korisnika i programa. Razvojem softvera za kloniranje i nadogradnjom lokalne mreže na brži, gigabitni *ethernet*, omogućit će se još lakša nadogradnja i održavanje laboratorija, pri čemu će postupak kloniranja i dalje biti najvažniji dio postupka, barem dok ne zažive drugačiji modeli računarstva zasnovani na uslugama u oblaku (eng. *cloud services*), virtualizacijom radne površine (eng. *desktop virtualization*) i napretkom koncepta posluživanja programa kao usluge (eng. *software as service*) i slično.

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The organisation of computer laboratory setup using system image

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Abstract. This article describes the organisation of the laboratory setup at the University Department of Professional Studies of the University of Split. Due to a limited number of computers, laboratories cannot be strictly specialized to a single technology stack. Technologies installed were carefully chosen to provide most coverage with optimal performance load. Collaboration with teachers is as important as thoroughly proofing installation stability. All of the computers are cloned in order to facilitate the setup and maintenance. The origin of the cloning image is a manually-installed computer. This approach facilitates seasonal reinstallations as well as repairs.

Key words: *image, computer laboratories administration*

Organizacija predavanja i vježbi u sklopu kolegija uvod u programiranje uvođenjem Pythona kao novog programskog jezika

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Sažetak. Odabir programskog jezika, kao onog kojim će se započeti programerska edukacija, jedan je od čestih problema s kojim se nastavnici susreću. U specifičnim projektima odabir često diktiraju subjektivni i objektivni razlozi, dok u slučaju odabira za edukaciju, tehnologija se treba prilagoditi specifičnim predznanjima studenata, heterogenosti grupe koja pristupa edukaciji i mnogim drugim čimbenicima. Zbog velikog broja odlučujućih faktora, konačan odabir ne može uvijek zadovoljiti sve potrebe i vrlo je vjerojatno da se veći broj stručnjaka nikada ne bi uspio usuglasiti oko jedne tehnologije. U radu je prikazano na koji način su se organizirale vježbe i predavanja u sklopu kolegija Uvod u programiranje koji se provodi na Sveučilišnom odjelu za stručne studije u Splitu budući da se od ove akademske godine uveo *Python* kao programski jezik. *Python* je programski jezik otvorenog koda koji naglasak stavlja na semantiku i programsku logiku, dok je sintaksa minimalna i intuitivna. Budući da je u sklopu kolegija naglasak na razvijanju programske logike općenito, bez obzira na specifični programski jezik, *Python* se pokazuje kao dobar odabir. Predavanja i vježbe su koncipirane kroz rješavanje raznih matematičkih problema, ali i kroz studentima bliže probleme iz stvarnog svijeta, kojima se od njih očekuje primjena i kombiniranje dotadašnjeg znanja. Na takav način ih se, između ostalog, uvodi u raščlanjivanje većih problema na manje. Kao integrirana razvojna okolina odabran je *Spyder*, besplatni IDE otvorenog koda.

Ključne riječi: Python, edukacija, programiranje

1. Uvod

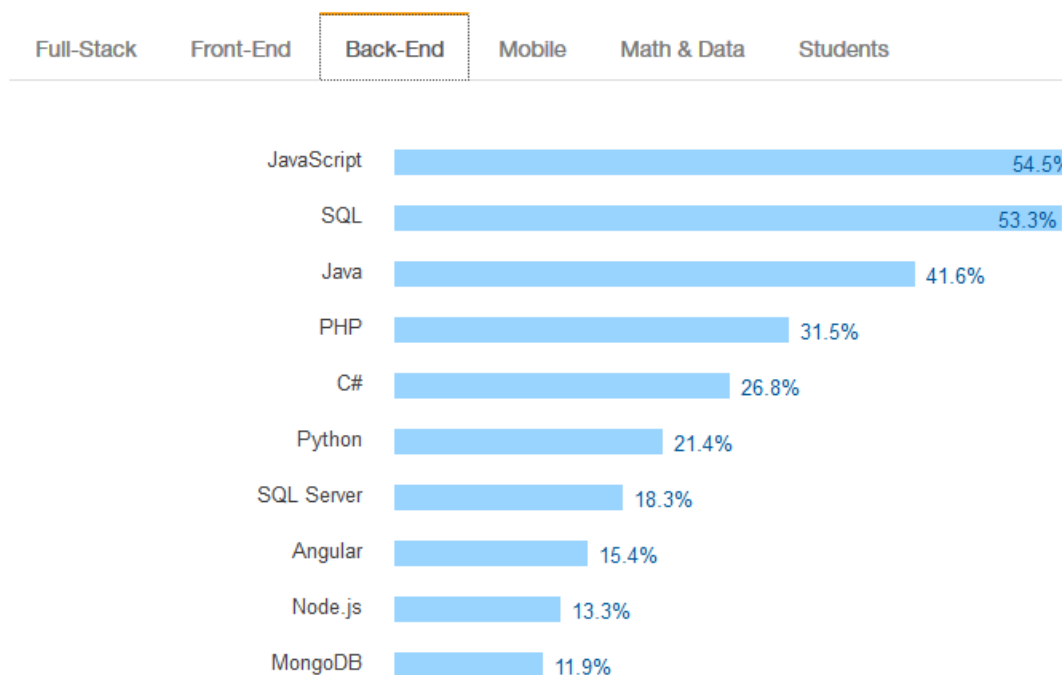
Kada se započinje učiti programiranje jako je važan odabir programskog jezika. Studenti su raznolika skupina i usvajanje osnovnih koncepata ovisi o prethodnom iskustvu svakog od njih. Često su studenti uvjereni kako su napisali ispravan kod, ali ne razumiju zašto njihov program ne radi ono što očekuju, kao što su prenijeli autori u [1]. Ovaj problem je potrebno rješavati u kolegiju Uvod u programiranje jer se broj programerskih predmeta na višim godinama povećava i bez dobrog temelja, nemoguće ih je popratiti. Ispravan pristup je da se svaki problem, koji je previše složen da se jednostavno opiše, razbije u skup manjih podproblema. Ovaj proces zahtijeva korištenje kompleksnih kognitivnih vještina kao što su rasuđivanje, planiranje i rješavanje problema. Programer prvo u glavi stvara apstraktnu sliku tijeka procesa koju potom pretlače u stvarnost, smišljajući logičke strukture koje diktiraju odvijanje programa i tek na kraju to sve skupa pretlače u kod koristeći konkretni programski jezik [2]. Do sada se nastava Uvoda u programiranje (UP) na Odjelu za stručne studije održavala koristeći *Visual Basic.NET* što je bio dobar izbor za prvi susret s kodiranjem, ali mana mu je bila zahtjevna sintaksa. Međutim, zbog sve veće popularnosti *Pythona* za različite namjene te jednostavne sintakse, ove godine se krenulo s njim kao novim odabirom. Na ovaj način se fokus s učenja složene sintakse jezika prebacuje na raščlanjivanje složenijih problema na manje. *Python* je programski jezik koji podržava različite paradigme kako za proceduralan tako i za objektno-orijentiran i funkcionalan pristup programiranju, a svoju popularnost zadobio je zbog velikog broja biblioteka (eng. *library*) i podrške zajednice

otvorenog koda (eng. *open source community*). Osim što je jako praktičan za edukacijske svrhe, pruža mogućnost vezivanja za već postojeće biblioteke u C- u te se zbog toga koristi i u profesionalnom svijetu.

2. Odabir programskog jezika

Kod osmišljavanja programa za kolegij Uvod u programiranje, jako je bitno voditi računa o odabiru tehnologije koja svojim specifičnostima ne odvraća mnogo pažnju s osnovne logike upravljanja programskim tokom. Treba se odmaknuti od programskih jezika „niže razine“ koji od programera zahtijevaju promišljanja o zauzimanju i oslobađanju memorije. Također, treba biti oprezan da odabrani jezik „više razine“ ne sakriva od studenta operacije koje spadaju u domenu programske logike ili ograničiti njihovu upotrebu. Nastoji se ne oslanjati se na specifičan paket tehnologija. Takvi paketi omogućuju korisniku brzi rezultat na principu „slaganja kockica“ i vremenski nisu dugog vijeka jer evolviraju i mijenjaju se. Stoga studentima pružaju usku, specifičnu i kratkoročnu vještinu. Imajući to na umu, pristupa se programskom jeziku koji ima široku primjenu u profesionalnom svijetu (Slika 1 [3]), popularan je i ne stavlja strogi naglasak na rad s memorijom i deklariranjem tipova varijabli. Programski jezik koji inzistira na striktno definiranim tipovima podataka (statički definirani tipovi varijabli) također odvlači od fokusa na usvajanje programske logike. Stoga je za potrebe kolegija izabran programski kolegij *Python* kao jezik s dinamičkim tipovima (eng. *dynamically typed*). Budući da ne ovisimo o vanjskim paketima, razlike *Pythona* 2.7 ili 3.5 uglavnom ne stvaraju probleme, barem kad je programska logika u pitanju. Popularnost ovog programskog jezika posljednjih godina u porastu je.

Most Popular Technologies per Dev Type



Slika 1

3. Python

Python je više paradigmatški, interpreterski jezik visoke razine. Osim toga, jezik je s dinamičkim tipovima podataka i naglaskom na čitkost koda. Vrlo je pogodan za početnike, kao i za iskusne programere koji mijenjaju tehnologiju zbog relativno nezahtjevne sintakse. Tako će *Python* ispravno interpretirati i linije koda s elementima sintakse nekih drugih programskih jezika na koje je programer navikao (zgrade, točka zarez, itd.). *Python* ne zahtijeva razvojno okruženje, već se

naredbe mogu unositi jedna po jedna direktno u interpreter u terminalu. Da bi se studentima olakšao postupak unosa programskog koda u tekstualni editor te pokretanje u interpreteru, koristimo razvojno okruženje *Spyder*. Ono dolazi u sklopu programskog paketa Anakonda [4], koji se pokazao prikladan i za neke predmete viših godina. Od dodatnih alata, *Spyder* nudi i programsku podršku za ispravljanje grešaka (eng. *debugger*), čijim korištenjem studenti mogu detaljno pratiti tijek izvođenja programa služeći se točkama prekida (eng. *break point*). Studenti, također, mogu pratiti ispravnost svog algoritma kroz preglednik varijabli (eng. *variable explorer*). Međutim, neke pogodnosti *Pythona* mogu imati negativne posljedice. *Python* se oslanja na ispravno uvlačenje blokova koda, čime se zaobilazi korištenje nečitkih zagrada, no neispravno formatiranje naoko istog koda rezultira greškama koje početnik teško uočava. Također, varijable definirane u užem dosegu neke petlje (eng. *scope*) vidljive su iz šireg dosega. To proizlazi iz činjenice što životni vijek varijable prelazi doseg u kojem je varijabla kreirana. Isto tako, varijable korištene u globalnom dosegu jedne *Python* skripte, ostaju u memoriji interpretera i prilikom izvršavanja drugih skripti.

4. Organizacija vježbi i predavanja

Budući da su studenti, u smislu predznanja, heterogena skupina jako je teško osmisliti program koji će biti optimalan za sve. Preduvjeti za uspješno usvajanje novih koncepata su poznavanje matematike i osnovnog služenja računalom. Sadržaj se obrađuje u ciklusima koji se okvirno mogu opisati kao:

- uvod u programsku logiku (kroz dijagrame toka i pisanje pseudokoda)
- upoznavanje sa sintaksom programskog jezika
- kreiranje varijabli, unos vrijednosti te ispis na ekranu (ulaz, izlaz)
- upravljanje tokom programa uz pomoć uvjeta
- upravljanje tokom programa uz pomoć petlji
- izbjegavanje repetitivnog koda i apstrakcija korištenjem funkcija
- upoznavanje s osnovama rekurzije
- složeni tipovi podataka (skupovi, n-torke, liste, rječnici, stringovi)
- promjenjivost i nepromjenjivost
- osnove objektno-orijentiranog i funkcionalnog programiranja

4.1. Uvod u programsku logiku i upoznavanje s razvojnim okruženjem

Prije susreta s konkretnim programskim jezikom, studentima se pokušava vizualno predočiti postupak računalnog rješavanja nekog problema (algoritma). Dijagrami toka su idealan izbor kao početni korak k apstraktnijem računalnom razmišljanju. Kroz ove dijagrame studenti se unaprijed upoznaju s konceptima uvjeta i petlji, a da pri tome nemaju direktan kontakt s kodom. Od njih se očekuje da grafički prikažu korake u rješavanju jednostavnih matematičkih problema. To je dobar uvod u pisanje pseudokoda, koji bi bio sljedeća faza u učenju, ali se preskače jer mu je *Python* sam po sebi sličan. Prelaskom na pisanje koda u interpreter, prvo se uče matematički i logički operatori te uvjeti. Obrađuju se i bitovni operatori kao i operacije s binarnim brojevima. Ovaj pristup ima dvojaku namjenu. Prva je da se osjeti rad u interpreteru i upozna s funkcionalnostima koje on donosi. Druga, važnija namjena, je da se nauči ispravno formirati kraće i duže logičke izraze kako bi se usvojila ta vještina specifična za područje programiranja. Upravo ovo pokazuje se najtežim za studente, dijelom zbog novih koncepata s kojima se nisu ranije imali prilike susresti, a dijelom zbog apstraktne prirode operacija s binarnim brojevima (bitovni operatori). Uvođenjem unosa teksta s tastature zadaci dobivaju manju apstraktnost te studenti bolje reagiraju na rješavanje takvih problema (interakcija s korisnikom).

4.2. Upravljanje tokom programa uz pomoć uvjeta i petlji

Upoznavanje s petljama uvodi se kroz ponavljanje dijelova programa, kao primjerice unos i ispis broja sve dok taj broj ne udovolji nekom uvjetu i sl. Ovdje se spontano usađuje spoznaja o ograničavanju petlje uvjetom, bez kojeg je petlja beskonačna. Koncept petlji (s pripadajućim uvjetom) ključna je građevna jedinica svakog algoritma i prvi je pravi izazov za početnika. Studenti su često nesigurni po pitanju gdje i koji tip petlje upotrijebiti te kako definirati uvjet prekida. Olakotna činjenica je što *Python* ne zahtijeva eksplicitno definiranje tipova varijabli pa se stoga studenti mogu fokusirati na problem. Također, im se nastoji zadati jednostavan, ali opsežan zadatak za vježbu koji im je po tematici zanimljiv i poznat iz realnog svijeta. Kao primjer možemo navesti igru rulet, u kojemu korisnik određuje koliko puta želi igrati, koliki ulog želi staviti i na koju kombinaciju. Ovakav tip zadatka interesantan je pokazatelj shvaćanja ili neshvaćanja petlji i uvjeta. Realizira se korištenjem ugniježđenih uvjeta što studentima predstavlja problem ako se koriste „pod izbori“. Na primjeru izbornika jedna grupa studenata koncipirala je izbornik bez hijerarhije (odaberite broj: 1. parni, 2. neparni, 3. 1 - 18, 4. 19 - 36, 5. jedan broj) te nisu imali većih problema prilikom realizacije. Druga grupa radila je hijerarhijski izbornik s podizbornicima (odaberite opciju: 1. parni/neparni, 2. raspon brojeva, 3. specifičan broj). Potom bi, ovisno o izboru, korisniku bio prikazan odgovarajući podizbornik (npr. za opciju 1 - parni, opciju 2 - neparni). Kod ovakvih ugniježđivanja primijećeni su višestruki problemi. Studenti nisu znali otkloniti greške iako se najčešće radilo o jednostavnom problemu s uvlačenjem (ispravno formatiranje koda). Također, osmišljavanje algoritma s ugniježđenim kodom nije se pokazalo kao trivijalna zadaća. Od logičkih problema zamijećeno je miješanje i (eng. *and*) i ili (eng. *or*) operatora. Na primjer, ako ulog mora biti između 0 i 1000 žetona, studenti su često gledali da je ulog veći i jednak 0 *ILI* manje i jednak 1000, što je logički ispravno za bilo koji broj (rezultat logičkog izraza uvijek je istinit). Točan logički izraz bi koristio logički operator *I* (broj mora biti *I* veće jednako 0 *I* manje jednako 1000) da bi broj pripao u raspon 0 - 1000. Stoga smo se zadržali na ovoj problematici veći broj sati od planiranog. Iz ovoga razloga vodilo se računa da svi naredni zadaci sadržavaju i ovu problematiku radi utvrđivanja.

4.3. Funkcije i složeni tipovi podataka

Kroz opsežne zadatke namjerno se prikazalo ponavljanje određenih dijelova koda. Tako se opravdala potreba za postojanjem i korištenjem funkcija, kao novog dijela gradiva. Neki od zadataka bili su ponovno zadani, no trebalo ih je riješiti korištenjem funkcija uključujući cijeli primjer pojednostavljene kartaške igre Ajnc. Predstavio im se koncept kompozicije funkcija kroz upotrebu *min* i *max* funkcija za dva broja, na primjeru najvećeg/najmanjeg broja od tri. Najveći kamen spoticanja su rekurzivne funkcije (funkcije koje pozivaju same sebe). Studenti često ne shvaćaju njihovu primjenu (za koju ni nema potrebe na njihovoj razini znanja) i prihvataju ih kao još jednu komplikaciju koja je samoj sebi svrha. Stoga postoji represija k rekurzijama i u pravilu bivaju najlošije svladane. U kolegijima viših godina, studenti koji odaberu smjer programiranje, će se upoznati s njihovom pravom primjenom (optimizacija pri raznim algoritmima za pretraživanje) te im je korisno imati bazno predznanje.

Savladavši prethodno navedena poglavlja organizira se prvi kolokvij. I ovdje je praksa pokazala da studenti koji nisu uspješno položili prvi kolokvij imaju problema sa savladavanjem čitavog kolegija. Gradivo koje je predviđeno za drugi dio kolegija stavlja naglasak na složene tipove podataka. Studenti nalaze ovaj dio gradiva jednostavnijim, vjerojatno zbog činjenice da se ne radi o logičkim izrazima koji zahtijevaju kreativno logičko razmišljanje prilikom osmišljavanja rješenja. Složeni tipovi podataka (*n*-torke, liste rječnici, stringovi) su jako zastupljeni u profesionalnoj programerskoj svakodnevnici i zbog toga se u zadacima za vježbu stavlja naglasak na manipulaciju s takvim tipovima. Detalje se implementacije složenih struktura skriva, dok se veća pažnja posvećuje promjenjivosti i nepromjenjivosti tipova u *Pythonu*. U ovoj fazi se ne potiče upotreba pomoćnih metoda koje posjeduju navedeni tipovi podataka. Njihovo korištenje će biti prezentirano kroz upoznavanje s konceptima objektno-orijentiranog programiranja, kao uvoda u kolegij koji se sluša

na višim godinama. Od studenata zahtijeva se da svojom kreativnošću i razmišljanjem postignu funkcionalnost koje navedene metode nude.

5. Zaključak

Svladavanje gradiva iz kolegija Uvod u programiranje jako je bitno kao temelj k razumijevanju predmeta računalne struke. Početnicima koji se nisu upoznali s konceptom programiranja u prethodnom obrazovanju, ovo je vrlo zahtjevan korak za razumijevanje što programiranje uopće predstavlja. Prvi susret može biti pomalo zastrašujuć i to rezultira raslojavanjem studenata u smislu napredovanja. Vrlo je teško osmisliti program koji neće biti prejednostavan naprednim studentima, a koji slabiji studenti mogu pratiti. Upravo zbog njih, problemi koji se rješavaju se stavljaju u kontekst bliske im i zanimljive tematike (igre na sreću, konjske utrke, pikselizirane slike kod matrica itd.) te se pokušava ne dodatno ih obeshrabriti naprednim zadacima iz područja matematike i fizike. Ovim se potiče dobrovoljan rad studenta kod kuće te promišljanje i intrigiranje kako će doći do konačnog rješenja. U suprotnom se riskira „treening“ sintakse na štetu kreativnog osmišljavanja algoritma. Dok pojedini autori tvrde kako neke osobe uopće ne mogu naučiti programirati, ostali tvrde kako možda neće svi postati vrsni programeri, ali bi mogli usvojiti osnovna znanja i vještine iz programiranja [1]. Cilj ovog kolegija je usmjeriti ih upravo k tome. Gradivo prvog dijela kolegija pokazuje se težim za usvojiti zbog većeg naglaska na programsku logiku, a manjeg na vještinu manipuliranja podacima koja se može usvojiti bez velike potrebe za kreativnim i logičkim razmišljanjem. Usvajanje osnovnih algoritamskih građevnih jedinica (uvjeti i petlje) ne znači nužno i sposobnost pronalaženja primjene za iste. Stoga je vrlo važno da student bude zaintrigiran da svojevoljno i aktivno razvije tu sposobnost samostalnim angažmanom kod kuće kao i u sklopu nastave.

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Organising lectures and exercises in Basic programming class using Python as new programming language

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Abstract. The choice of programming language to be used for education is the most difficult task teachers often encounter. In real-world projects, the technology stack is often dictated by project specifications and

requirements. On the other hand, the technology stack in education must be adapted to student background. Due to the diversity of the requirements, there is no ideal technology, so the choice must be a compromise. This article outlines the methods used to organise exercises and lectures in the Basic Programming class. As of year 2015/16 the programming language Python is being used as the introductory language to programming at the University Department of Professional Studies. Python is an open-source language that emphasizes semantics and logic over syntax. Since the Basic programming class teaches programming logic, Python is a good fit. Students are eased into the techniques of problem solving through mathematical and real-world modelled exercises. Spyder is used as an open-source Integrated development environment.

Key words: *Python, education, programming*

Radni parametri solarnog toplinskog sustava za pripremu PTV-a

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Sažetak. U radu su prikazani rezultati mjerenja radnih parametara solarnog toplinskog sustava koji se u laboratoriju koristi za zagrijavanje potrošne tople vode. Solarni toplinski pretvornik smješten je na lokaciji 43°31'21" N i 16°27'01" E, usmjeren prema jugu i to pod fiksnim nagibom od 30° u odnosu na horizontalnu plohu. Mjerenje radnih parametara izvršeno je za dva specifična perioda, ljetni i zimski, kako bi se analizirao rad sustava u različitim uvjetima dozračene sunčeve energije. Na osnovu izmjerenih radnih parametara procijenjene su učinkovitosti i koeficijenti pokrivanja solarnog toplinskog sustava. Dobiveni rezultati uspoređeni su s podacima raspoloživim u stručnoj literaturi.

Ključne riječi: sunčeva energija, solarni toplinski sustav, učinkovitost, koeficijent pokrivanja

1. Uvod

Potrebe za energijom kontinuirano se povećavaju. U posljednjih 40 godina ukupna svjetska opskrba primarnom energijom udvostručila se, dok se u istom vremenskom periodu svjetska potrošnja električne energije povećala za oko 3,8 puta [1]. Unatoč mnogobrojnim aktivnostima u cilju pronalaženja adekvatne zamjene, još uvijek se najveći dio energije dobiva iz fosilnih goriva; oko 85 % primarna energija te oko 80 % električna energija [1]. Takvi trendovi imaju negativne utjecaje na okoliš, odnosno imaju za rezultat klimatske promjene, povećanje prosječnih temperatura zraka te povećanje koncentracije ugljikova dioksida.

Kako bi se negativni utjecaji na okoliš umanjili, na razne načine potiče se proizvodnja električne i toplinske energije iz obnovljivih izvora energije. Među njima sunčeva energija zauzima značajno mjesto.

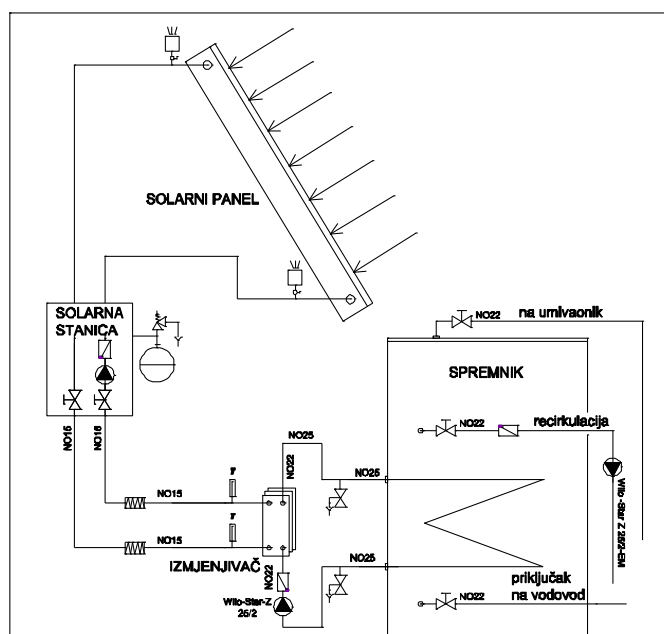
Sunce u prosjeku dnevno dozrači na površinu Zemlje oko 1 kWh/m² energije [2]. U Hrvatskoj se vrijednosti dnevne dozračene energije kreću, ovisno o zemljopisnom položaju, između 3,0 i 4,5 kWh/m² [2]. Godišnja dozračena sunčeva energija na površinu Hrvatske iznosi oko 74.000 TWh/god, što je za oko 650 puta veći iznos od ukupne godišnje potrošnje energije u Hrvatskoj.

Tijekom 2014. u EU instalirano je oko 2,9 miliona četvornih metara površine solarnih toplinskih kolektora [3], od čega najviše pločastih kolektora. U Republici Hrvatskoj tijekom 2014. instalirano je 18.400 m² pločastih kolektora te 2.500 m² vakuumskih kolektora ekvivalentne toplinske snage 14,6 MW_{th} [3]. Za usporedbu, u 2013. ekvivalentna toplinska snaga instaliranih toplinskih kolektora iznosila je oko 12,2 MW_{th}.

Procjena je da je do kraja 2014. u Republici Hrvatskoj sveukupno (kumulativno) instalirano oko 157.950 m² solarnih toplinskih kolektora ekvivalentne toplinske snage oko 111 MW_{th} (što iznosi oko 0,037 m²/stanovniku, dok je EU prosjek oko 0,093 m²/stanovniku) [3].

2. Laboratorijski solarni toplinski sustav za pripremu PTV-a

Laboratorijski solarni toplinski sustav (slika 1) sastoji se od spremnika potrošne tople vode (PTV) volumena 150 litara, pločastog izmjenjivača topline snage 1,4 kW, pločastog solarnog toplinskog pretvornika površine apsorbera 2,32 m² te solarne stanice s pripadajućom armaturom (cirkulacijska pumpa s tri brzine, regulacijsko-sigurnosni elementi, upravljačko-mjerna jedinica). Sustav se sastoji iz primarnog i sekundarnog cirkulacijskog kruga. U primarnom krugu cirkulira toplinski medij (Tyfocor-LS), koji preuzima toplinsku energiju iz pločastog solarnog toplinskog pretvornika te je prenosi i predaje pločastom izmjenjivaču topline. Protok toplinskog medija tijekom rada sustava iznosio je 2 litre/min. Voda, koja cirkulira sekundarnim krugom, preuzima toplinu od toplinskog medija u pločastom izmjenjivaču topline te je predaje potrošnoj toploj vodi u spremniku. Konačni prijenos topline s vode iz sekundarnog kruga na PTV vrši se putem izmjenjivača topline u obliku zavojnice koji se nalazi unutar spremnika PTV-a.



Slika 1 Shematski prikaz laboratorijskog solarnog toplinskog sustava

Solarni toplinski pretvornik (slika 2) smješten je na lokaciji 43°31'21" N i 16°27'01" E (Kopilica, Split) i to pod fiksnim nagibom od 30° u odnosu na horizontalnu plohu te usmjeren prema jugu.

Laboratorijski solarni toplinski sustav može predstavljati stvarni sustav za pripremu potrošne tople vode jednog dvočlanog kućanstva. Za potrebe ovog rada, a na osnovu preporuka iz literature [4, 5], definirani su osnovni parametri sustava, kao što su volumen spremnika PTV-a i temperatura vode na izljevnom mjestu.

Na osnovu „srednjeg zahtjeva“ za količinom PTV-a [4] te na osnovu odabrane temperature vode na izljevnom mjestu od 45°C, proizlazi potreba za toplom vodom od 35 litara/dan po osobi. Ne ulazeći u detaljni proračun dimenzioniranja solarnog spremnika, a pridržavajući se smjernica za dimenzioniranje malih solarnih sustava danih u literaturi [4, 6], proizlazi da je potreban volumen solarnog spremnika:

$$V_{\text{sol}} (\text{litara}) = \text{prosječna dnevna potrošnja tople vode (litara)} \times 2 \quad (1)$$

$$V_{\text{sol}} (\text{litara}) = 35 \text{ litara/dan, osobi} \times 2 \text{ osobe} \times 2$$

$$V_{\text{sol}} (\text{litara}) = 140$$

Na osnovu dobivenog volumena od 140 litara, proizlazi da spremnik potrošne tople vode od 150 litara (slika 2), koji je sastavni dio laboratorijskog solarnog toplinskog sustava, u potpunosti zadovoljava predviđene potrebe.



Slika 2 Solarni toplinski spremnik s pločastim izmjenjivačem topline; solarni toplinski pretvornik

3. Rezultati mjerenja radnih parametara solarnog toplinskog sustava

Mjerenje radnih parametara solarnog toplinskog sustava izvršeno je za dva karakteristična perioda, ljetni (lipanj i srpanj) i zimski period (veljača). Mjerenjem su obuhvaćeni podaci o dozračenju energiji sunca (na plohu nagnutu pod kutom od 30°), temperatura toplinskog medija, temperatura potrošne tople vode unutar spremnika te temperatura vanjskog zraka.

Mjerenje dozračenju energije sunca izvršeno je pokretnim mjernim uređajem te u određenim mjernim intervalima (svakih pola sata). Tako očitane vrijednosti dozračenju sunčeve energije predstavljaju trenutnu vrijednost s kojima se ne može pouzdano odrediti ukupna dozračenju energija sunca tijekom rada solarnog toplinskog sustava. U nastavku će izmjerene vrijednosti biti uspoređene s vrijednostima dostupnim iz javnog internetskog servisa PVGIS (eng. *Photovoltaic Geographical Information System*) [7].

Mjerenje temperature toplinskog medija izvršeno je na mjestu spoja cijevne instalacije solarnog toplinskog sustava s pločastim izmjenjivačem topline. Na samom pločastom izmjenjivaču topline mjerene su i temperature toplinskog medija na izlazu iz pločastog izmjenjivača topline te vrijednosti temperature ulaza i izlaza cirkulacijske vode (radni medij sekundarnog kruga prijenosa topline).

Temperatura potrošne tople vode mjerena je u uronjenoj čahuri unutar spremnika PTV-a, a koja se nalazi otprilike po sredini visine spremnika. Kako bi se postigla ujednačena temperatura potrošne tople vode po visini spremnika, tijekom rada solarnog toplinskog sustava vršena je recirkulacija vode u spremniku.

Konačno, temperatura vanjskog zraka mjerena je na lokaciji postavljanja solarnog toplinskog pretvornika temperaturnim senzorom laboratorijske meteorološke postaje.

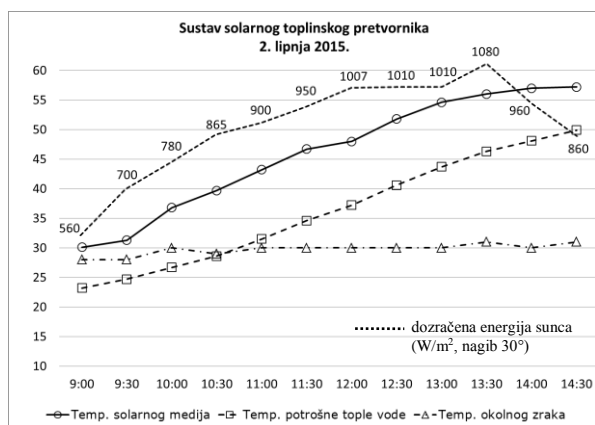
Mjerenje radnih parametara solarnog toplinskog sustava ima za svrhu demonstraciju rada laboratorijskog solarnog sustava u različitim uvjetima dozračenju energije sunca. Konačno, na osnovu izmjerenih vrijednosti određeni su neki od osnovnih radnih parametara malih solarnih toplinskih sustava, kao što su na primjer učinkovitost i koeficijent pokrivanja.

3.1 Mjerenje radnih parametara tijekom ljeta 2015.

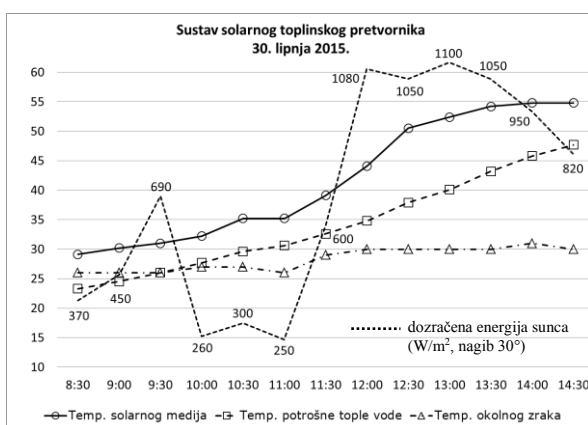
Mjerenje radnih parametara u ljetnom periodu izvršeno je tijekom lipnja i srpnja 2015. Rezultati mjerenja za četiri odabrana dana (dva u lipnju i dva u srpnju), prikazuju promjenu temperature PTV-a unutar spremnika i to od početne temperature (sobne) do konačne temperature na kraju mjerenja (slike 3, 4, 5 i 6). Tijekom lipnja početna temperatura PTV-a iznosila je oko 23°C, dok je ista tijekom srpnja bila oko 25°C.

Na slici 3 prikazani su rezultati mjerenja tijekom vedrog dana u lipnju 2015., pri čemu se PTV do završetka perioda mjerenja zagrijala na 50°C, uz prirast temperature tijekom mjerenja od 3,5 do 6,5°C/sat. Na slici 4 prikazani su rezultati mjerenja tijekom dana (lipanj 2015.) s prolaznom naoblakom, vidljivom iz podataka o dozračenoj energiji sunca. Zbog smanjene količine dozračene energije PTV se zagrijala na 47,7°C, uz prirast temperature tijekom perioda mjerenja od 2,9 do 5,7°C/sat.

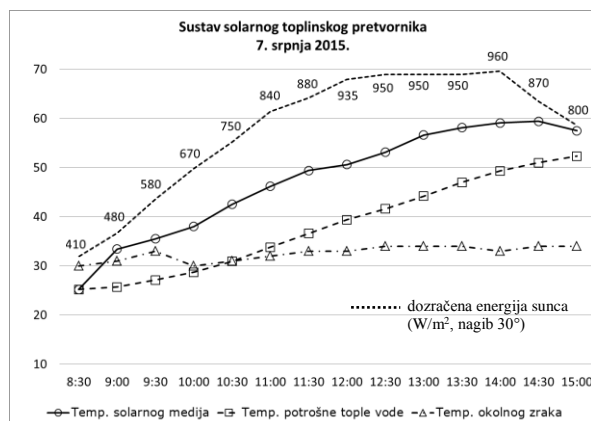
Na slikama 5 i 6 prikazani su rezultati mjerenja tijekom srpnja, pri čemu su postignute nešto veće konačne temperature PTV-a. Do završetka perioda mjerenja PTV se zagrijala na oko 55°C, dok je temperatura toplinskog medija dosegla oko 60°C.



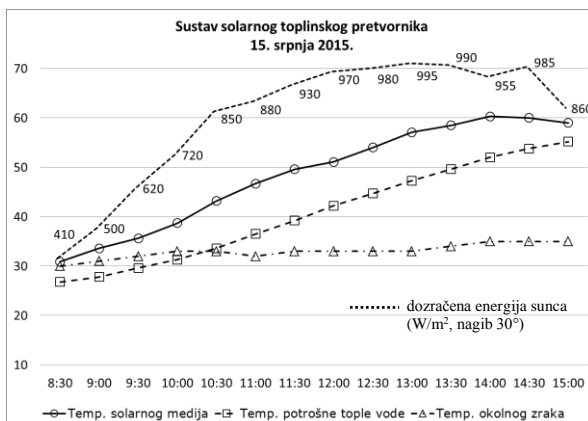
Slika 3 Rezultati mjerenja br. 1 (2. lipnja 2015.)



Slika 4 Rezultati mjerenja br. 2 (30. lipnja 2015.)



Slika 5 Rezultati mjerenja br. 3 (7. srpnja 2015.)



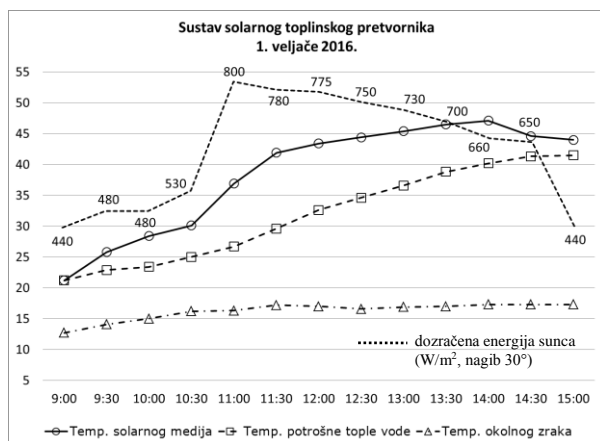
Slika 6 Rezultati mjerenja br. 4 (15. srpnja 2015.)

Uz temperature toplinskog (solarnog) medija i potrošne tople vode, na slikama 3, 4, 5 i 6 prikazane su izmjerene vrijednosti temperatura vanjskog zraka (°C) te vrijednosti dozračene energije sunca na plohu pod nagibom od 30°, odnosno na solarni toplinski pretvornik (W/m^2). Iste će u nastavku biti korištene prilikom procjene učinkovitosti i koeficijenta pokrivanja solarnog toplinskog sustava.

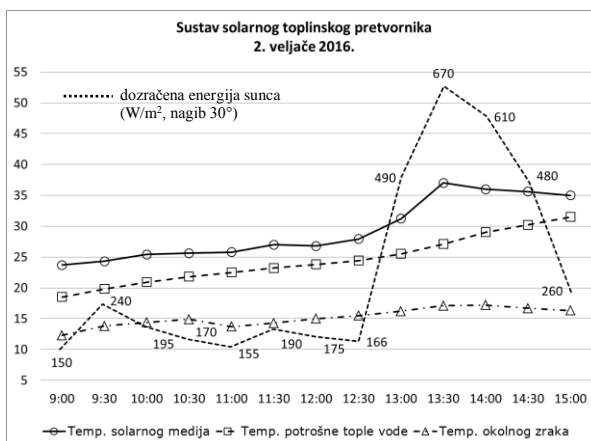
3.2 Mjerenje radnih parametara tijekom zime 2016.

Mjerenje radnih parametara u zimskom periodu izvršeno je tijekom veljače 2016. Rezultati mjerenja za četiri odabrana dana prikazani su slikama 7, 8, 9 i 10. U ovom slučaju početna temperatura PTV-a unutar spremnika iznosila je oko 20°C (sobna temperatura).

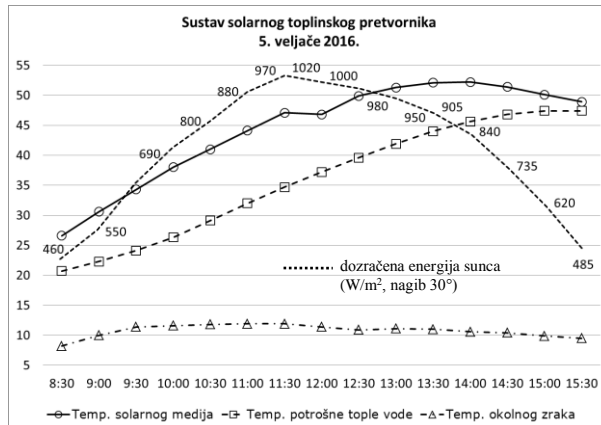
Na osnovu prikazanih rezultata proizlazi da i tijekom veljače, pod uvjetom čistog neba i uzimajući u obzir navedenu početnu temperaturu PTV-a, solarni toplinski sustav može zadovoljiti potrebe za toplinskom energijom potrebnom za zagrijavanje PTV-a na 45°C. Tako je, prema rezultatima mjerenja na slici 9, konačna temperatura PTV-a iznosila 47,4°C, dok je prirast temperature PTV-a tijekom mjerenja iznosio od 0,6 do 5,6°C/sat.



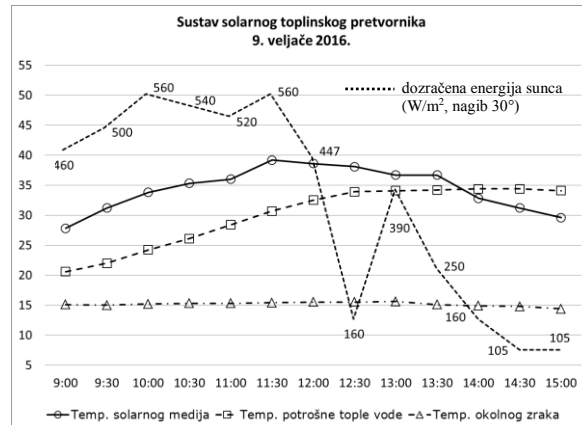
Slika 7 Rezultati mjerenja br. 5 (1. veljače 2016.)



Slika 8 Rezultati mjerenja br. 6 (2. veljače 2016.)



Slika 9 Rezultati mjerenja br. 7 (5. veljače 2016.)



Slika 10 Rezultati mjerenja br. 8 (9. veljače 2016.)

U preostalim slučajevima (slike 7, 8 i 10), kada je zbog djelovanja dnevne naoblake bio smanjen intenzitet dozračene energije sunca, nisu zadovoljene ukupne potrebe za toplinskom energijom za pripremu PTV-a.

Tako je, na primjer, 2. veljače 2016. (slika 8) najviša postignuta temperatura PTV-a iznosila oko 31,5°C, dok je ostvareni prirast temperature PTV-a tijekom mjerenja iznosio od 1,3 do 3,5°C/sat.

Neka od mjerenja provedenih tijekom veljače 2016. (oblačni dani) pokazala su da solarnim toplinskim sustavom nije moguće ostvariti zagrijavanje PTV-a, odnosno sustav nije ni bio u funkciji zbog niske temperature toplinskog medija u solarnom toplinskom pretvorniku.

4. Procjena učinkovitosti i koeficijenta pokrivanja solarnog toplinskog sustava

Na osnovu izmjerenih podataka izvršen je proračun predane toplinske energije potrošnoj toploj vodi i to prema izrazu:

$$Q_{PTV} = m \times c \times \Delta t_{PTV} \quad (2)$$

Pri čemu su:

m – masa vode sadržane u spremniku PTV-a (kg)

c – specifični toplinski kapacitet PTV-a (kJ/kg°C)

Δt_{PTV} – razlika temperature PTV-a, od početne do konačne temperature grijanja (°C).

Dovedena toplina PTV-u, za svako od mjerenja tijekom ljetnog perioda, prikazana je u tablici 1.

Tablica 1 Dovedena toplina potrošnoj toploj vodi – ljetni period

	$t_{TM,max}$ (°C)	$t_{PTV,max}$ (°C)	Δt_{PTV} (°C)	Q_{PTV} (kJ)
mjerenje 1 (2. lipnja 2015.)	57,2	49,9	26,7	16.735
mjerenje 2 (30. lipnja 2015.)	54,8	47,7	24,4	15.294
mjerenje 3 (7. srpnja 2015.)	59,4	52,3	27,1	16.986
mjerenje 4 (15. srpnja 2015.)	60,3	55,2	28,4	17.801

$t_{TM,max}$ – najviša postignuta temperatura toplinskog medija na ulazu u pločasti izmjenjivač topline (°C)

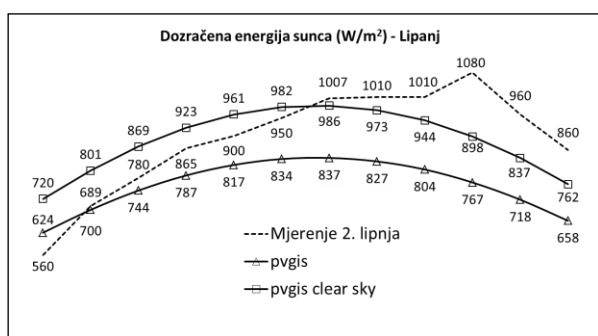
$t_{PTV,max}$ – najviša postignuta temperatura potrošne tople vode u spremniku (°C)

S obzirom na to da je mjerenje dozračene sunčeve energije izvršeno u određenim mjernim intervalima (svakih pola sata) te da se s tako očitanim vrijednostima ne može pouzdano odrediti ukupna dozračena energija sunca tijekom rada solarnog toplinskog sustava, izvršena je usporedba izmjerenih vrijednosti s vrijednostima dostupnim iz javnog internetskog servisa PVGIS [7].

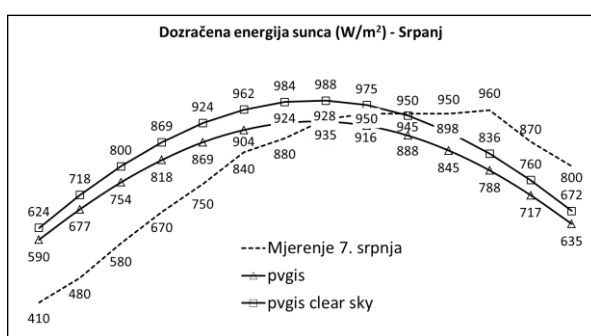
U tu svrhu, u okviru PVGIS-a definirana je lokacija postavljanja solarnog toplinskog pretvornika te su dobivene prosječne dnevne vrijednosti dozračene energije sunca za plohu pod nagibom od 30° (na osnovu mjesečnog prosjeka).

Vrijednosti dozračene energije sunca za uvjete prosječne naoblake (pvgis) i uvjete čistog neba (pvgis clear sky) za lipanj i srpanj prikazani su na slikama 11 i 12. Zajedno s vrijednostima iz PVGIS-a prikazane su i izmjerene vrijednosti tijekom 2. lipnja i 7. srpnja 2015., a u okviru vremenskog perioda mjerenja kao što je prikazano na slikama u 3. poglavlju. Prikazane vrijednosti dozračene energije sunca iz PVGIS-a često se koriste pri planiranju manjih solarnih toplinskih i fotonaponskih sustava.

Kako bi se napravila procjena učinkovitosti i koeficijenta pokrivanja solarnog toplinskog sustava, korišteni su podaci o izmjerenoj dozračenoj energiji sunca. Pri tome je pretpostavljeno da između perioda mjerenja (svakih pola sata) nije bilo značajnije promjene dozračene energije sunca u odnosu na izmjerene vrijednosti svakog perioda mjerenja.



Slika 11 Dozračena energija sunca (2. lipnja 2015.)



Slika 12 Dozračena energija sunca (7. srpnja 2015.)

Učinkovitost solarnog toplinskog sustava izračunata je na osnovu izraza:

$$\eta_{\text{SOL}} = E_{\text{PTV}} / E_{\text{SOL}} \quad (3)$$

Pri čemu su:

η_{SOL} – učinkovitost solarnog toplinskog sustava (%)

E_{PTV} – energija koja je predana potrošnoj toploj vodi solarnim sustavom u danu (kWh)

E_{SOL} – solarna energija koja djeluje na solarni toplinski pretvornik u danu (kWh).

Koeficijent pokrivanja solarnog toplinskog sustava izračunat je na osnovu izraza:

$$C = Q_{\text{PTV}} / Q_{\text{POT}} \quad (4)$$

Pri čemu su:

C – koeficijent pokrivanja solarnog sustava (%)

Q_{POT} – potrebna toplina za zagrijavanje potrošne tople vode u danu (kJ)

Q_{PTV} – toplina koja je predana potrošnoj toploj vodi solarnim sustavom u danu (kJ).

Vrijednosti učinkovitosti i koeficijenta pokrivanja solarnog toplinskog sustava u ljetnom periodu, a s obzirom na gore navedene radne parametre sustava, prikazani su u tablici 2 (za mjerenja izvršena 2. lipnja i 7. srpnja 2015.).

Tablica 2 Procjena učinkovitosti i koeficijenta pokrivanja solarnog toplinskog sustava – ljetni period

	E_{SOL} (kWh)	E_{PTV} (kWh)	η_{SOL} (%)	Q_{POT} (kJ)	Q_{PTV} (kJ)	C (%)
mjerenje 1 (2. lipnja 2015.)	9,35	4,65	49,69	13.664,1	16.735,4	122,5
mjerenje 3 (7. srpnja 2015.)	10,09	4,72	46,74	12.410,5	16.986,1	136,8

Procijenjene vrijednosti učinkovitosti i koeficijenta pokrivanja solarnog toplinskog sustava iz tablice 2 u skladu su s podacima iz stručne literature [5,8,9].

Koeficijent pokrivanja solarnog toplinskog sustava za pripremu PTV-a u ljetnom periodu veći je od potrebnih 100 %. Ako se uzmu u obzir odabrani radni parametri sustava, proizlazi da u ljetnom periodu solarni toplinski sustav proizvodi više toplinske energije nego što je potrebno, odnosno, potrošnu toplu vodu zagrijava na višu temperaturu (i do 55°C) od odabrane (45°C).

Jedan od parametara koji utječe na učinkovitost solarnog toplinskog sustava je temperatura vanjskog zraka. Utjecaj temperature vanjskog zraka nije uključen u analize koje su izvršene u okviru ovog rada. Vrijednosti izmjerenih temperatura vanjskog zraka prikazane su na slikama u 3. poglavlju. Vrijednosti dovedene topline PTV-u, za svako od mjerenja tijekom zimskog perioda, prikazana je u tablici 3.

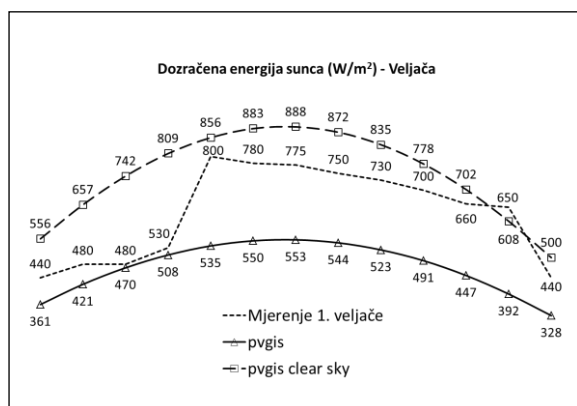
Tablica 3 Dovedena toplina potrošnoj toploj vodi – zimski period

	$t_{TM,max}$ (°C)	$t_{PTV,max}$ (°C)	Δt_{PTV} (°C)	Q_{PTV} (kJ)
mjerenje 5 (1. veljače 2016.)	47,1	41,5	20,3	12.724
mjerenje 6 (2. veljače 2016.)	37,0	31,5	13,0	8.148
mjerenje 7 (5. veljače 2016.)	52,2	47,4	26,7	16.735
mjerenje 8 (9. veljače 2016.)	39,2	34,4	13,5	8.462

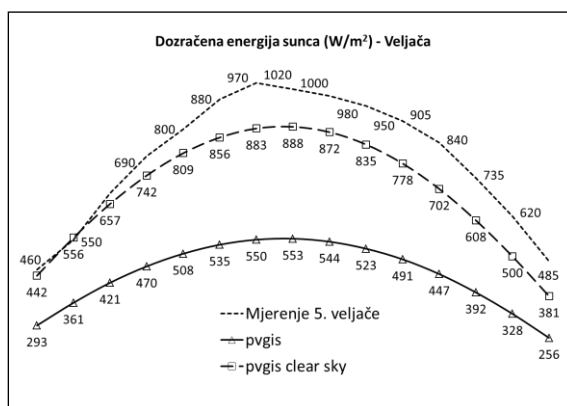
$t_{TM,max}$ – najviša postignuta temperatura toplinskog medija na ulazu u pločasti izmjenjivač topline (°C)

$t_{PTV,max}$ – najviša postignuta temperatura potrošne tople vode u spremniku (°C)

Kao što je bilo prikazano za mjerenja u ljetnom periodu, tako su upotrebom PVGIS-a i za veljaču prikazane vrijednosti dozračene energije sunca za plohu pod nagibom od 30° (slike 13 i 14) i to posebno za uvjete prosječne naoblake (pvgis) i uvjete čistog neba (pvgis clear sky).



Slika 13 Dozračena energija sunca (1. veljače 2016.)



Slika 14 Dozračena energija sunca (5. veljače 2016.)

Vrijednosti učinkovitosti i koeficijenta pokrivanja solarnog toplinskog sustava u zimskom periodu, a s obzirom na već navedene radne parametre sustava, prikazani su u tablici 4 (za mjerenja izvršena 1. veljače i 2. veljače 2016.).

Za razliku od ljetnog perioda, koeficijent pokrivanja solarnog toplinskog sustava za pripremu PTV-a u zimskom periodu niži je od potrebnih 100 %. Vrijednosti učinkovitosti i koeficijenta pokrivanja solarnog toplinskog sustava, prikazani u tablici 4, u skladu su s podacima iz stručne literature [5,8,9].

Tablica 4 Procjena učinkovitosti i koeficijenta pokrivanja solarnog toplinskog sustava – zimski period

	E_{SOL} (kWh)	E_{PTV} (kWh)	η_{SOL} (%)	Q_{POT} (kJ)	Q_{PTV} (kJ)	C (%)
mjerenje 5 (1. veljače 2016.)	8,94	3,53	39,53	14.917,7	12.723,9	85,29
mjerenje 6 (2. veljače 2016.)	4,30	2,26	52,54	16.610,0	8148,3	49,06

5. Zaključak

Dobiveni rezultati za učinkovitost i koeficijent pokrivanja solarnog toplinskog sustava za pripremu PTV-a u skladu su s podacima iz stručne literature, a uzimajući u obzir pretpostavljene potrebe za potrošnom toplom vodom. Na osnovu izračunatih koeficijenata pokrivanja proizlazi da u ljetnim mjesecima sustav u potpunosti zadovoljava pretpostavljene potrebe za toplinskom energijom (npr. 122,5 %), dok isti tijekom zimskog perioda u prosjeku nije dostatan. Učinkovitost sustava u terminima mjerenja iznosila je između 35 i 50 %.

Budući stručni rad trebao bi obuhvatiti utjecaje (1) procesa izmjene topline u dva stupnja (primarni krug s toplinskim medijem – sekundarni krug s vodom – potrošna topla voda), (2) konstantnog protoka toplinskog medija u primarnom krugu te (3) temperature okolnog zraka na radne parametre solarnog toplinskog sustava. Konačno, potrebno je vršiti kontinuirano mjerenje dozračene energije sunca na lokaciji postavljanja solarnog toplinskog pretvornika, a kako bi se dobili precizniji podaci o raspoloživoj energiji sunca za rad solarnog sustava.

Zahvala

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Operating Parameters of a Solar Thermal System for DHW Heating

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Abstract. The paper presents the results of measuring the operating parameters of a solar thermal system. The solar thermal system is used in the laboratory for heating domestic hot water (DHW). A solar thermal panel is placed at the location 43°31'21" N i 16°27'01" E, facing South at the fixed angle of 30°, in relation to the horizontal plane. The measurement of operating parameters was carried out over two specific periods of time (in summer and winter), in order to analyse the performance of solar system in different operating conditions. Based on the results measured, the efficiency and coverage ratios of the solar thermal system are estimated. Finally, the results were compared with the data available in the literature.

Key words: *solar energy, solar thermal system, efficiency, coverage ratio*

Digital economy and increasing trends of broadband network access in Europe and the Republic of Croatia

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Abstract. The first part of the paper deals with forecasts of the global growth of the required access speed for broadband networks in the next decade. Broadband access is one of the basic components of digital economy. This part of the article also describes other factors influencing the development of digital economy. The second part of the paper is a comparative analysis between main factors of the Croatian digital economy and the digital economy in the EU countries, and the movement of certain factors for the period between 2014 and 2015. One of the main factors is "Connectivity", but it is lagging behind in relation to movements in the EU. Furthermore, the article shows the comparison of the situation of individual broadband access technologies in the Republic of Croatia and the state of the EU average, indicating differences in the developmental trends. Finally, the paper proposes activities and stakeholders to further enhance the overall digital economy of the Republic of Croatia.

Key words: *digital economy and society index, connectivity, integration of digital technology*

1. Introduction

Eurostat gives a whole set of information about the state of the EU and each of its member states in its document Quality of life – Facts and views. The data presented in this article is taken from the 2015 yearly edition of the mentioned Eurostat document and the 2013 yearly report of the EU member states. Through analysis a correlation between the state of a national economy (described with gross domestic product per capita) and certain social facts is presented [8], [9].

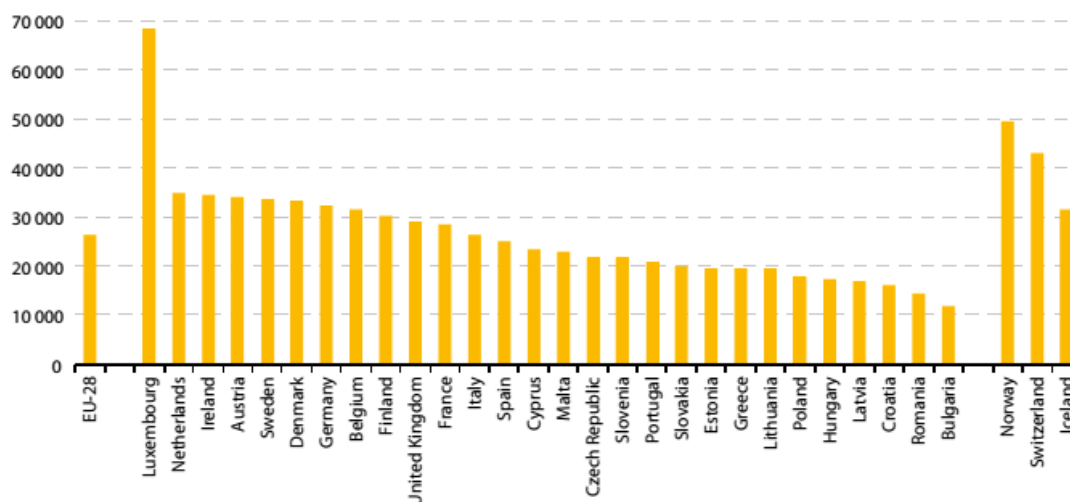


Fig. 1: Gross domestic product (GDP) at market prices, 2013 (Current prices, PPS per capita) [8]

From the graph presented in Fig. 1 it is visible that the Republic of Croatia is among the last in the EU when ordered by GDP per capita. When an analysis of the economic data found at the European Commission web pages is undertaken, it can be easily distinguished that the global economic crises that started in 2008 left its mark on the total economic growth of the EU and each of its member states. Perhaps that can be most obviously seen from the employment rate data during the years of crisis, presented in Table 1.

Table 1: Percent of employment in ages 20 to 64 [8]

	Year	2008	2011	2012	2013	2014	Values targeted for 2020
Percent of employment in ages 20 to 64	EU	70.3	68.6	68.4	68.4	69.2	75
	RH	64.9	59.8	58.1	57.2	59.2	62.9

The European Commission has defined EU development goals it wants to achieve by the year 2020. Among those development goals of the EU, there are a 75% employment rate for people ages 20 to 64 and a scientific and education investment at a 3% rate of the GDP per capita. The estimations for Croatia set the employment rate at 62.9% and investment in science and education at 1.4% of the GDP per capita (at the moment those investments are at 0.79% GDP per capita). It could be argued that the predictions of the European Commission for the Republic of Croatia are not very optimistic.

The European Union plans to base its further economic development on new technologies, protection of the environment, reduced electric energy consumption and, in general, on the idea known as Digital Economy.

The term Digital Economy first occurred in a best-seller book named “The Digital Economy” published in the year 1995. The author of the book is Canadian born statesman, businessman, consultant and author **Don Tapscott** (born 1. June, 1947). In the book he discusses how are the new technologies (especially computing and information technologies) going to change society and particularly business and economy.

In today’s world the term Digital Economy is widely accepted. The European Commission bases most of further EU development on and through that term. According to the strategic plans of the European Commission, further economic growth is not possible outside of the limits dictated by the term of Digital Economy.

In the year 2013 the European Commission has brought a whole series of strategic measures and plans connected with the term Digital Economy. It was additionally motivated to do so by the economic crises that started in the year 2008 and shook the global and European economies. One could say it is a strategic look at the possibilities of further economic growth in the European Union but also Europe in general.

According to the strategic guidelines of the European Commission, the development of Digital Economy also encourages the entrepreneurship development, development of new work places, total economy growth and especially growth of small and middle sized companies.

This very strategic plan, if implemented, should motivate further economic growth in the European Union, but also in Europe in general. If Croatia wants to achieve further economic growth, it has to harmonize and coordinate its strategic plans for development with the European trends in digital economy development. It has to develop its own complete strategy and determine its strategic goals.

2. Cloud computing and digital economy

One important activity through which positive changes in the economic environment can be observed is cloud computing [5].

The following questions need to be asked: Why is cloud computing important for further economic development? What is the connection between cloud computing and Digital Economy? In which aspects can cloud computing provide better possibilities than traditional forms of business based on Local area networks and bought applications? Why is cloud computing particularly motivating for small and middle size companies and how can it reduce operating costs of a business?

2.1. Work based on Local area network infrastructure

The traditional business model has demanded that companies have their own local area network and that they buy their business applications. After buying the business application, it was necessary to install the application on the internal company infrastructure. To ensure work continuity of the local area network, companies had to have their own IT specialists, who maintained the networks and also helped maintain compatibility with bought software. To ensure that the servers of the local area network (strong computers on which the business applications were installed) were continuously accessible, the servers needed to be placed in special air-conditioned rooms and provided with backup generators for power outs. As a consequence of traditional model demands, more sophisticated applications were not easily accessible or were completely inaccessible to small companies. Acquiring such applications demanded large initial investments from small companies which were then spent on:

- Buying the application
- Building the needed infrastructure
- Providing adequate storage for the needed IT equipment
- Employing IT and Network specialists for development and maintenance of the needed infrastructure

Also, it is important to mention that maintenance and further development of the bought applications were laborious to their sellers because they needed to reach out to all of their customers for each upgrade or fix patch.

2.2. The concept of cloud computing

The concept of cloud computing is based on the idea that applications are not sold but rented out to the end user for an agreed period of time.

Companies do not buy the application but rent its services for the time needed. This approach provides the possibility of starting a business with significantly smaller initial investments on IT support and infrastructure. Another benefit is that if a company realizes that it doesn't need a certain application, it can just terminate the lease of that application.

When applications are leased, they are accessed through the internet, which means there is no need for a company to have its own local area network infrastructure but a quality broadband internet access.

When companies had their own local area networks with central servers, which were then accessed by terminals in order to use a certain application, the demanded network speed was 100 Mbit/s. In cloud computing the server is not in a local area network but in a server center which can be located anywhere in the world. In order to have quality access to the needed application, the demanded speed is also 100 Mbit/s.

Companies no longer need their own local area networks, air-conditioned server storage rooms with backup generators, they no longer need their own network specialists to take care of the vital infrastructure or need fewer of them, and they no longer need to permanently buy applications.

Modern companies only need standard user computers, a fast internet access and to rent out the needed applications for a certain amount of time or certain amount of service.

By utilizing this concept, small and middle size companies avoid large initial investments, but even in general, the monthly cost of operations is lower, since there is no need to maintain an internal local area network, and thus the costs of IT support are significantly lower. This allows small and middle size companies to be more competitive in the market and the general price of services to be lower. Smaller initial investments motivate the economy which then reduces the unemployment rate.

In order to achieve cloud computing the following need to exist:

- Software centers which will provide the needed services
- A quality broadband internet access
- Network security in the software centers, on the network and at the end user

Because of this the European Union is willing to financially support the development of:

- Software centers
- Fast and super-fast internet access
- Network and software security

2.3. Software center development

According to all presented, development of software centers today is a global phenomenon which shows no sign of slowing down.

Software centers serve for storing and processing data through various applications. They are accessible through broadband internet access. Unfortunately, a large number of companies still fear of cloud computing because they are afraid of leaking or loosing fragile and sensitive strategic or personal information. They feel uneasy not knowing the exact physical location of their data which can be stored in software centers around the world and not knowing the steps taken to ensure the security of their data.

However, security mechanisms which exist today and which are implemented by large software centers provide significantly higher security level than most companies could hope to offer on their own. This is especially true for small companies that are just being set up. Data security in software centers is extremely high. Another vital security part of the architecture is the security of the network by which the data is being transferred. The security there is not as high as in software centers and there is room for improvement, which is why it is a field that's been constantly worked on. The weakest link in the security chain is the end user, who is also most often the target of attacks. Most attacks try to sabotage the communication and acquire vital information, such as user names and passwords. Since most of the attacks target the end user, the security level is the same or even higher when using cloud computing.

Companies can rent applications through online services. Software centers can and mostly are located all over the world, and often in colder parts of the world to reduce the costs of cooling the spaces for the servers.

When it comes to conducting business for companies it is not a big problem that the users do not know the exact physical location of where their data is stored. However, this is a problem when it comes to data which is of national importance. For instance, data related to and stored by applications such as e-citizen, e-government, e-healthcare and other public services work on and store data of national significance so they need to be protected on a national level.

The Croatian Republic, as well as other European countries, has to take the development of their own software centers as a part of their national strategy relating to digital economy into the account. These software centers would be used for storing applications and data of national importance, but could also have capacity which could be rented out to other countries or companies for safe storage of their application and data. It would not be a good idea to let this part of the digital market be developed by someone else and then rent out their services.

2.4. Development of fast and superfast Internet access

In order to develop cloud computing in its full capacity it is important that end users, be they physical users or companies, get access to fast and superfast internet. Without such internet access there is no cloud computing and without cloud computing there are no advantages that it brings with it, such as the expense reduction, increase in productivity and competitiveness.

In the modern world, running a company without it having a web page, e-mail or at least internet access is unthinkable. Companies that do not have access to internet do not exist in the modern economic sense. When consumers need anything, the first thing they do is search the web for information.

The basic economic capacity of a country comes from its people and its land. People are the ones performing the economic activity and land is the place where the activity is performed.

When it is said that approximately 70% of land in Croatia cannot get broadband internet access, it means that 70% of the national land is out of economic function. In Croatia there is a big difference between internet coverage in urban, suburban and rural areas. Only urban areas can be satisfied with the quality and the speed of internet access. Although over 57% of the population in Croatia lives in urban areas, urban areas make only 3% of the national territory. This leads to the conclusion that only 3% of the national territory has internet stable enough to be put to economic use.

The most developed countries in Europe such as Denmark, Belgium, The Nederland, and Germany have a balanced development of broadband internet access on their whole territory which means they can put their whole territory to economic use.

When it comes to ability of connectivity and the quality of connectivity, the Republic of Croatia is among the last in the European Union. It is important to point out that telecom operators cannot take the whole blame for this situation. The reasons of this problem are more complex, as is their solution.

3. European digital economy

3.1. Digital agenda

The European commission has presented its goals in digital economy through a document know as Digital agenda [1], [2], [7], [12]. These goals state that by the year 2020 the following needs to be achieved:

- Fast internet access (30 Mbit/s to 100 Mbit/s) for all European citizens
- Superfast internet access (100 Mbit/s or higher) for 50% of all European households

The agenda makes no difference based on the location inside the European Union. Reaching the goals set by the digital agenda is a key precondition for further economic and societal development.

3.2. Digital economy and DESI index

The European commission, as part of its digital agenda, keeps track of digital economy in European society through the so called DESI index (DESI-Digital Economy and Society index). This index is calculated for EU in general and for each of its member states. The DESI index is a complex indicator consisting of several components and subcomponents [7].

Five base DESI index components are:

- Connectivity
- Human Capital
- Use of Internet
- Integration of digital technology

- Digital Public Services

Each of the five base components is complex and made out of several subcomponents.

- Connectivity is calculated as a weighted average of its four subcomponents
 - Fixed broadband internet access
 - Mobile broadband internet access
 - Speed of internet access
 - Availability of internet access
- Human capital is calculated as a weighted average of its two subcomponents
 - Basic internet usage skills
 - Advances internet usage skills
- Use of internet is calculated as a weighted average of its three subcomponents
 - Content of use
 - Communication use
 - Business use
- Integration of digital technology is calculated as a weighted average of its two subcomponents
 - Digitalization of business
 - E-Shopping
- Digital Public Services is calculated as a weighted average of its two subcomponents
 - E-Government
 - E-Healthcare

Fig. 2. “Croatia's performance in the DESI 2015” graphically shows the state of digital economy in the Republic of Croatia. By the total DESI indicator the Republic of Croatia is with a normalized value of 0.38 (normalized on scale from 0 to 1) on the 24 place of the 28 European Union countries.

There are DESI indicators by which the Republic of Croatia is above the EU average. That is the DESI indicator of integration of digital technologies where 25% of all small and middle size companies in Croatia have online stores and 8.4% conduct overseas business (6.5% is the EU average). Small and middle size companies in Croatia make an average of 11% of its business online (8.8% is the EU average). Big companies make 14% of their business online (20% is the EU average).

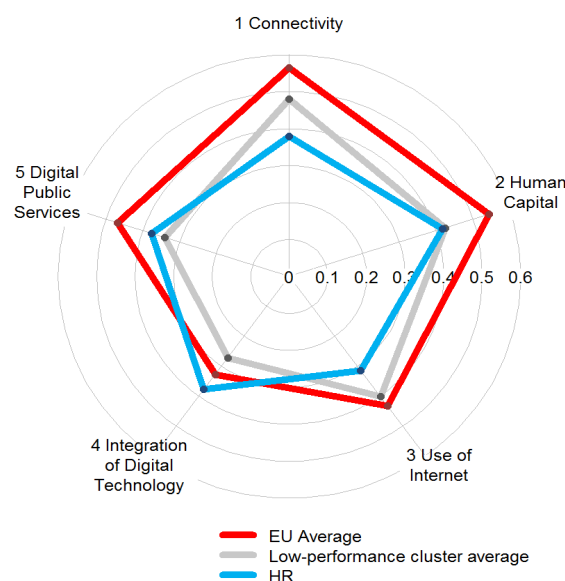


Fig. 2: Croatia's performance in the DESI 2015 [7]

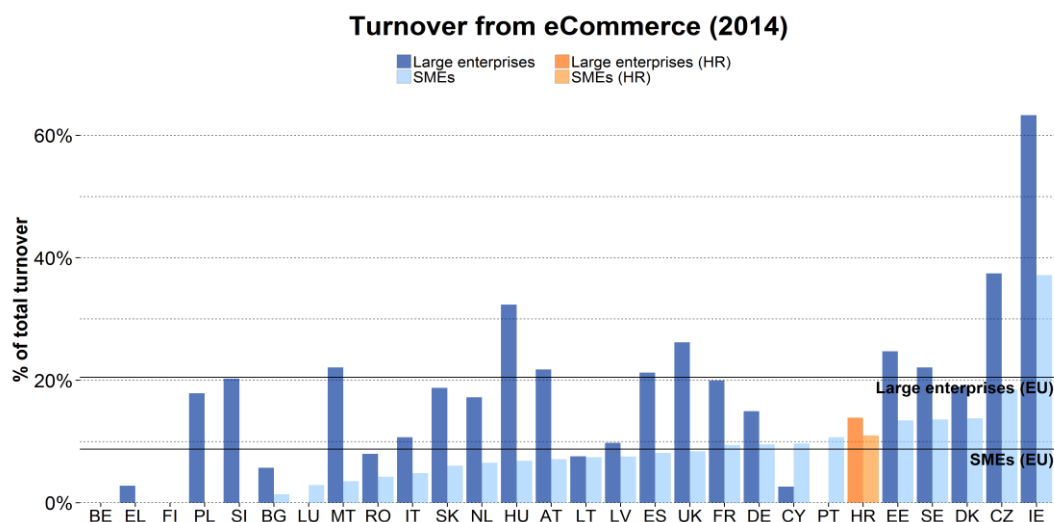


Fig. 3: Integration of Digital Technology, SME Turnover from eCommerce [7]

In the Republic of Croatia 25% of small and middle size companies conduct online sales (15% is the EU average). 8.4% of Croatian small and middle size companies conduct overseas online sales (6.5% is the EU average).

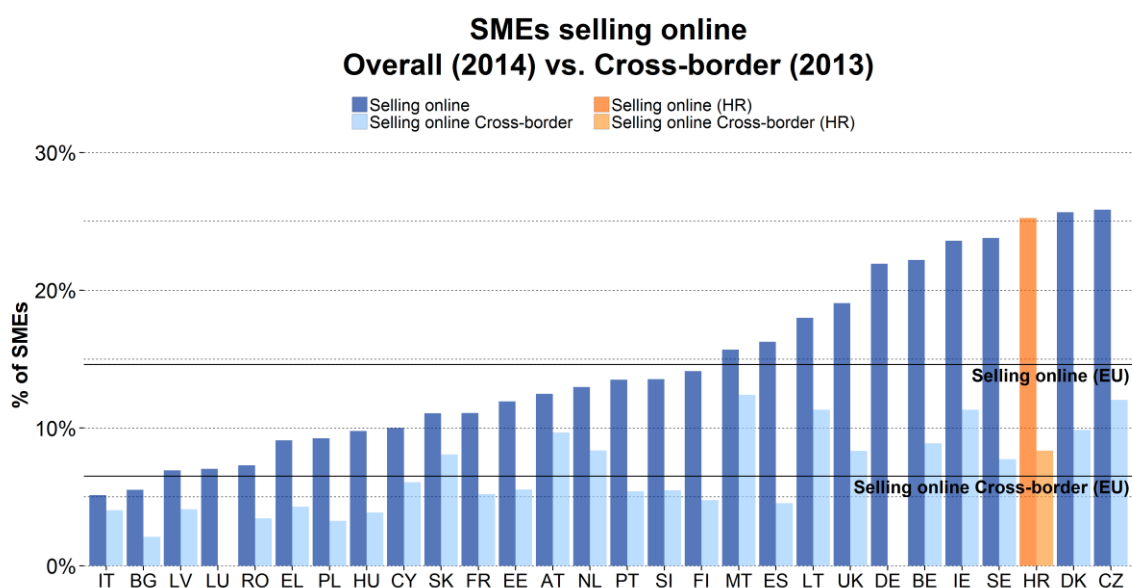


Fig. 4: Integration of Digital Technology, SMEs selling online [7]

The Croatian economy is not very advanced but the DESI indicator of Integration of digital technologies shows that it is heading in the right direction and that it can potentially achieve big growth. An obstacle in achieving that growth is the bad DESI index relating to Connectivity. Despite the fact that fixed broadband internet access is available in 97% of households only 61% of households take the advantage of the opportunity. By this index of the 30 European countries Croatia is the worst ranked.

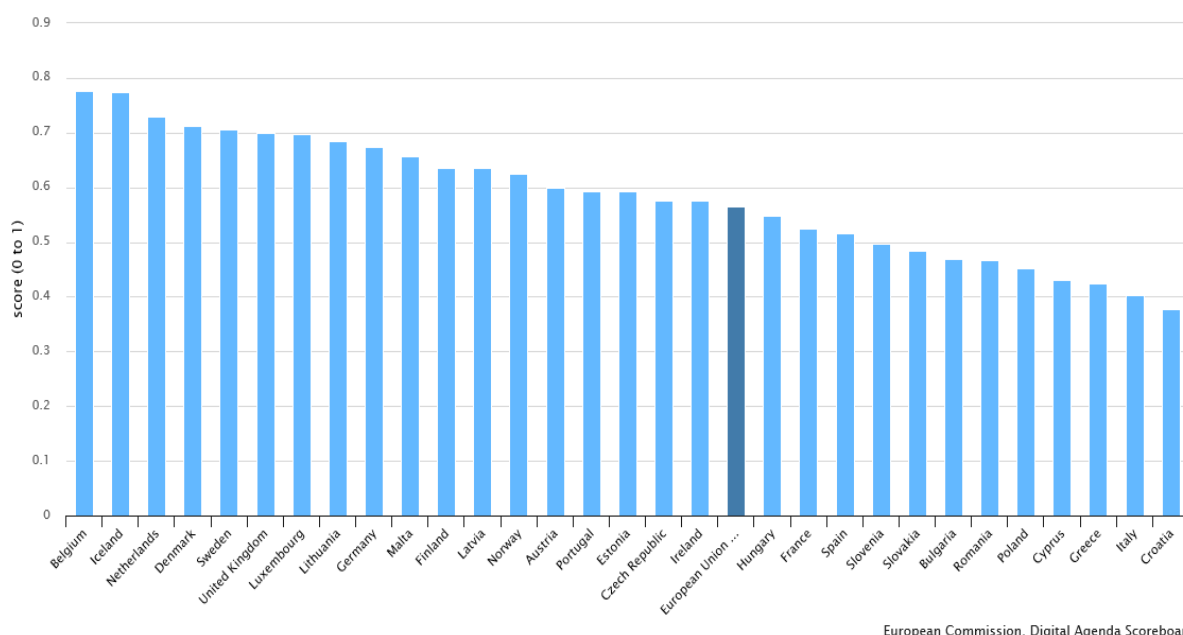


Fig. 5: Ranking in Connectivity [7]

Although 57% of households in Croatia have access to broadband internet of high speeds (NGA), only 1.1% of households use such access. It is important to notice two facts here:

- The reason why 57% of households have access to NGA internet is because 57% of the population lives in the four major urban areas which occupy only 3% of the national territory. Once more, this brings out the fact that only 3% of the national territory can be put to economic use because all of the adequately developed infrastructure is in densely populated urban areas.
- The fact that only 1.1% of households use a NGA connection points out two facts:
 - The price of such a connection is relatively high compare to an average household income
 - Low rate of informatics and information education

An average household in Croatia spends 2.5% of its gross income on an internet connection (12-30Mbps) while the average in the European Union is 1.4%. It can clearly be seen from this data that for citizens of Croatia an internet connection is quite expensive. However, the reason why it is so expensive for an average Croatian household is not the high price of internet service but the low average household gross income. This makes the problem more difficult to solve as there is no more room for further price reduction.

When ranked by the DESI indicator of Human capital, Croatia is 23rd in Europe with a modes 0.42 result. Croatia needs to work on achieving increasing the populations' digital qualities and abilities. A clear indication of their lack can be seen in the fact that 28% of the Croatian population has never used an internet connection (the European Union average is 18%). On the contrary, in states like Denmark 92% of the population use internet and the EU average is at 75%. Advanced countries have a culture of internet usage which still needs to develop in Croatia. However, there are some aspects in which Croatia is above the EU average. For instance, video communication over the internet is at 38%, while the EU average is 37%, and reading the news over the internet is at 79%, while the EU average is at 67%.

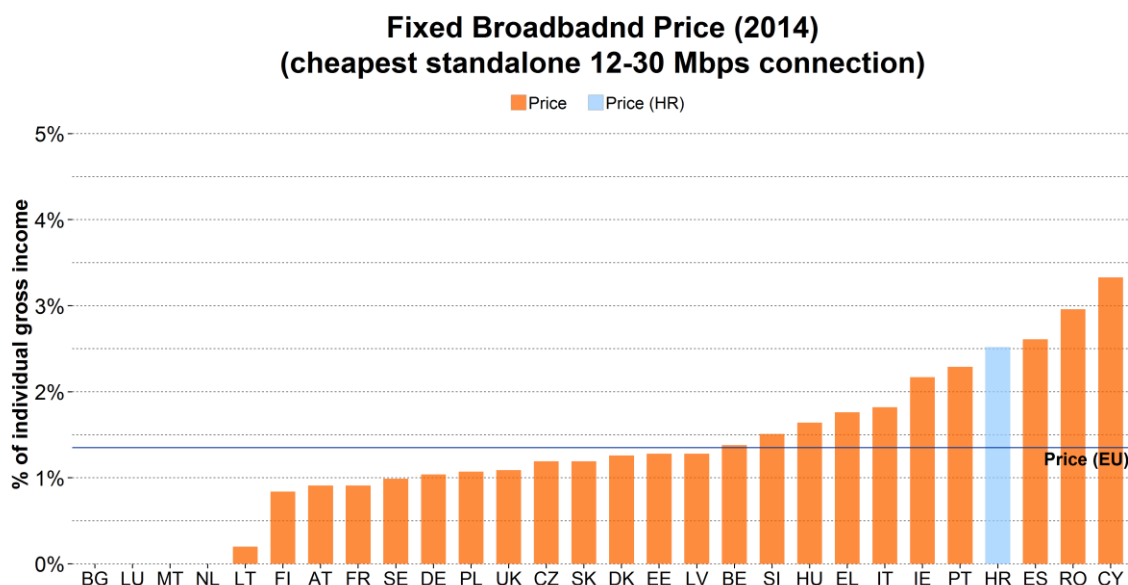


Fig. 6: Connectivity, Fixed Broadband Price. [7]

Further analysis of DESI indicators for Croatia (2014-2015) shows some positive, but also some negative trends.

Positive trends:

- Small and middle size businesses base their sales and management on modern communication technologies more than average in the EU and usage of such technologies is showing an increase.
- Online sales as well as cross border trade are above the EU average.
- In some of its public services such as e-Recipe (part of e-Healthcare), Croatia is among the leading in the EU (over 99% of all recipes are issued in this way).

Negative trends:

- Croatia is the worst in the EU when it comes to Connectivity and does not use all of the existing infrastructure.
- Fast and superfast internet access can only be achieved in highly urban areas which make only 3% of the national territory.
- Croatian citizens pay the highest price for internet access in relation to their income.
- When ranked by the amount of people who use the Internet Croatia is 21 out of 28 EU countries.

The European Union bases and will continue to base its further development on Digital economy. Croatia should do the same, but it lacks a complete strategy for further development based on Digital Economy. For years Croatia has been developing strategies such as the Strategy for increase of broadband internet access. Although these strategies are heading in the right direction, they are not a complete solution. Developing strategies without considering their implications and what they are trying to achieve is the reason Croatia is among the worst in the EU regarding the factors those strategies are trying to influence.

By taking into consideration the example of Italy which also has a strategy of just increasing the number of internet access points without a clear idea why that wants to be achieved, it can be seen that that is a bad approach, given that Italy is on the second last place in the European Union, only being better than Croatia.

Croatia has to take all of the DESI indicators into careful consideration and then develop a complete strategy regarding Digital economy. This strategy should produce well determined goals that should be reached through a set of strategic measures implemented in several iterations.

4. Future economic growth in Croatia based of Digital economy

As mentioned before, further economic growth in Croatia has to be based, among other things, on the development of Digital economy.

4.1. Investment in science and education

Modern society is a scientific one or, in other words, one based on education and knowledge. Therefore, it will come as no surprise that it is planned to increase investment in science and education. This investment should reach a European level of 3% of the country's GDP by the year 2020.

The educational system should take special care and make special effort in stimulating young people to enroll in areas of computer and information science. An estimate based on enrollment quotas shows that this profession will have a big lack of potential employees. It is also important to stimulate students to take part in the Erasmus and Erasmus+ program so they gain international and work experiences. This will not only make future employees more opened to international business, but will also help in creating more international business and thus benefit the economy. It is also important to simplify the process of establishing new firms and make the information on such activity easily accessible.

It is immensely important to continue developing public online services regarding education. Some ideas go as far as to suggest creating the available public service sites that would freely provide all the textbooks for primary school and high schools.

It is important to develop a culture of using communication and information technologies for online learning. Especially to establish online learning as a lifelong informal activity.

4.2. Development of informatics in society

As part of the national strategy regarding digital economics, it is important to define and encourage development of software centers which will serve as a basis for cloud computing and storing data of national interest. Also, special care needs to be given to development of online public services. By the year 2020 all interaction with state administration should be possible over the internet. This would make things not only more efficient but also less costly. Through the use of online public services citizens need to be able to save both time and money, need to be given a high quality service and thus to be stimulated to use such services.

4.3. Connectivity development

When ranked by DESI indicator for connectivity Croatia is the last in the European Union. It has the worst infrastructure, the highest prices and the least spared out broadband internet access coverage. The weight of infrastructure development cannot be solely placed on the market and existing telecom operators. Units of local government, with the help of EU funds, need to be stimulated to make development programs regarding broadband internet access infrastructure. Local government should be able to establish communal firms with the purpose of communication infrastructure development. A strategy is needed to ensure the possibility of broadband internet access all over the national territory. This is a needed precondition to further economic growth in Croatia. Every part of the national territory has to have access to water, electricity, roads and fast internet. This would not only make the whole territory economically usable, but would also motivate development of underdeveloped areas and thus motivate decentralization. In a communication sense it is important not only to motivate development of

fixed networks, but also mobile ones, such as is the 4G system network. Tax reduction on investments in infrastructure development should be carefully considered.

Future development of any economic activity will not be possible without high quality internet access.

4.4. Strategy of economic growth as a strategy of digital growth

The European commission has determined all strategic goals which should be reached by the year 2020. Croatia should do the same and also look into all the motivational funds Europe has prepared for such development.

In the year 2011 70% of GDP (around 9 trillion euros) was achieved in economic service activities. Cloud computing is a technological innovation, but also a modern form of continuous service providing. From this, it could be concluded that cloud computing is a representation of a modern form of conducting business and as such is the future of economic growth.

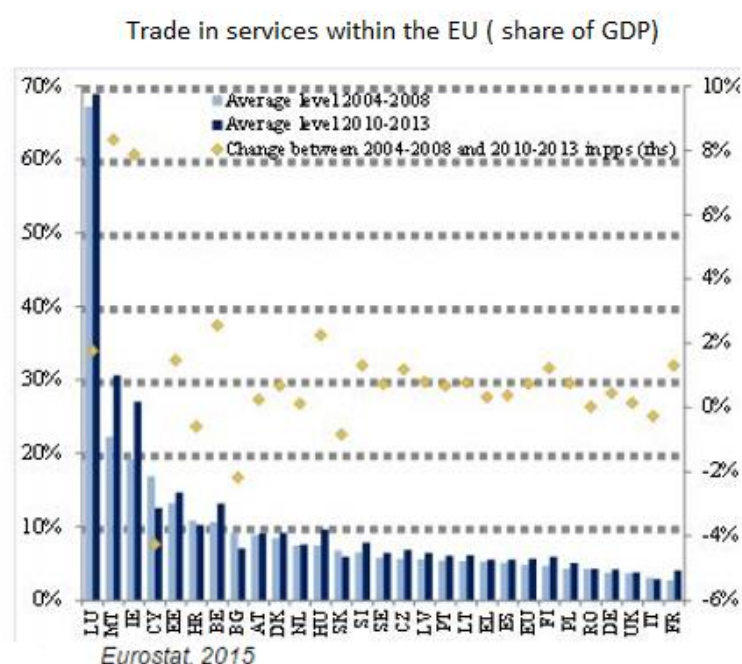


Fig. 7: Trade in service within the EU [13]

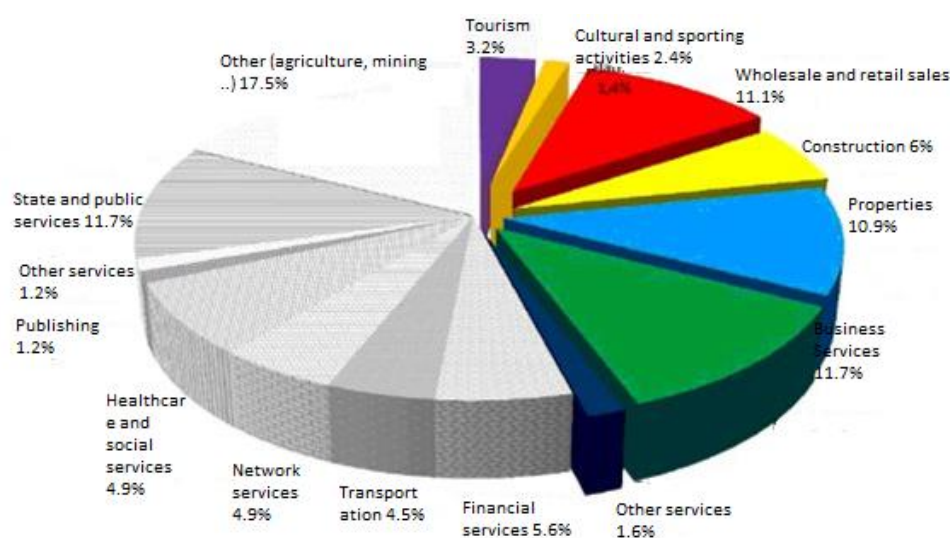


Fig. 8 Proportion of services in the modern economy [13]

Following the example set by the EU Croatia should develop a complete strategy regarding digital economy. There should be only one complete strategy not multiple strategies as there have been so far.

A country does not exist in an economic sense if it does not have stable and fast internet access. In the modern world many rural activities or, more precisely, activities of the primary economic sector increasingly use services and support of computer software to optimize their activity and thus make them more competitive on the market. Development of the primary economic sector will also depend on it using more and more of modern technologies, especially information and informatics technologies. Without this change in conducting business, the primary sector cannot survive, let alone grow.

Cloud computing and other modern IT technologies will reduce the number of needed government employees. A good example of this can be seen through the online public services provided to citizens in countries such as Estonia or Denmark. Such services reduce the need for government administration employees and consequently make the state more efficient and reduce its expenses.

From the DESI indexes it can be seen that although the Croatian economy is weak, it is healthy or, more precisely, it is heading in the right direction. The Croatian economy shows it can adapt to digital economy even more than the current state of connectivity allows. It could be said that Croatia deserves and is capable of a better economy than it has at the moment.

Unfortunately, whenever the bad economic state of Croatia is discussed, more time is spent on trying to find who to blame for such a situation than on developing a strategy to improve the state of the country's economy. It is vital to form a development strategy, to determine the goals of the strategy and the deadlines to achieve them, then to work on achieving the set goals. No goal can be reached by social division, but only by working towards it.

5. Conclusion

The European Union to a large extent bases further economic growth and employment rate growth on the service sector. The modern service sector is and will largely be based on modern technologies, especially computing and information technologies. Special stress is given to the development of software centers which will be the base for increasing the market of digital services. Another important part of development is increasing the access to fast and super-fast broadband internet. National territory can only be used if it has internet access and access to communication networks [3], [5], [6].

Further economic growth in Croatia, as in the European Union, will be based on digital economy. It is vital to create a full development strategy based on digital economy. The strategy needs to define goals, but also the dynamic of achieving the set goals. Concrete actions in mobilizing people, society and economic subjects in Croatia need to be defined and undertaken from the strategy.

According to DESI indicators, Croatia is good in some areas, even to a point that it is above EU average, but bad in other areas, sometimes even the worst in the EU. The European Union has development funds that can be used for broadband access development, software center development and cyber security development. These funds are available until the year 2020. Every year that passes without using these funds is a wasted year.

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Utjecaj udaljenosti od gnječene površine na svojstva termomehanički očvrsnute legure aluminija ASTM 2011

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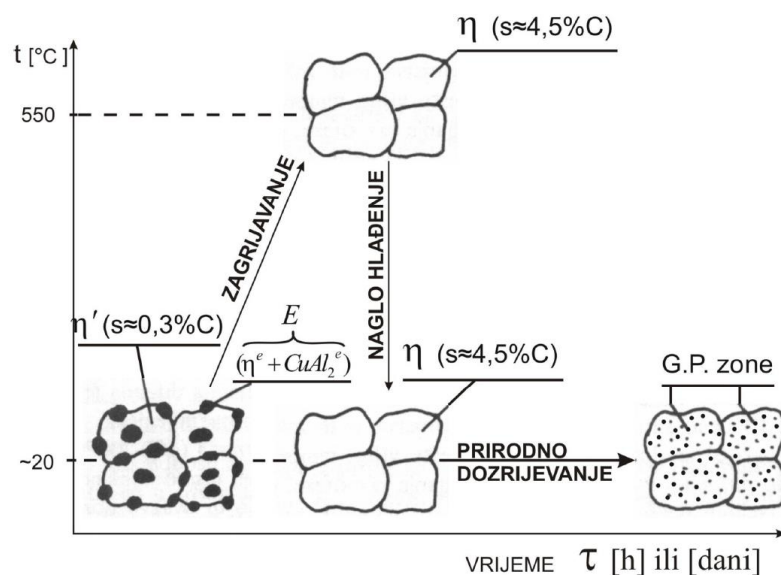
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Sažetak: Precipitacijski očvrstivim legurama aluminija dodatno povećanje otpornosti materijala, uz odgovarajuću toplinsku obradu, postiže se hladnim gnječenjem. Plastična deformacija vrši se kao međufaza toplinske obrade i to nakon rastvornog žarenja i gašenja, a prije umjetnog dozrijevanja. Gnječenje je obavljeno između tlačnih ploča hidrauličke prese. Cilj istraživanja odrediti je utjecaj udaljenosti od gnječene površine uzorka na postignuta svojstva (tvrdoću) nakon završene obrade. Odabrani su cilindrični uzorci, koji su nakon obrade izrezani uzduž simetrale te je određen profil tvrdoća između dvije gnječene površine. Korišten je centralni kompozitni plan pokusa, a rezultati ispitivanja statistički su obrađeni primjenom programa *Design-expert*. Promjenjive varijable pokusa su temperatura dozrijevanja, vrijeme držanja uzorka na temperaturi dozrijevanja i udaljenost od gnječene površine. Odzivna veličina pokusa je tvrdoća nakon provedene termomehaničke obrade.

Ključne riječi: *Alumijeve slitine, precipitacijsko očvršćivanje, tvrdoća, deformacija*

1. Uvod

Očvrstivost koja se postiže toplinskom obradom ne počiva na principu modifikacije rešetke već na promjeni rastvorivosti legiranih elemenata u rešetki aluminija. Zagrijavanjem legure i rastvaranjem maksimalne količine atoma bakra u rešetki aluminija te sprječavanje difuzije naglim hlađenjem u strukturi se dobivaju prezasićeni mješanci i veoma izvitoperene rešetke što dovodi do povećanja čvrstoće. Difuzijom nakon hlađenja dio atoma bakra napušta mjesta na kojima su gašenjem zadržana. Guinier-Prestonove zone, slika 1, nastaju zbog mikronehomogenosti unutar mješancaca, iako se sami mješanci mogu smatrati homogenima. Na područjima reda veličine stotinjak atoma znatne su razlike u koncentracijama. Difuzijom se stvaraju slojevi (pločice) bogati atomima bakra. Ovakve pločice, veličine nekoliko mikrona, gusto su raspršene u mješancima te remete pravilnost kliznih ravnina povećavajući čvrstoću legure (prirodno dozrijevanje). S obzirom na to da se difuzija dešava na nižim temperaturama, odvija se sporo i nepotpuna je pa nastaju samo Guinier-Prestonove zone. Nakon dozrijevanja (naknadna difuzija) od desetak dana legura dostiže konačna svojstva koja se više ne mijenjaju. Ako se dozrijevanje vrši na višim temperaturama 100 – 200 °C (umjetno dozrijevanje) dolazi do potpunije difuzije, tj. uspostavlja se ravnoteža. Dozrijevanjem u kraćem vremenskom periodu (do 100 sati) dobije se Θ'' faze (eutektički kristali intermetalnog spoja CuAl_2) kada je čvrstoća najviša [1].



Slika 1 Promjene faza pri toplinskoj obradi duraluminija

2. Plan pokusa

Polazna ideja je da se hladnom deformacijom, ako se ista obavi nakon gašenja, a prije dozrijevanja, povećava tvrdoća. Kako bi se ujednačili polazni parametri sve epruvete su rastvorno žarene.

Odabrani materijal je AlCuBiPb, odnosno ASTM 2011, kemijskog sastava prema tablici 1 [2]

Tablica 1 Kemijski sastav legure EN AlCuBiPb (ASTM 2011)

Al	Bi	Cu	Fe	Pb
91,2 – 94,6%	0,2 – 0,6%	5 – 6%	≤ 0,7%	0,2 – 0,6%
Ostali pojedinačno	Ostali ukupno	Si	Zn	
≤ 0,05%	≤ 0,15%	≤ 0,4%	≤ 0,3%	

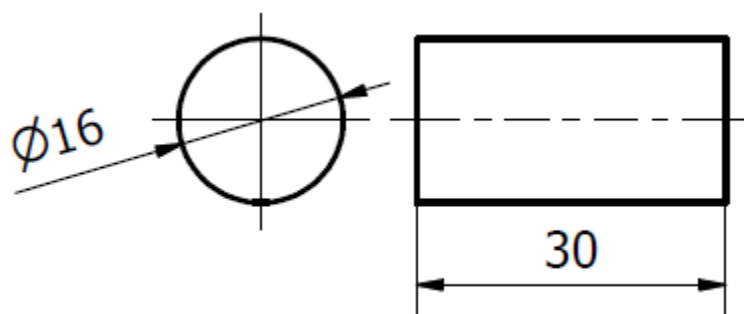
Nepromjenjivi parametri korišteni za obradu rastvornog žarenja su:

- temperatura rastvornog žarenja 525 ° C [3]
- trajanje rastvornog žarenja 75 min [4]
- maksimalno vrijeme izvan peći nakon rastvornog žarenja, a prije gašenja 15 s [4]
- gašenje u vodi sobne temperature
- temperatura dozrijevanja 165 ° C [3]

Faktori koji su varirani u pokusu su:

- udaljenosti od površine 0 – 10 mm
- stupanj ugnječenja 0 – 30 %
- vrijeme trajanja dozrijevanja 0 – 1200 min

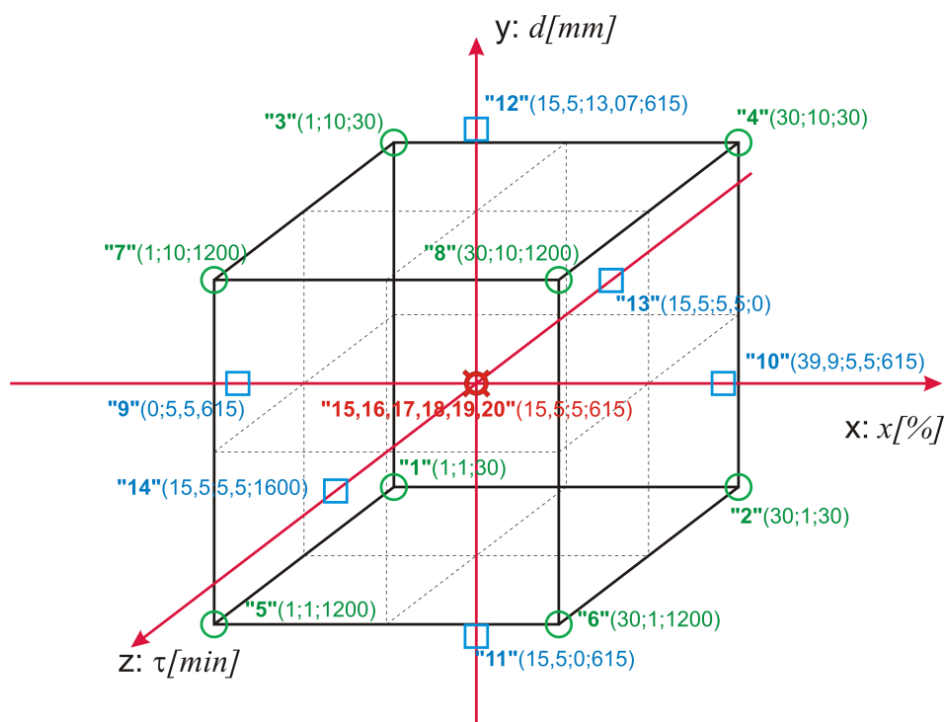
Dimenzije epruveta prema slici 2.



Slika 2 Dimenzije epruveta

3. Centralno kompozitni plan pokusa

U svrhu planiranja odabran je Centralni kompozitni plan pokusa [5] (*central composite design*, CCD). Svaki faktor mijenjan je na pet razina. Svrha ovakvog pristupa planiranju pokusa je pronalaženje matematičkog modela koji opisuje proces uz minimalan broj potrebnih pokusa. U ovom slučaju mijenjana su tri parametra (vrijeme dozrijevanja, udaljenost od površine i stupanj deformacije). Svaki parametar mijenjan je na pet nivoa ($+\alpha$; $-\alpha$; $+1$; -1 ; 0). Na slici 3 prikazana je shema eksperimentalnih točaka pokusa. Simbol \boxtimes označava centralnu točku gdje razina svakog faktora ima srednju vrijednost, a koja se ponavlja šest puta. Ovim ponavljanjem postiže se smanjenje varijance i dobra procjena čiste greške. Simbol \square označava šest aksijalnih točaka udaljenih α od središta, a simbol \circ označava osam vršnih točaka plana pokusa.



Oznaka:npr. "5" (1,1,1200) - epruveta br.5 (deformacija 1%, udaljenost od površine 1mm, dozrijevanje 1200 min)

Slika 3 Centralno kompozitni plan pokusa

Prvi korak kod statističke analize bio je određivanje vrste transformacije odzivne veličine. S obzirom na dobivene rezultate nije bilo potrebe za transformacijom. U sljedećem koraku program upućuje na funkciju koja najbolje opisuje pojavu – u ovom slučaju polinom 2. reda. Rezultati analize varijance prikazani su u tablici 2. Odzivna veličina dobivena pokusom je tvrdoća. Rezultati mjerenja tvrdoća su statistički obrađeni pomoću *Design Expert* [6] programa te je pomoću navedenog programa određen i matematički model [7].

Tablica 2 Analiza varijance

ANALIZA VARIJANCE						
izvor varijacije	suma kvadrata odstupanja	broj stupnjeva slobode	srednji kvadrat odstupanja	F vrijednost	P vrijednost prob>F	značajnost
MODEL	2551,0543	9	283,4505	14,0483	0.0001	značajan
A	15,7681	1	15,7681	0,7815	0.3974	
B	9,1327	1	9,1327	0,4526	0.5163	
C	1259,7800	1	1259,7800	62,4369	< 0.0001	
A ²	76,3463	1	76,3463	3,7839	0.0804	
B ²	25,0794	1	25,0794	1,2430	0.2910	
C ²	484,6594	1	484,6594	24,0205	0.0006	
AB	0,1067	1	0,1067	0,0053	0.9435	
AC	910,2222	1	910,2222	45,1122	< 0.0001	
BC	6,8718	1	6,8718	0,3406	0.5724	
Ostatak	201,7687	10	20,1769			
Odstupanje od modela	136,0082	5	27,2016	2,0682	0.2221	neznačajan
Čista greška	65,7604	5	13,1521			
	2752,8229	19				

F vrijednost modela od 14,05 ukazuje na značajnost modela jer vjerojatnost da se pojavi tako velika vrijednost odstupanja od modela uslijed šuma manja je od 0,1 %. Vrijednost „Prob > F“ manja od 0,05 %, za pojedine članove predloženog matematičkog modela govori u prilog značajnosti njihovog utjecaja. U ovom modelu značajna su vrijednost faktori C, C² i AC (temperatura, kvadrat temperature i umnožak stupnja ugnječenja i temperature). F vrijednost veličine odstupanja od modela od 14,05 znači da ova veličina nije značajna u odnosu na čistu grešku. Postoji vjerojatnost od 22,22 % tako velike F vrijednosti. Odstupanje od modela nastaje zbog šuma. S obzirom na to da odstupanje od modela nije značajno, model je prihvaćen i dalje analiziran.

Matematički model s stvarnim faktorima dan je izrazom:

$$HB = +94,41872 + 1,27153 \cdot \varepsilon + 0,90572 \cdot h + 0,062075 \cdot \tau - 0,013732 \cdot \varepsilon^2 - 0,086615 \cdot h^2 - 2,13104 \cdot 10^{-5} \cdot \tau^2 + 1,98708 \cdot 10^{-3} \cdot \varepsilon \cdot h - 1,25749 \cdot 10^{-3} \cdot \varepsilon \cdot \tau + 3,95266 \cdot 10^{-4} \cdot h \cdot \tau$$

gdje je:

- HB – tvrdoća u Brinellima
- ε – stupanj ugnječenja

- h – udaljenost od površine, mm
- τ – vrijeme progrijavanja, sat h

Pomoću *Design-expert* programa generirano je 20 stanja pokusa prikazanih u tablici 3 i na slici 3.

Tablica 3 Stanja pokusa i odzivne veličine (izmjerena i očekivana tvrdoća)

Uzorak	Test broj	Stupanj ugnječenja %	Udaljenost od površine mm	Trajanje dozrijevanja na temperaturi 165°C min	Izmjerena tvrdoća HB 2,5/62,5/15	Očekivana tvrdoća HV
19	1	15,5	5,5	615	128,67	132,83
20	2	15,5	5,5	615	127,67	132,83
4	3	30	10	30	124,00	122,03
14	4	15,5	5,5	1600	130,25	130,42
9	5	0	5,5	615	134,67	128,23
3	6	1	10	30	94,00	98,02
12	7	15,5	13,07	615	130,00	129,58
5	8	1	2	1200	137,00	140,39
11	9	15,5	0	615	130,75	128,96
2	10	30	2	30	119,75	122,53
13	11	15,5	5,5	0	118,67	113,36
15	12	15,5	5,5	615	135,67	132,83
1	13	1	2	30	98,17	98,97
8	14	30	10	1200	123,50	124,47
6	15	30	2	1200	124,38	121,27
16	16	15,5	5,5	615	131,25	132,83
17	17	15,5	5,5	615	136,25	132,83
7	18	1	10	1200	144,63	143,13
10	19	39,89	5,5	615	126,00	126,69
18	20	15,5	5,5	615	129,75	132,83

4. Provedba pokusa

Uzorci su rastvorno žareni i dozrijevani u laboratorijskoj peći, slika 4, prema podacima za leguru ASTM 2011.



Slika 4 Progarnibilna laboratorijska peć DEMITERM EASY 9

Deformacija, odnosno gnječenje epruveta između ploča hidraulične prese, slika 5, izvršeno je prema podacima za stupanj ugnječenja epruveta iz tablice 3.



Slika 5 Plastična deformacija uzoraka između ploča hidraulične prese

Prije mjerenja tvrdoće izvršena je obrada epruvete rezanjem u ravni okomito na čelo epruvete (slika 6). Na slici 7 (lijevo) prikazane su epruvete pripremljene za mjerenje odzivne veličine – tvrdoće po Brinellu.



Slika 6 Priprema epruveta za mjerenje tvrdoće

Mjerenje tvrdoće vršilo se u tri točke, a srednja vrijednost tvrdoće izračunata je kao aritmetička sredina očitanih tvrdoća, tablica 4. Kako bi se izbjegao utjecaj ruba na mjerenje, minimalna udaljenost od ravnih površina cilindričnih uzoraka bila je 2 mm. Na slici 7 (desno) prikazano je mjerenje tvrdoće pomoću univerzalnog tvrdomjera.

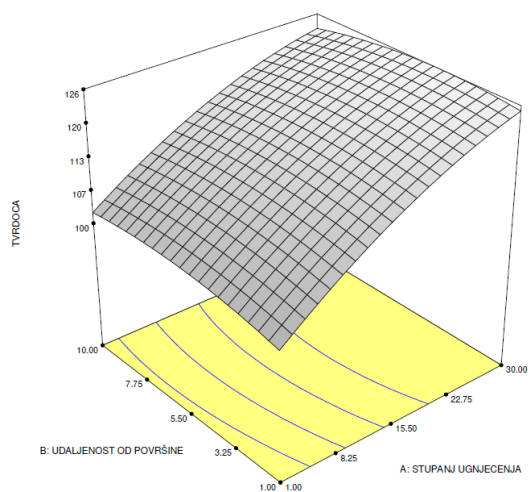


Slika 7 Epruvete pripremljene za mjerenje tvrdoće HB 2,5/62,5/15 (lijevo) i mjerenje tvrdoće epruveta pomoću univerzalnog tvrdomjera (desno)

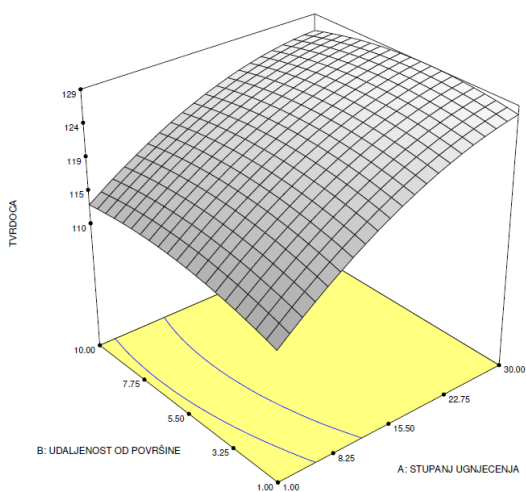
Tablica 4 Izmjerene i srednje vrijednosti tvrdoće

Uzorak broj	Tvrdoća HB 2,5/62,5/15 mjerjenje 1	Tvrdoća HB 2,5/62,5/15 mjerjenje 2	Tvrdoća HB 2,5/62,5/15 mjerjenje 3	Tvrdoća HB 2,5/62,5/15 srednja vrijednost
9	134	135	135	135
1	95	96	98	96
5	135	137	129	134
3	93	94	95	94
7	150	143,5	142	145
11	133	129	133	131
13	118	118	120	119
14	128	135	131	130
15	136	135	136	136
16	128	136	133	131
17	135	135	138	136
18	137	124	123	130
19	129	129	128	129
20	128	127	128	128
12	132	129	129	130
2	123	123	121	121
6	123	126	126	126
4	123	124	125	124
8	125	122	118	124
10	127	124	127	126

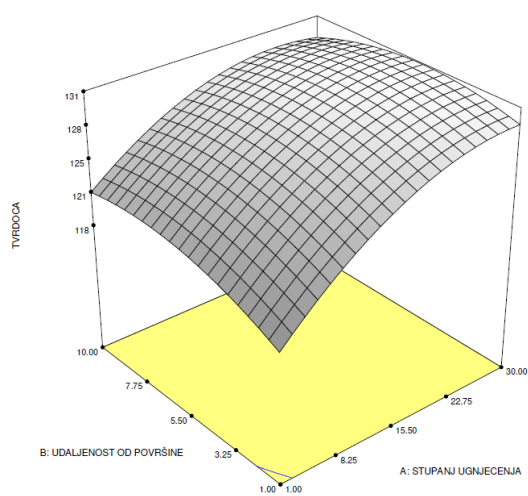
Rezultati dobiveni ovim ispitivanjem obrađeni programom *Desing-Expert* [6] prikazani su na slici 8.



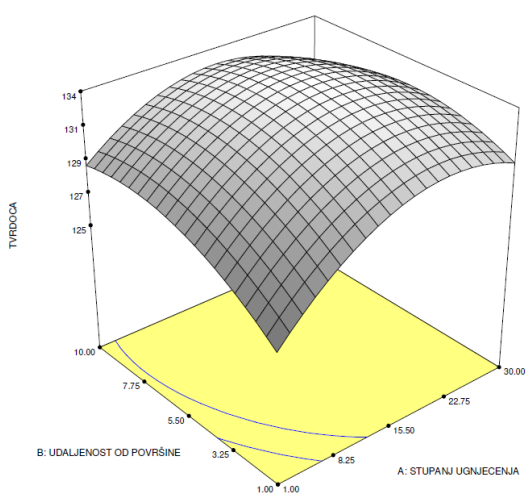
Trajanje dozrijevanja: 90 minuta



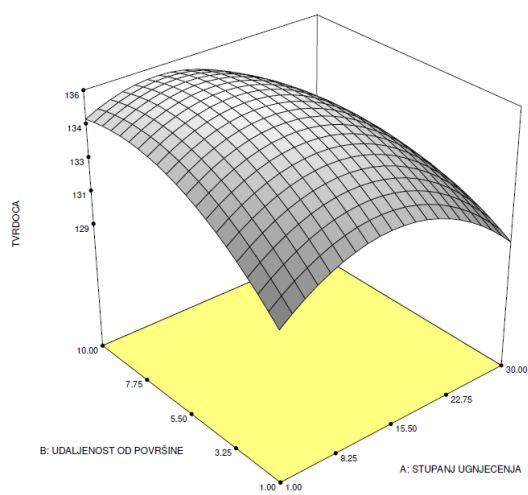
Trajanje dozrijevanja: 270 minuta



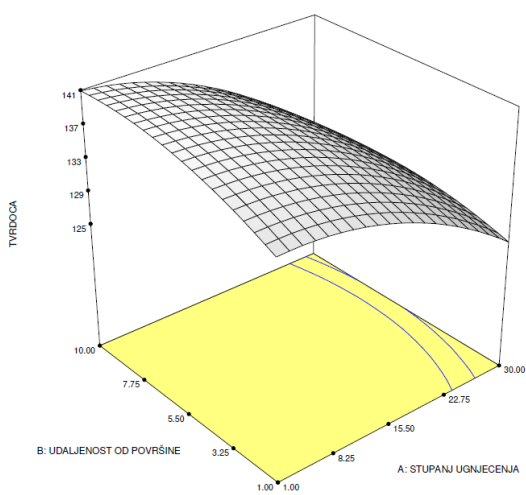
Trajanje dozrijevanja: 450 minuta



Trajanje dozrijevanja: 630 minuta



Trajanje dozrijevanja: 810 minuta

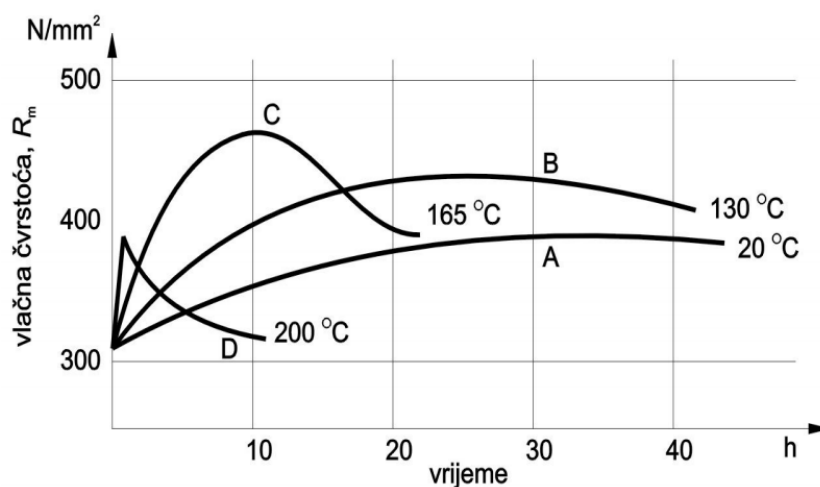


Trajanje dozrijevanja: 1080 minuta

Slika 8 Rezultati ispitivanja

5. Zaključak

Promjenom vremena trajanja dozrijevanja primjetna je promjena tvrdoće tako da uzorci s najvećim stupnjem ugnječenja ($\varepsilon = 30\%$) nakon kratkog vremena dozrijevanja postižu najveće vrijednosti tvrdoće. Produljivanjem vremena trajanja dozrijevanja uočava se pomicanje područja maksimalnih vrijednosti tvrdoće od područja visokog stupnja ugnječenja na područje srednjih vrijednosti stupnja ugnječenja ($\varepsilon = 15\%$). Za uzorke tretirane srednjm vrijednostima stupnja ugnječenja, najveće vrijednosti tvrdoće postižu se ako je trajanje dozrijevanja između 540 i 720 minuta. Daljnim produljenjem trajanja dozrijevanja maksimalnu tvrdoću postižu epruvete s najmanjim stupnjem ugnječenja. Također se može uočiti da se s produljenjem trajanja dozrijevanja područje maksimalne tvrdoće udaljava od površine. U slučaju velikog stupnja ugnječenja i dugog trajanja dozrijevanja dolazi do nastajanja Θ' faze, odnosno pojave krupnih polukoherentnih precipitata, i smanjenja tvrdoće. Budući da je temperatura dozrijevanja za sve uzorke ista, unutarne napetosti na granicama zrna (unutarne elastične energije unešene hladnim gnječenjem) pospješuju pojavu dozrijevanja. Tretirana legura hladnim deformiranjem očvršćuje. Rezultati ispitivanja u potpunosti svojstvima slijede krivulju C (slika 9). S povećanjem udaljenosti od gnječene površine uzorka uočava se blagi porast tvrdoće materijala zbog očito većeg ugnječenja uzrokovanog pojavom bačvanja uzoraka. Rezultati dobiveni ispitivanjem preliminarni su. Za pouzdanu primjenu navedenih rezultata potrebno je proširiti opseg ispitivanja. S obzirom na to da je stupanj ugnječenja u funkciji udaljenosti od čela duž osi uzorka, u daljnjim ispitivanjima trebalo bi odrediti stvarni stupanj ugnječenja na mjernim mjestima.



Slika 9 Ovisnost vlačne čvrstoće o trajanju i temperaturi dozrijevanja za leguru aluminija ASTM2011 [8]

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Influence of distance of deformed surface on properties of heat and mechanical hardened aluminum alloy ASTM 2011

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Abstract Precipitation-hardened aluminium alloys can be further strengthened by heat treatment as well as by cold deformation. Plastic deformation is performed during the heat treatment phase, after annealing and quenching but before artificial aging. Deformation is performed between pressure plates of a hydraulic press. The aim of this experiment is to determine the influence of distance from a deformed surface of a specimen on the properties of material (hardness) after treatment. A cylindrical specimen is chosen, and is cut lengthwise after treatment. The profile of hardness is determined between two deformed surfaces. A central composite plan of the experiment is used, and the results are statistically processed by Desin-Expert software. Alternate variables in the experiment are the temperature of aging, the duration of aging, and the distance from the deformed surface. Response value of the experiment is the hardness after completion of the aging process.

Key words: *Aluminium alloys, precipitation hardening, hardness, deformation*

Online processing of microscopic images

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Abstract. In this paper we present the concept and prototype for online automatic processing of microscopic images. The idea behind the system is based on the needs of different scientific and professional areas for automation of image processing. There are many tasks in these areas that can take advantage of computer vision (CV) and machine learning (ML) techniques for image segmentation and classification. Advances in ML area of deep neural networks enable us to use the same models for many different recognition tasks. The problem is that image processing usually requires particular skills in CV and ML for successfully building these models. With this system, all models would be supervised by independent ML experts while other users could set up systems through simplistic wizards. Another problem is obtaining and preparing large quantities of data for training and testing CV and ML models. Manual sampling and labelling of large quantities of images is necessary for building good automatic models. This problem can be mitigated by online collaboration between interested parties through sharing image databases.

Key words: *online, microscopic, image processing*

1. Introduction

Image processing is one of most difficult problems in artificial intelligence field. Specialized computer vision (CV in further text) subfield has developed with idea of enabling software to mimic the different phenomena of human vision. From early on, scientist understood that most of mechanisms can't be clearly described and programmed and tools from field of machine learning (ML in further text) are becoming most successful approach for many computer vision tasks. Even simple tasks as discriminating between images of cats and dogs can be rather involving but can be solved with high accuracy using machine learning models [1]. Similar models can be used for processing of scientific images that are usually simpler since we can control some aspects of image acquiring (e.g. perspective and lighting). Yet, these models usually require large quantity of manually labelled images that are expensive to produce. In this paper we present the concept and prototype for online automatic processing of microscopic images.

During last 50 years, image processing was moving from manual feature construction and rules-based evaluation towards automatic feature discovery and evaluation using approaches from ML field. Early CV was focused on using filters and rules for specific tasks. This approach had little success since digital images are very complex source of information where single pixels have no real meaning while meaningful image segments are hard to extract and

describe. Use of complex ML models (like neural networks) was also limited both by computing power, limitations of current ML models and quantity of available data. Over the last several years, use of graphical processing units for building ML models has significantly increased in conjunction with some theoretical breakthroughs in deep learning. Currently deep neural networks (DNN in further text) are dominating approach in domain of image processing as well as in some other domains like natural language processing. This approach allows researchers to train “end-to-end” DNN architecture for image processing tasks with very little human intervention. These advances resulted in different online services that allow us train and use DNN models but they usually require expert knowledge in both programming and ML field since they usually offer only raw computing power. Proposed online system is an attempt to minimize required expert knowledge for automatic processing of microscopic image. In addition, online system could mitigate labelled data bottleneck through sharing of datasets and/or models for standardized tasks. We have developed a prototype for specific problem of recognising Foraminifera species. Foraminiferal species are morphospecies, defined according to their external morphological characteristics, primarily by wall structure, chamber and test shape, and the position of the aperture. Classification was developed in collaboration with micropaleontologists, following generic classification of Loeblich and Tappan [2] and Cimerman and Langer [3].

In this paper we describe typical DNN architecture for image classification task (section 2) and architecture of possible online service for building, using and sharing of such models between scientists in other fields (section 3). As use-case we present a prototype for microscopic images segmentation and classification of marine microorganisms (Foraminifera).

2. Image processing with deep neural networks

In this section we describe typical deep neural network (DNN in further text) approach for image classification task. Only recently some important research breakthroughs were made that enabled to train them effectively for many different image processing problems. We begin with digital image representation and typical low-level operations, then we describe feed-forward neural network and in the end we describe deep neural networks with convolutional and dense layers for image classification task.

Digital images are represented by a grid of pixels, each pixel describing intensity of image in that point. Pixels form three matrixes (Figure 1) that separately describe red, green and blue brightness (sometimes called channels). Other representations of image are possible, but this is most commonly used with convolutional neural networks since they can learn any other representation directly from RGB channels.

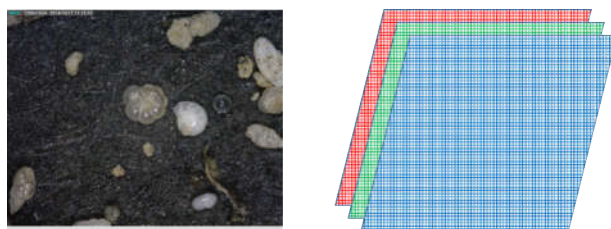


Figure 1 Representation of an image as separate RGB channels. Intensities of single pixels are limited to range 0-255. Each pixel is represented with 3 intensities.

Since individual pixels are usually meaningless it is hard to use them as predictors for simpler ML models. For this reason researchers have constructed different methods for extracting meaningful features from images. Besides global image statistics, different feature descriptors

have been proposed, like SIFT [4] or SURF [5] descriptors. These descriptors are applied at points of interest in image and can be used both for recognising particular images, objects or classes of objects. Another solution is to convolve image with features (filters) of interest to obtain statistics of feature presence or to obtain dense maps of features. Both solutions imply manual creation and selection of features appropriate for particular task. Also, these operations are expensive and usually only the beginning of some image processing task and some model still has to be built to operate on results of this operation.

Feed forward neural networks are one possible ML model that could theoretically provide “end-to-end” learning from raw pixels to image class and in past there has been many attempts to use them. Feed-forward neural networks (FFNN in further text) are composed of many small units (neurons) interconnected in a way to form flow of information in one direction. Basic unit is composed of weighted sum over inputs and non-linear activation function f (Figure 2). Weights are part of network parameters that have to be determined through training.

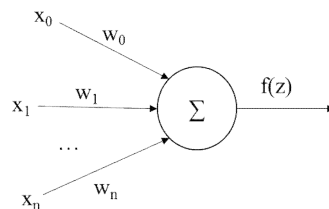


Figure 2 Single neuron is composed of weights and activation function. One of the weights is usually bias that always has input 1.0. Output of the neuron is the result of activation function applied on weighted sum of inputs.

In FFNNs neurons can be organized in layers and neurons in each layer usually receive input only from neurons in previous layer. First layer is receiving input vector, computes its output and passes it to the next layer. Last layer usually implements some regression or classification model (Figure 3).

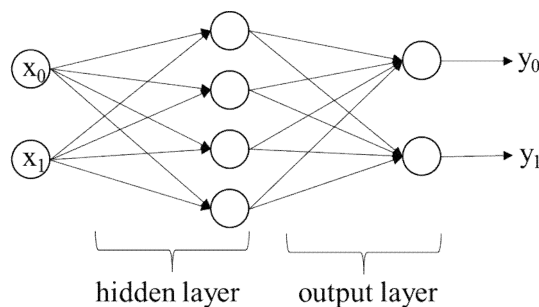


Figure 3 Two-layer feed-forward neural network with two inputs and two outputs.

In image processing first layers of DNN are often convolution layers, thus forming convolutional neural network (CNN). These layers basically consist of small FFNNs that are applied (and trained) across all pixels of single image. This operation equals to convolution of image with different filters. Highest responses to convolutions within small pixel neighbourhood are pulled and passed to next layer. This operation reduces amount of data that is processed by further layers while also enabling small spatial invariance. It was determined that these first few convolutional layers usually describe some simple image features (e.g. edges or corners) and vary little between different image domains. This opens possibility of reusing convolutional layers between different image processing tasks (transfer learning [6]). These networks usually have dozens of different hyperparameters (e.g. number of

convolutional and dense layers, convolution window width, learning parameters, etc.) that have to be determined in advance before training the final network. These hyperparameters can be determined by cross-validation but that usually requires extensive search in hyperparameters space and many training iterations. However, for large DNNs, any set of reasonable hyperparameters can usually produce acceptable model in terms of accuracy.

Training of FFNN consists of showing it samples of input-output pairs from some unknown distribution. For each pair we can calculate error $E(input)$ as squared difference between output of the network and desired output or some other convenient function of error. For hidden layers we propagate error backwards according to the estimate of how much each parameter contributed to the error. This process I known as backpropagation. Estimate of parameter contribution to the error is given by gradient with respect to model parameters: $dE(input)/dw$. So the algorithm for learning consists of choosing samples from true distribution that we're trying to model, showing it to the network and minimizing the error by moving in opposite direction of error gradient. This process is known as gradient descent and there are numerous variations of this basic algorithm (stochastic gradient descent). Most common variations repeatedly iterate trough some set of input-output pairs and adjust network parameters by some fraction of the error (standard gradient descent). This can be done by using small batches (like 100 samples) to calculate more stable mean gradient. Exact training regime depends on domain but in image classification domain it is usually done on fixed training set that is prepared and labelled in advance.

Gradient descent is also used to train deep neural networks but some practical problems arise. Since most neural networks use sigmoid output function, error that is backpropagated can vanish because of limited computer precision and first network layers learn slowly or don't learn at all. This problem was addressed in [7] and ReLU activation was proposed as solution. ReLU activation has simple form:

$$f(x) = \begin{cases} x & \text{for } x > 0 \\ 0 & \text{for } x \leq 0 \end{cases} \quad (1)$$

ReLU is still nonlinear activation function but its gradient is conserved better then with *sigmoid* or *tanh* functions. Another problem is that these deep models have high variance and thus can easily overfit the training data and perform poorly on new data points. This problem was addressed in different ways in the past. Usually this required to carefully choose model size and hyperparameters using cross-validation. Today, advice is to use model as large as time and hardware constraints permit and rely on other means to address overfitting. Most common ways are to add additional constraints to network parameters (e.g. regularization). For some domains (like image recognition) generation of additional training samples by distorting original samples can help also (data augmentation). Another method (dropout) to prevent overfitting was proposed in [8]. Core idea is to randomly disable parts of the network during training. This training regime effectively results in an ensemble of smaller networks that share some parameters. During prediction this network has much lower variance and this usually results in much better final model. In the end, aggregating several of these final models can also be aggregated in even larger, more robust model.

In conclusion, we can say that these recent findings allowed to train models more easily and with less human intervention. Another important factor that makes DNN models viable is widespread use of GPU units for execution of heavy calculations needed for training. Also, transferred learning enables us to reuse parts of the pre-trained DNN and fine-tune them for another similar problem. All of these findings can be incorporated in a system for automatic image processing with some limitations that we describe in next section.

3. Online image processing architecture

Manual processing of microscopic images can be very time consuming and repetitive. In many cases, results of such processing are summarized in statistic that describes some given sample. Good examples are identifying and counting foraminiferal species in samples of marine sediment, blood cell counting or mitosis detection on histology images. Manual processing can have serious drawbacks both in cost and accuracy (one of the problems faced by those studying foraminifera is inconsistent use of species and generic names). This leads to limited size of samples that can be processed. Automatic processing on other hand can be much faster but it can be expensive to develop a system for smaller specific domains. As it was described in previous section, DNNs offer couple of ways for reusing models in similar domains. While such models could be less accurate, if trained on small number of samples, they can compensate it with size of the test sample if task permits it. Centralizing and sharing models and image datasets could also improve accuracy for more common tasks. Basic architecture would be composed of web API accessible by browser based or desktop client application, image storage, models storage and computing instances for training and applying models (Figure 4).

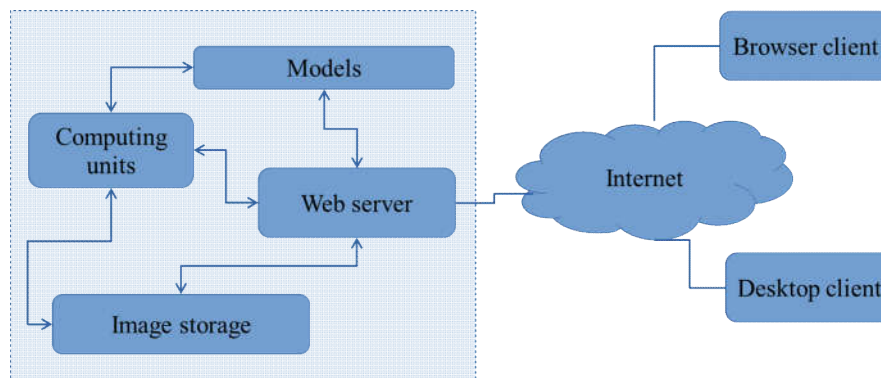


Figure 4 Proposed online image processing architecture.

Online nature of this architecture is essential for collaboration between users. Sharing trained models can be done by creating ensembles for specific tasks or by transferred learning. Sharing of datasets for training models could resolve one of the most serious bottle-neck of ML systems: scarcity of data. This collaboration could also lead to establishing standards for image acquisition and creation of new benchmark datasets. This wouldn't compromise privacy of datasets, since they would be only shared for training new models as extra data. Hardware requirements for such system in production would include GPU computing units to make CNN/DNN training viable. Since exact computing needs can be hard to anticipate in advance, we propose to rely on 3rd party resources like Amazon's GPU EC2 instances and S3 storage [9]. Since most of computing power is required only during model training, these instances could be allocated only occasionally while most of computing for applying models can be done on dedicated machines. Limitation of this approach is the need to transfer large quantities of data between server and clients. While this still remains an inconvenience, today this is not a large problem and can be mitigated with better client applications.

As a proof of concept, similar architecture was developed consisting of a single server machine relying on ad-hoc segmentation and simple linear model for classification task. Main goal was to build intuitive interface and workflow, while use of DNN models and managing more realistic quantities of data is left for future implementation. To test the usability of such interface we developed a prototype of this architecture specialized for segmentation and classification of foraminiferal species. It was developed in collaboration with micropaleontologists with no experience in ML and CV. Most of requirements were

concentrated on user interface for samples labelling and reporting results. Remained obstacle is still automatic acquisition of images since it would require specialized equipment (like in [10]). Task was to identify, classify and count foraminiferal individuals from microscopic images of marine sediment extracted from some area of interest. The results obtained in this way could be used for different purposes, like in petroleum exploration. Images were obtained by simple 5 megapixel CCD camera pointed at microscope ocular (Figure 5).



Figure 5 Microscopic image of foraminiferal specimens.

Images contained different foraminiferal specimens that were classified according to the wall type into three primary groups: agglutinated, calcareous porcelaneous and calcareous hyaline group (Figure 6). Training and testing samples (single foraminiferal individuals) were extracted automatically by ad-hoc algorithm. Extraction was done by thresholding and segmenting connected areas of appropriate size and shape. Several global shape and texture features were extracted and training and validation sets were created. For wall type classifications, linear model was trained on 100 images of single foraminiferal individuals. Other classifications were implemented but not largely tested. This simple model with relatively small training set was able to achieve above 60% accuracy.

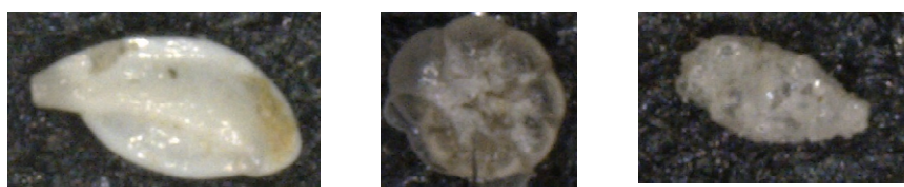


Figure 6 Three classes of foraminiferal wall type: porcelaneous, hyaline and agglutinated.

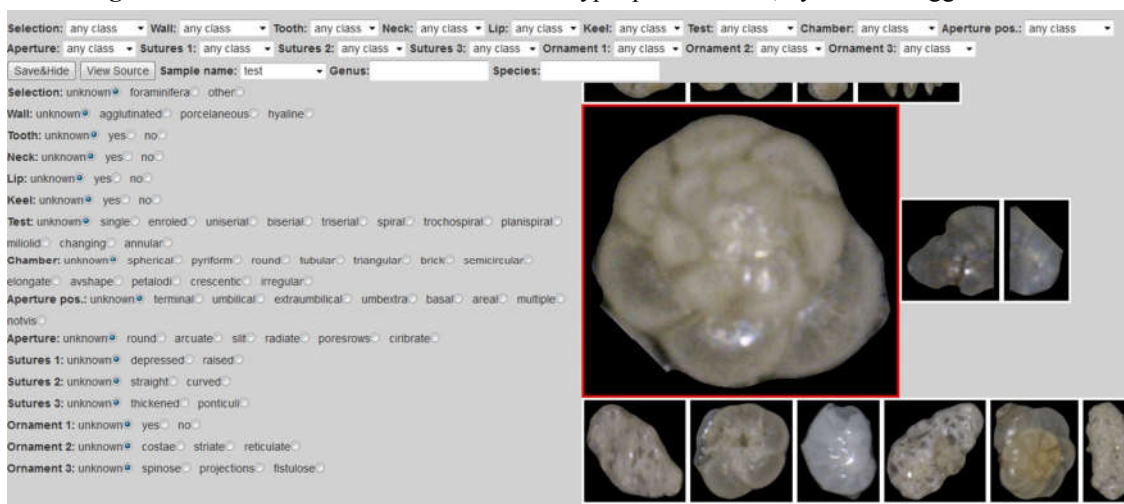


Figure 7 Inspection/manual correction of foraminiferal classification.

Agreed workflow consisted of uploading images, sending them for automatic segmentation, manually labelling images and training initial model. After training of initial model (on some smaller quantity of data), we can replace manual labelling of new data with automatic labelling and manual inspection of these labels. We implemented a simple interface tailored for that task but concluded that it should be replaced with more flexible design for general tasks. Inspection and correction of labels automatically increases training set and better model can be trained (Figure 7). Finally, simple statistical reports were made for datasets.

4. Conclusion and further work

We presented an online microscopic images processing architecture that relies on current advancements in ML and CV fields. Major breakthroughs in DNN enable us to (re)build different models with minimum adjustments. Datasets and models sharing is central for this architecture. Simplicity of use is one of primary concerns since system is intended for use in research outside ML and CV. Online nature of this architecture also facilitates assistance of ML experts. Simple prototype was developed as proof-of-concept for this architecture while DNN models were presented as a possible solution for more realistic implementation. Currently, we're implementing more general prototype that would rely on external services for DNN models training. Prototype will implement separate workflows for image segmentation, classification and detection tasks.

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Modeliranje koncepata i podataka za nastavni plan područja računarstva

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Sažetak. Planiranje i izrada kurikuluma važan su dio obrazovnog procesa. Kurikulum za područje računarstva treba biti osmišljen tako da studentima pruži znanja iz više područja, poput operacijskih sustava, programskih jezika, informacijskih sustava, inteligentnih sustava, sigurnosti mreža i komunikacije i slično. Kroz obrazovni proces studente treba pripremiti za razna zanimanja. Tako su, osim osnovnih informatičkih zanimanja poput programiranja, danas aktualna i zanimanja vezana za računalnu kemiju, ekoinformatiku ili bioinformatiku. Stoga kurikulum mora pružiti jasne i primjenjive ciljeve obrazovnog procesa uz mogućnost fleksibilnih programa obrazovanja koji se mogu prilagoditi stalnim promjenama na tržištu rada. Uz to, nastavni planovi moraju pripremiti studente za cjeloživotno obrazovanje, moraju sadržavati elemente stručne prakse i iskustva u komunikaciji, timskom radu i etici te moraju naučiti studente da prepoznaju važnost apstrakcije kako bi bili u stanju objediniti teoriju i praksu.

U ovom radu prikazan je postupak raščlanjivanja osnovnih koncepata područja računarstva kao što su: područja znanja i njihovi dijelovi, kolegiji i nastavne jedinice, ishodi učenja te radna mjesta i potrebne vještine. Dizajniran je model podataka i implementiran ogledni skup podataka kurikuluma računarstva. Izrađeno je nekoliko primjera upita kojima se mogu dobiti informacije o ciljevima i ishodima učenja, traženim kompetencijama na tržištu rada te mogućnosti studenata da se zaposle i mogućnosti poslodavaca da dobiju kandidate s potrebnim znanjem i vještinama. Model koncepata oblikovan je pomoću alata za prikaz znanja preko konceptualnih grafova, a podaci i upiti oblikovani su i izrađeni u relacijskoj bazi podataka.

Ključne riječi: modeliranje koncepata, modeliranje podataka, kurikulum, područje računarstva

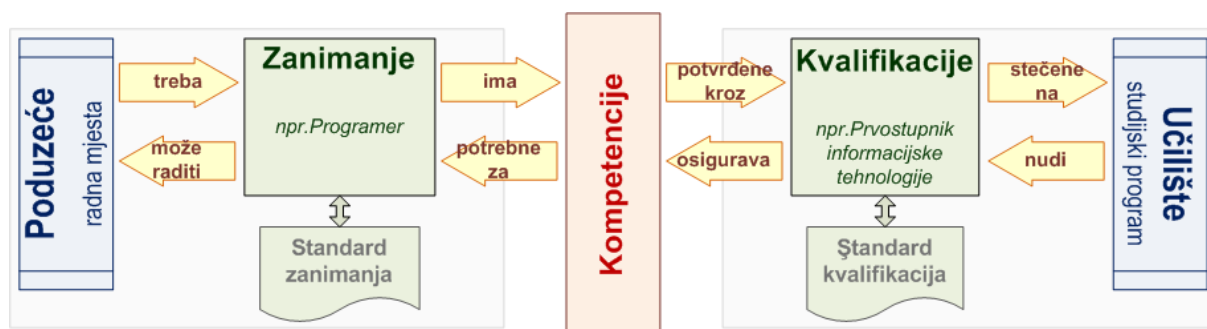
1. Uvod

Obrazovanje i znanost u RH su od posebnog javnog interesa. Obrazovanje je jedan od najvažnijih razvojnih prioriteta s obzirom na dinamičnost promjena u društvu, gospodarstvu i kulturi, a naročito globalizaciju i primjene novih tehnologija koji se s uspjehom mogu rješavati samo uz pomoć znanosti [1]. Obrazovni sustav i tržište rada moraju međusobno surađivati jer će jedino tako pridonijeti razvoju gospodarstva, odnosno društva. Na slici 1 opisan je koncept povezivanja tržišta rada i procesa obrazovanja [2]. Hrvatski kvalifikacijski okvir¹ - HKO ima zadatak osigurati povezivanje između kompetencija koje opisuju zanimanja pojedinih radnih mjesta u poduzeću i kvalifikacija koje se stječu u obrazovnim programima. Kvalifikacija je naziv za objedinjene skupove ishoda učenja² određenih razina, obujma, profila, vrste i kvalitete, a dokazuje se svjedodžbom, diplomom ili drugom javnom ispravom

¹ Hrvatski kvalifikacijski okvir je reformski instrument kojim se uređuje cjelokupni sustav kvalifikacija na svim obrazovnim razinama u Republici Hrvatskoj kroz standarde kvalifikacija temeljene na ishodima učenja i usklađene s potrebama tržišta rada, pojedinca i društva u cjelini. <http://www.kvalifikacije.hr/>

² Ishodi učenja su kompetencije koje je osoba stekla učenjem i dokazala nakon postupka učenja. [3]

koju izdaje ovlaštena pravna osoba [3]. Stoga je težnja da obrazovni programi stvaraju ishode učenja koja su temelj za podršku ključnim poslovima na odgovarajućim radnim mjestima.



Slika 1. Povezivanje potreba tržišta rada i obrazovanja [1]

Treba napomenuti kako proces izrade standardnih kvalifikacija (a što je zadatak HKO-a) započinje od definiranja zanimanja po sektorima u privredi i ispitivanja u kojim djelatnostima se zapošljavaju osobe s tim zanimanjima (uz anketiranje poslodavaca) [2]. Zatim se definiraju kompetencije³ i skupovi kompetencija potrebne za prepoznata zanimanja na temelju kojih se izrađuju ishodi učenja i skupovi ishoda učenja⁴ koji postaju dijelom obrazovnih programa. Standardi bi trebali osigurati kvalitetu i garantirati iste ishode učenja za iste kvalifikacije [2].

Drugo poglavlje ovog rada opisuje ukratko osnovne elemente obrazovnog procesa i potreba tržišta rada s naglaskom na kvalifikacije koje povezuju ova dva subjekta. Izrađen je konceptualni model s primjerima koncepata i veza među konceptima za studij informacijske tehnologije (računarstva).

U trećem poglavlju prezentiran je model podataka sustava obrazovanja vezano za nastavni plan (kurikulum). Za neke segmente organiziranja i praćenja uspješnosti obrazovnog procesa osmišljen je prototip s upitima nad podacima. Rezultat upita prikazuje odnos nastavnih cjelina i područja znanja koje je u njima zastupljeno, a također i razinu odgovarajućih ishoda učenja.

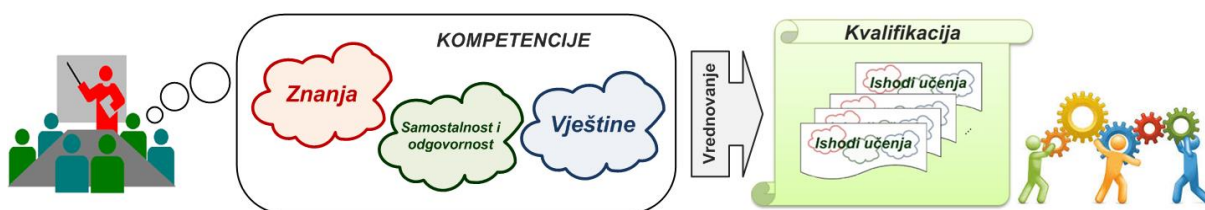
U četvrtom zaključnom poglavlju dan je osvrt na pojavljivanje ishoda učenja u procesu obrazovanja i potreba tržišta rada. Cilj je ukazati na potencijal programskih rješenja (jednog ili više informacijskih sustava) koji se mogu povezati preko odgovarajućih standarda kvalifikacija i radnih mjesta i tako pravovremeno pomoći svim sudionicima u donošenju kvalitetnih poslovnih odluka.

2. Koncepti obrazovnog procesa i njihova veza s tržištem rada

Prema slici 1, kompetencije su točka u kojoj se susreću kvalifikacije koje je osoba stekla učenjem i završenim obrazovanjem s jedne strane te s druge strane zanimanja koja su potrebna poduzećima, a za koja se traže određene kompetencije. Na slici 2 prikazan je s lijeva na desno proces obrazovanja u kome se stječu kompetencije poput određenih znanja i vještina koje se vrednuju preko ishoda učenja koji su, nadalje, sastavni dio potvrde (dokumenta) o kvalifikacijama nakon završenog obrazovanja s kojom osoba može tražiti posao na tržištu rada.

³ Kompetencije su znanja i vještine te pripadajuća samostalnost i odgovornost. [3]

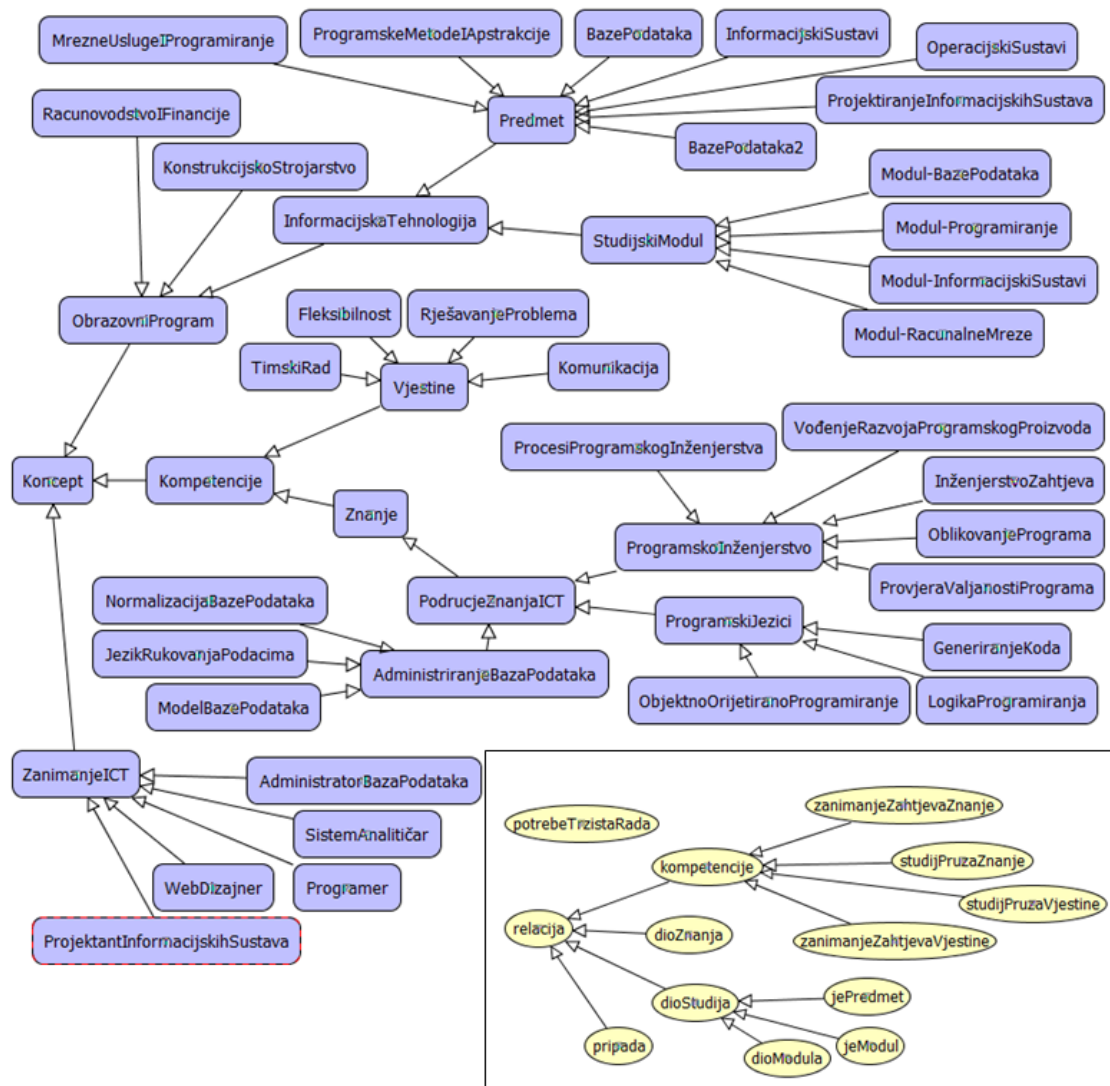
⁴ Skup ishoda učenja je najmanji cjelovit skup povezanih ishoda učenja iste razine, obujma i profila. [3]



Slika 2. Osnovni elementi kvalifikacija [5]

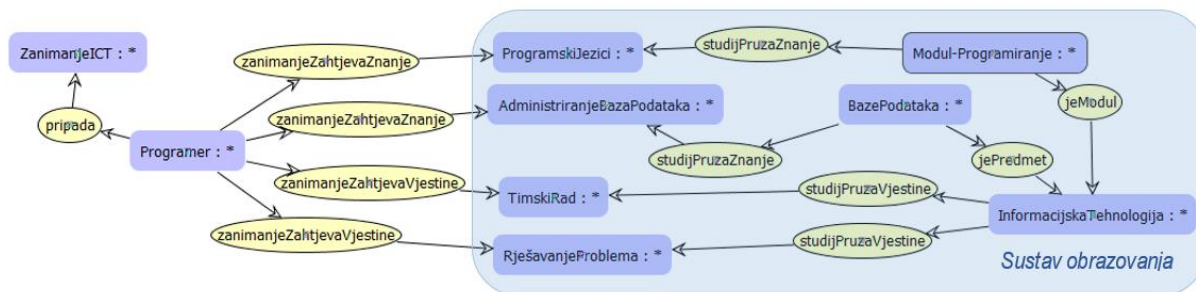
2.1 Konceptualno modeliranje obrazovanja i potreba tržišta rada

Model sustava obrazovanja i njegovih osnovnih elemenata poput studijskih programa, pripadajućih predmeta i kompetencija prikazan je na primjeru studija informacijske tehnologije (IT), studijskih modula i nekoliko oglednih predmeta (slika 3). Model je izrađen tehnikom modeliranja koncepata u alatu Cogui [6]. Da bi priča bila zaokružena, u modelu je nabrojano i nekoliko osnovnih zanimanja iz područja IT. Uz model koncepata (naziva se i taksonomija koncepata) nužno je modelirati i relacije među konceptima koje opisuju prirodu njihove povezanosti (slika 3).



Slika 3. Koncepti sustava obrazovanja i pripadajuće relacije

Na temelju taksonomije konceptata i taksonomije relacija mogu se graditi pravila povezanosti, poput konceptualnog grafa [7] na slici 4. Ovaj graf opisuje odnos između obrazovanja, kompetencija i zanimanja (slika 1.) povezano preko primjera studija *Informacijske tehnologije* i zanimanja *programera*.



Slika 4. Konceptualni graf za primjer studija IT i znanja i vještina koje pruža za zanimanje *programera*

U nastavku rada predložen je prototip modela podataka za opseg promatranog područja, a to je sustav obrazovanja (desni dio slike 4). Prepoznati su osnovni dijelovi tog sustava: nastavni planovi studijskog programa, eventualno modula unutar studija i pojedinačnih predmeta. Nastavni plan treba povezati s kompetencijama, a prema dosadašnjoj analizi to povezivanje treba ostvariti preko ishoda učenja. Pogledajmo kako je to zadano u dokumentu *Strategije obrazovanja, znanosti i tehnologije*.

2.2 Ciljevi obrazovnog sustava

Strategija obrazovanja, znanosti i tehnologije [1] u domeni visokog obrazovanja navodi nekoliko ciljeva koje treba implementirati u nastavni proces, prvenstveno kroz prilagodbu nastavnog plana i proširenje elementima ishoda učenja. Evo primjer dva zanimljiva cilja (djelomično izdvojeno iz originala [1]) koji se mogu implementirati u programsko rješenje za poboljšanje obrazovnog sustava:

- 1) Prilagoditi sadržaje studijskih programa jasno definiranim ishodima učenja – treba zadati jasne i provjerljive ishode učenja na svim razinama studijskog programa koji trebaju biti potvrđeni odgovarajućom kvalifikacijom.
- 2) Utemeljiti razlikovanje sveučilišnih, odnosno stručnih studijskih programa isključivo na transparentnim verificiranim kompetencijama – na stručnim studijima prevladavaju stručni nastavni sadržaji kojima se usvajaju vještine, a na sveučilišnim studijima prevladavaju sveučilišni nastavni sadržaji kojima se pretežno usvajaju (teorijska) znanja. Stručni bi studiji trebali biti fleksibilniji tako da mogu brzo odgovarati na kratkoročne zahtjeve tržišta.

Razmišljajući kao informatičari, ova dva cilja možemo protumačiti kao glavne korisničke zahtjeve visoke razine koji definiraju skup funkcionalnosti programskog rješenja. Prvi cilj je temeljni za modeliranje baze podataka u koju bi se evidentirali svi elementi obrazovnog procesa. Drugi cilj je više strateškog karaktera jer je potrebno realizirati prvi cilj da bi se kroz lepezu upita nad osnovnim podacima dobila pregledna izvješća koja bi služila za poboljšanje obrazovnog procesa i donošenje strateških odluka. Pogledajmo prijedlog realizacije ova dva navedena cilja.

3. Model prototipa nastavnog plana studija Informacijske tehnologije

Modeliranje podataka započinje definiranjem osnovnih entiteta poput popisa predmeta i oblika održavanja nastave, popisa kategorija znanja (područja i pripadajuće jedinice znanja⁵) i slično. Nakon toga će biti zadana glavna skupina podataka koja prikazuje nastavne cjeline za pojedini predmet podijeljene po tjednima održavanja nastave. Nastavnim cjelinama će se dodijeliti jedinice znanja pomoću kojih će biti moguće praćenje nastavnog plana po područjima znanja za pojedini predmet, ali i na razini studija (ili neke druge podjele). Na kraju će ishodi učenja povezati jedinice znanja i nastavne cjeline. Tako se otvara niz mogućnosti praćenja obrazovnog procesa i njegovih dijelova kroz ishode učenja i pripadajuća područja znanja (kompetencija). U nastavku su detaljnije opisani elementi modela podataka i preglednih izvješća.

3.1 Osnovni entiteti nastavnog plana

Osnovni entiteti baze podataka nastavnog plana (za područje računarstva, odnosno informacijske tehnologije *Sveučilišnog odjela za stručne studije Sveučilišta u Splitu*) prikazani su na slici 5. To su podaci o: predmetima, području znanja i jedinicama znanja, oblicima nastave i razinama ishoda učenja.

Predmet				
ID_predmeta	naziv_predmeta	Kratki	ECTS	ID_studija
SIT010	Uvod u programiranje	UPROG	8 RC	
SIT013	Programske metode i apstrakcije	PMA	8 RC	
SIT014	Baze podataka	BP	6 RC	
SIT015	Informacijski sustavi	INFS	6 RC	
SIT022	Mrežne usluge i programiranje	MUP	5 RC	
SIT025	Projektiranje informacijskih sustava	PIS	5 RC	

Oblik_nastave	
ID_oblik	naziv_oblika_nastave
1	Predavanja
2	Auditorne vježbe
3	Laboratorijske vježbe
4	Seminarski rad
5	Terenska nastava

Jedinica_znanja		
ID	ID_podrucja_znanja	naziv_jedinice_znanja
1	Programski jezici	Objektno-orijentirano programiranje
2	Programski jezici	Generiranje koda
3	Programski jezici	Logika programiranja
4	Programski jezici	Formalna semantika
5	Programski jezici	Funkcijsko programiranje
6	Programski jezici	Sekvencijalno programiranje
7	Programski jezici	Proceduralno programiranje
8	Programsko inženjerstvo	Inženjerstvo zahtjeva
9	Programsko inženjerstvo	Procesi programskog inženjerstva
10	Programsko inženjerstvo	Vođenje razvoja programskog proizvoda
11	Programsko inženjerstvo	Oblikovanje programa
12	Programsko inženjerstvo	Izrada programa
13	Programsko inženjerstvo	Provjera valjanosti programa
14	Programsko inženjerstvo	Pouzdanost programa
15	Baze podataka	Sustav za upravljanje bazom podataka
16	Baze podataka	Jezik rukovanja podacima
17	Baze podataka	Normalizacija baze podataka
18	Baze podataka	Model baze podataka

Područje_znanja		
ID_pr	podr	podrucje_znanja_naziv
1	ASP	Algoritmi i strukture podataka
2	PJ	Programski jezici
3	PI	Programsko inženjerstvo
4	AR	Arhitektura računala
5	BP	Baze podataka
6	UI	Umjetna inteligencija
7	RG	Računalna grafika
8	ICR	Interakcija čovjeka i računala
9	PDS	Paralelni i raspodijeljeni sustavi

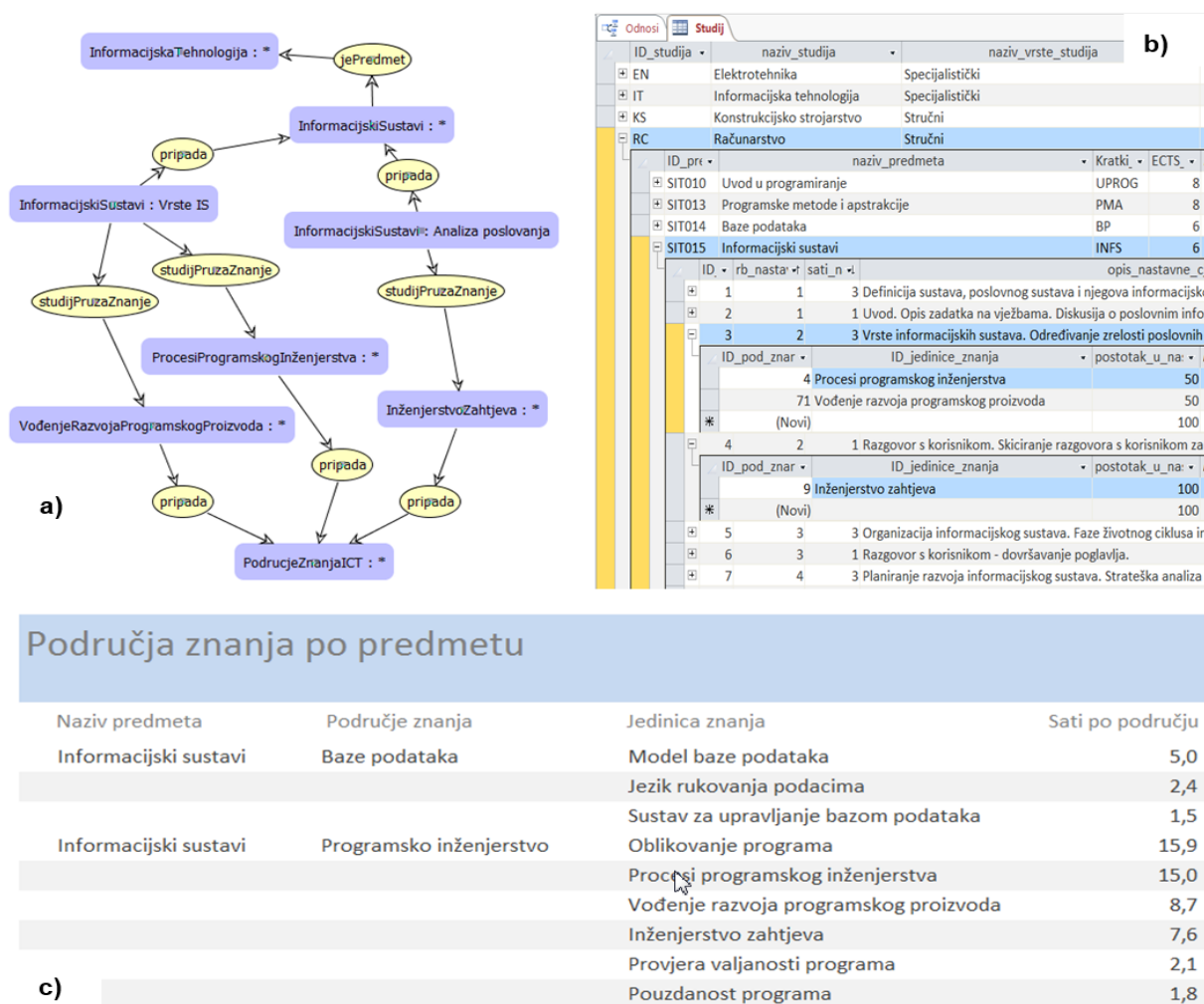
Razina_ishoda_učenja		
ID	naziv_razine	opis_razine_ishoda_učenja
1	Pamćenje	pamćenje i dosjećanje informacija, prisjećanje
2	Razumijevanje	shvaćanje, sposobnost organiziranja i uređivanja, razumijevanje onoga što je pročitano, slušano
3	Primjenjivanje	upotrebljavanje čeg koncepta za rješenje problema
4	Analiziranje	raščlamba na sastavnice u svrhu prilagodbe novim informacijama
5	Sintetiziranje	povezivanje dijelova ili ideja u cjelinu, iskazivanje originalnosti
6	Vrednovanje	ocjena vrijednosti nečega/nekoga
7	Kreiranje	kao 5. Sintetiziranje - misli sa na novo

Slika 5. Osnovni entiteti i primjeri podataka nastavnog plana

⁵ U ovom primjeru prototipa programskog rješenja za kompetencije je, radi jednostavnosti, uzeta samo kategorija znanja.

3.2 Praćenje važnih funkcionalnosti obrazovnog procesa

Na slici 6a) zadan je konceptualni graf koji povezuje predmet *Informacijski sustavi* na studiju IT s odgovarajućim kompetencijama; to je područje znanja *Programskog inženjerstva*. Desni dio slike 6b) prikazuje primjer podataka u bazi gdje se uz zadane koncepte vodi i podatak o postotku udjela pojedinog područja znanja u jednoj nastavnoj cjelini. Uz pomoć takve mjere moguće je kroz izvješće *Područja znanja po predmetu* dobiti udio pojedinog područja znanja u održanim satima, slika 6c). Naravno da je uz odgovarajući algoritam moguće taj podatak prevesti u ECTS bodove. Kada bi se nastavne cjeline i znanje u ostalim predmetima mjerili na isti način mogli bi na kraju obrazovanja dobiti udio pojedinog područja znanja u cjelokupnom studiranju. To je prvi korak k postizanju kompetencija koje se traže na tržištu rada jer se lako može usporediti koje kompetencije pruža studij, a koje se traže na tržištu rada.



Slika 6. Povezivanje nastavnih cjelina i područja znanja

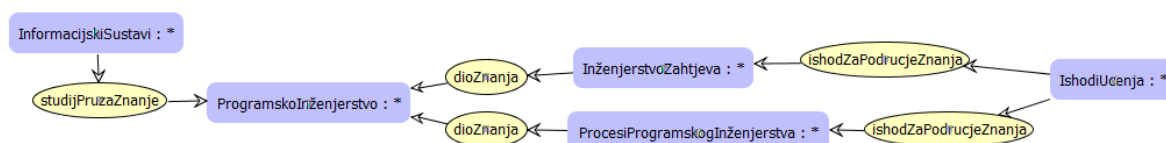
3.2.1 Proširenje podataka s ishodima učenja

Daljnja usporedba dobiva još jednu dimenziju proširenjem postavljenog modela s ishodima učenja. Ako se definiraju ishodi učenja na razini predmeta onda se može dobiti pregled kao na slici 7. Ako grupiramo predmete prema područjima znanja pa kažemo da se predmet *Informacijski sustavi* i *Projektiranje informacijskih sustava* nalaze uglavnom u području znanja *Programskog inženjerstva* onda možemo pomoću izvješća sa slike 7 usporediti koliko su ishodi učenja usklađeni.

Ishodi učenja po predmetu			
Šifra predmeta	Naziv predmeta	Razina ishoda učenja	Ishodi učenja za predmet
SIT015	Informacijski sustavi	Pamćenje	1-Definirati temeljne pojmove, modele i oblike upravljanja unutar procesa razvoja informacijskog sustava.
		Razumijevanje	2-Opisati i oblikovati načine prepoznavanja i specifikacije zahtjeva za programskim rješenjem.
		Primjenjivanje	3-Prikazati slijed i namjenu procesa modela informacijskog sustava.
		Analiziranje	4-Povezati područja i pristupe u oblikovanju arhitekture informacijskog sustava.
		Sintetiziranje	5-Izabranim aktivnostima razvoja informacijskog sustava pridijeliti uloge i područja izrade programskog rješenja.
			5-Predložiti model i aktivnosti životnog ciklusa razvoja informacijskog sustava.
SIT025	Projektiranje informacijskih sustava	Pamćenje	1-Definirati temeljne pojmove, modele i oblike ciklusa projektiranja informacijskog sustava.
		Razumijevanje	2-Opisati i oblikovati načine prepoznavanja i specifikacije zahtjeva cilja i opsega informacijskog sustava, te njegovih funkcionala
		Primjenjivanje	3-Prikazati vrste i namjenu modela razvoja i projektiranja informacijskog sustava.
		Analiziranje	4-Povezati područja i pristupe u projektiranju i izradi informacijskog sustava.
		Sintetiziranje	5-Izabranim aktivnostima projektiranja informacijskog sustava pridijeliti područja izrade programskog rješenja.
			5-Predložiti metodu i modele i razvoja i projektiranja informacijskog sustava.

Slika 7 Ishodi učenja za pojedini predmet

Predložena usporedba je prihvatljiva ako pregledavamo ograničenu količinu informacija, poput ovo primjera koji se odnosi na dva predmeta. Pregledi koji bi nam pružili usporedbu znanja i/ili ishoda učenja na razini cijelog studija, modula na koje je studij podijeljen, godina studiranja i slično, zahtijevaju međusobno povezivanje elemenata obrazovnog procesa i unošenje velikog broja podataka. Složenost takvog programskog rješenja nadilazi opseg ovog rada. Ipak, možemo pogledati primjer povezivanja područja znanja i ishoda učenja na razini koncepata kao na slici 8.



Slika 8. Primjer povezivanja koncepata znanja i ishoda učenja

Ako se povezivanje među konceptima na slici 8. realizira preko nastavnih cjelina za pojedini predmet onda se mogu dobiti pregledi strukturirani u raznovrsnim hijerarhijama, ovisno o potrebi analiziranja elemenata sustava obrazovanja. Jedan primjer je i izvješće na slici 9, koje pokazuje ishode učenja grupirane prema područjima znanja.

Znanje i ishodi učenja za predmet		
Šifra i naziv predmeta	Područje i jedinice znanja	Ishodi učenja predmeta i po jedinici znanja
SIT01	Informacijski sustavi	
	Programsko inženjerstvo	
	Inženjerstvo zahtjeva	
		1-Definirati temeljne pojmove, modele i oblike upravljanja unutar procesa razvoja informacijskog sustava. Navedi ključne komponente kod opisa poslovanja potrebne za model IS-a Prepoznati funkcionalne i nefunkcionalne zahtjeve u primjeru specifikacije zahtjeva
		3-Prikazati slijed i namjenu procesa modela informacijskog sustava. Primijeniti ključne elemente i zajedničke metode u fazi analize kako bi se izradili zahtjevi za SW srednje veličine Provesti reviziju skupa funkcionalnih zahtjeva kako bi se odredila kvaliteta novog programa
	Procesi programskog inženjerstva	
		1-Definirati temeljne pojmove, modele i oblike upravljanja unutar procesa razvoja informacijskog sustava. Opisati komunikaciju programskog rješenja s ostalim funkcionalnostima poslovanja
		2-Opisati i oblikovati načine prepoznavanja i specifikacije zahtjeva za programskim rješenjem. Opisati važne prednosti i nedostatke nekoliko osnovnih modela razvoja (vodopadni, iterativni, agilni)
		3-Prikazati slijed i namjenu procesa modela informacijskog sustava. Navedi razlike među fazama razvoja IS-a Usporediti nekoliko zajedničkih modela procesa obzirom na njihovu važnost u razvoju pojedinih vrsta programa
		4-Povezati područja i pristupe u oblikovanju arhitekture informacijskog sustava. Objasniti ulogu modela zrelosti procesa u poboljšanju procesa Usporediti nekoliko modela poboljšanja procesa poput CMM, CMML, ISO9000

Slika 9. Izvješće pregleda znanja i ishoda učenja za predmet *Informacijski sustavi*

3.2.2 Nastavne cjeline, ishodi učenja i područja znanja

Područjima i jedinicama znanja pridijeljeni su ishodi učenja razrađeni prema osnovnim razinama ishoda učenja [9] [10]. Slika 10. prikazuje razradu pojedine cjeline znanja na očekivane ishode učenja. Taj popis ishoda učenja zadan je za cijeli studij (eventualno za studijski modul). Pojedinom predmetu se po područjima znanja pridružuju podskupovi odgovarajućih ishoda učenja. Na kraju te ishode učenja pridružimo nastavnim cjelinama (i njihovim područjima znanja, slika 11) i tada dobivamo temelj za pretraživanje i zaključivanje na osnovu svih važnih elemenata procesa obrazovanja.

Područje znanja			
ID_	podr_	podrucje_znanja_naziv	ID_koncepta
1	ASP	Algoritmi i strukture podataka	Rac
2	PJ	Programski jezici	Rac
3	PI	Programsko inženjerstvo	Rac
ID_jedinice_znanja			
naziv_jedinice_znanja			
8 Inženjerstvo zahtjeva			
ID_	opis_ishoda_po_jed_znanja		
3	Opisati temeljne i zajedničke tehnike koje se koriste za prikupljanje zahtjeva		
4	Navesti ključne komponente modela podataka (ER model)		
5	Prepoznati funkcionalne i nefunkcionalne zahtjeve u primjeru specifikacije zahtjeva		
6	Provesti reviziju skupa funkcionalnih zahtjeva kako bi se odredila kvaliteta novog programa		
7	Primijeniti ključne elemente i zajedničke metode u fazi analize kako bi se izradili zahtjevi za SW srednje veličine		
8	Usporediti planski pristup i agilni pristup specifikaciji zahtjeva i opisati prednosti i rizike za svaki od njih		
9	Prevesti u prirodni jezik (pseudokod) specifikaciju korisničkih zahtjeva		

Slika 10. Povezivanje područja znanja i ishoda učenja

Nastavna cjelina					
ID_	ID_pretr_	rb_nast_	sat_	opis_nastavne_cjeline	
1	SIT015	1	3	Definicija sustava, poslovnog sustava i njegova informacijskog sustava. Organizacija poslovnog sustava.	
2	SIT015	1	1	Uvod. Opis zadatka na vježbama. Diskusija o poslovnim informacijskim sustavima u poduzećima i odabir teme projekta z	
3	SIT015	2	3	Vrste informacijskih sustava. Određivanje zrelosti poslovnih procesa i uspješnost informacijskog sustava.	
ID_pc_				ID_jedinice_znanja	postotak_u_nast_jedinici
				4 Procesi programskog inženjerstva	50
				ID_	ID_ishoda_po_jed_znanja
				7 Usporediti nekoliko modela poboljšanja procesa poput CMM, CMMI, ISO9000	
				8 Objasniti ulogu modela zrelosti procesa u poboljšanju procesa	
				* #####	
				71 Vođenje razvoja programskog proizvoda	50
				ID_	ID_ishoda_po_jed_znanja
				17 Koristiti alate za upravljanje razvojem IS-a te pratiti zadatke i resurse	
				* #####	
				(Novi)	100
4	SIT015	2	1	Razgovor s korisnikom. Skiciranje razgovora s korisnikom za pojedini projekt.	
				ID_pc_	ID_jedinice_znanja
				9 Inženjerstvo zahtjeva	100
				ID_	ID_ishoda_po_jed_znanja
				9 Prepoznati funkcionalne i nefunkcionalne zahtjeve u primjeru specifikacije zahtjeva	
				10 Primijeniti ključne elemente i zajedničke metode u fazi analize kako bi se izradili zahtjevi za SW srednje veličine	

Slika 11. Nastavne cjeline razrađene na područja znanja kojima se pridružuju odgovarajući ishodi učenja

Na slici 11 razrađene su nastavne cjeline predmeta na područja znanja (od prije slika 6b) kojima se onda dodatno pridružuju upravo oni ishodi učenja koji se odnose na ta područja znanja. Razrada ishoda učenja po područjima znanja trebala bi sadržavati potpuni skup ishoda učenja koja na kraju studija definiraju kompetencije završenog studenta. Kada bi cijeli nastavni plan bio razrađen do detalja onda bi se mogla pratiti evolucija svakog područja znanja i konačni rezultat bi definirao završene kvalifikacije (slika 2).

U nastavku su prikazani: (1) primjer pregleda znanja i pripadajućih ishoda učenja u odnosu na nastavne cjelina pojedinog predmeta (slika 12) i (2) primjer pregleda znanja i nastavnih cjelina pojedinog predmeta u odnosu na očekivane ishode učenja (slika 13).

Znanje - Ishodi učenja - Nastavne cjeline			
Šifra i naziv predmeta	Područje i jedinica znanja	Ishodi učenja po jedinici znanja	Nastavne cjeline predmeta
SIT015 Informatički sustavi	Programsko inženjerstvo		
	Inženjerstvo zahtjeva		
		1. Pamćenje - Navesti ključne komponente kod opisa poslovanja potrebne za model IS-a	1 Definicija sustava, poslovnog sustava i njegova informacijskog sustava. Organizacija poslovnog sustava.
		1. Pamćenje - Prepoznati funkcionalne i nefunkcionalne zahtjeve u primjeru specifikacije zahtjeva	2 Razgovor s korisnikom. Skiciranje razgovora s korisnikom za pojedini projekt.
		3. Primjenjivanje - Primijeniti ključne elemente i zajedničke metode u fazi analize kako bi se izradili zahtjevi za SW srednje veličine	2 Razgovor s korisnikom. Skiciranje razgovora s korisnikom za pojedini projekt.
		3. Primjenjivanje - Provesti reviziju skupa funkcionalnih zahtjeva kako bi se odredila kvaliteta novog programa	3 Razgovor s korisnikom - dovršavanje poglavlja.
	Procesi programskog inženjerstva		
		1. Pamćenje - Opisati komunikaciju programskog rješenja s ostalim funkcionalnostima poslovanja	1 Definicija sustava, poslovnog sustava i njegova informacijskog sustava. Organizacija poslovnog sustava.
		1 Uvod. Opis zadatka na vježbama. Diskusija o poslovnim informacijskim sustavima u poduzećima i odabir teme projekta za svakog st	
		2. Razumijevanje - Opisati važne prednosti i nedostatke nekoliko osnovnih modela razvoja (vodopadni, iterativni, agilni)	3 Organizacija informacijskog sustava. Faze životnog ciklusa informacijskog sustava.
		3. Primjenjivanje - Navesti razlike među fazama razvoja IS-a	3 Organizacija informacijskog sustava. Faze životnog ciklusa informacijskog sustava.
		3. Primjenjivanje - Usporediti nekoliko zajedničkih modela procesa obzirom na njihovu važnost u razvoju pojedinih vrsta programa	1 Definicija sustava, poslovnog sustava i njegova informacijskog sustava. Organizacija poslovnog sustava.
		4. Analiziranje - Objasniti ulogu modela zrelosti procesa u poboljšanju procesa	1 Uvod. Opis zadatka na vježbama. Diskusija o poslovnim informacijskim sustavima u poduzećima i odabir teme projekta za svakog st
		2 Vrste informacijskih sustava. Određivanje zrelosti poslovnih procesa i uspješnost informacijskog sustava.	
		4. Analiziranje - Usporediti nekoliko modela poboljšanja procesa poput CMM, CMMI, ISO9000	2 Vrste informacijskih sustava. Određivanje zrelosti poslovnih procesa i uspješnost informacijskog sustava.
	Vođenje razvoja programskog proizvoda		
		1. Pamćenje - Prepoznati i opravdati nužne uloge u timu razvoja IS-a	4 Planiranje razvoja informacijskog sustava. Strateška analiza poslovanja i preoblikovanje poslovnih procesa.
		3. Primjenjivanje - Koristiti alate za upravljanje razvojem IS-a te pratiti zadatke i resurse	4 Planiranje razvoja informacijskog sustava. Strateška analiza poslovanja i preoblikovanje poslovnih procesa.
		5. Sintetiziranje - Provesti analizu troškova i dobiti kako bi se umanjili rizici	4 Planiranje razvoja informacijskog sustava. Strateška analiza poslovanja i preoblikovanje poslovnih procesa.

Slika 12. Podjela znanja na ishode učenja te pridružene nastavne cjeline, po predmetima

Znanje - Nastavne cjeline - Ishodi učenja			
Šifra i naziv predmeta	Područje i jedinica znanja	Nastavne cjeline	Ishodi učenja po znanju i cjelinama
SIT015 Informatički sustavi	Programsko inženjerstvo		
	Inženjerstvo zahtjeva		
		1 Definicija sustava, poslovnog sustava i njegova informacijskog sustava. Organizacija poslovnog sustava.	
		1. Pamćenje - Navesti ključne komponente kod opisa poslovanja potrebne za model IS-a	
		2 Razgovor s korisnikom. Skiciranje razgovora s korisnikom za pojedini projekt.	
		1. Pamćenje - Prepoznati funkcionalne i nefunkcionalne zahtjeve u primjeru specifikacije zahtjeva	
		3. Primjenjivanje - Primijeniti ključne elemente i zajedničke metode u fazi analize kako bi se izradili zahtjevi za SW srednje veličine	
		3 Razgovor s korisnikom - dovršavanje poglavlja.	
		3. Primjenjivanje - Provesti reviziju skupa funkcionalnih zahtjeva kako bi se odredila kvaliteta novog programa	
	Procesi programskog inženjerstva		
		1 Definicija sustava, poslovnog sustava i njegova informacijskog sustava. Organizacija poslovnog sustava.	
		1. Pamćenje - Opisati komunikaciju programskog rješenja s ostalim funkcionalnostima poslovanja	
		3. Primjenjivanje - Usporediti nekoliko zajedničkih modela procesa obzirom na njihovu važnost u razvoju pojedinih vrsta programa	
		1 Uvod. Opis zadatka na vježbama. Diskusija o poslovnim informacijskim sustavima u poduzećima i odabir teme projekta za svakog studenta / grupu studenata	
		1. Pamćenje - Opisati komunikaciju programskog rješenja s ostalim funkcionalnostima poslovanja	
		4. Analiziranje - Objasniti ulogu modela zrelosti procesa u poboljšanju procesa	
		2 Vrste informacijskih sustava. Određivanje zrelosti poslovnih procesa i uspješnost informacijskog sustava.	
		4. Analiziranje - Objasniti ulogu modela zrelosti procesa u poboljšanju procesa	
		4. Analiziranje - Usporediti nekoliko modela poboljšanja procesa poput CMM, CMMI, ISO9000	
		3 Organizacija informacijskog sustava. Faze životnog ciklusa informacijskog sustava.	
		2. Razumijevanje - Opisati važne prednosti i nedostatke nekoliko osnovnih modela razvoja (vodopadni, iterativni, agilni)	
		3. Primjenjivanje - Navesti razlike među fazama razvoja IS-a	
	Vođenje razvoja programskog proizvoda		
		4 Planiranje razvoja informacijskog sustava. Strateška analiza poslovanja i preoblikovanje poslovnih procesa.	
		1. Pamćenje - Prepoznati i opravdati nužne uloge u timu razvoja IS-a	
		3. Primjenjivanje - Koristiti alate za upravljanje razvojem IS-a te pratiti zadatke i resurse	
		5. Sintetiziranje - Provesti analizu troškova i dobiti kako bi se umanjili rizici	

Slika 13. Podjela znanja po nastavnim cjelinama predmeta i pridruženi ishodi učenja

Složene usporedbe svih elemenata sustava obrazovanja koji su u ovom radu opisani mogu pružiti preglede sintetizirane na razini studija i stečenih kvalifikacija. Primjerice, u baznim predmetima nekog studija ishodi učenja mogu biti nižih razina (takozvani *lower order thinking* [11]), a onda se u predmetima viših godina uče detalji nekog područja uz povezivanje i korištenje znanja i tada se postižu više razine ishoda učenja po područjima (takozvani *higher order thinking* [11]). Pregledom područja znanja i dostignutih razina ishoda učenja moglo bi se zaključiti za koje kvalifikacije je student više, a za koje manje obrazovan. Dodavanjem dimenzije ECTS bodova dostignute razine mogu biti mjerene i u postotku.

Nadalje, iz literature [11], zanimljivo je kako se nad ovom dimenzijom kognitivnog procesa (*Cognitive Process Dimension*, odnosno podjela prema Bloomovoj taksonomiji, kakvu poznajemo u ovom radu [4]) može dodati takozvana dimenzija znanja (*Knowledge Dimension*). Tako se dimenzija znanja može klasificirati u četiri stanja: činjenično, konceptualno, proceduralno i metakognitivno znanje. Načelno bi se moglo reći da ta dimenzija znanja odvaja stručne sadržaje od teorijskih znanja. Sigurno bi bilo zanimljivo napraviti dodatnu analizu primjera u ovom radu uključivanjem i dimenzije znanja u praćenje obrazovnog procesa.

4. Zaključak

Za zaključak bi se mogli osvrnuti na pojavljivanje ishoda učenja u procesu obrazovanja i potreba tržišta rada [4]. Na početku procesa obrazovanja u nastavnom planu svrha praćenja ishoda učenja je utvrditi očekivanja od svake aktivnosti učenja. U postupku ocjenjivanja, ishodi učenja bi trebali osigurati homogenost u procjeni uspješnosti studenata. Sve ove elemente, zajedno s pružanjem informacija poslodavcu o kvalifikacijama kandidata na osnovu ishoda učenja opisali smo kroz jednostavni primjer/prototip programskog rješenja u ovom radu. Potreba i plan da se dobro definiraju kvalifikacije na razini cijelog sustava obrazovanja RH osnovni je cilj HKO-a [3], ali ne samo u Republici Hrvatskoj nego i na razini EU. I najvažniji zadnji korak u ovoj priči, ali prvi u procesu izrade HKO je standard zanimanja koji se može koristiti pri utvrđivanju kvalifikacija, prvenstveno u strukovnom obrazovanju. Time je još jednom naglašena povezanost s obrazovnim procesom koji treba biti u stanju brzo odgovoriti na potrebe tržišta rada prilagođavanjem svog nastavnog plana.

Primjer prototipa programskog rješenja razrađenog u ovom radu ukazuje na mogućnost povezivanja (jednog ili više) informacijskih sustava obrazovanja koji bi se mogli povezati preko odgovarajućih standarda kvalifikacija i radnih mjesta i tako pravovremeno pomoći svim sudionicima u donošenju kvalitetnih poslovnih odluka.

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Conceptual and Data Modeling for a Computer Science Curriculum

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Abstract. The stage of planning and creation of a Curriculum is an important step in the educational process. A Curriculum in Computer Sciences must be conceptualized in such a way that students acquire knowledge from various areas such as operational systems, programming languages, information systems, intelligent systems, communications and network security, etc. The educational process must prepare students for various professions. In addition to classical IT professions, today's IT related jobs include EcoInformatics or BioInformatics. Therefore the curriculum must offer a clear and applicable purpose of the educational process, including flexible educational programs that can be easily adjusted to the continuous changes in the job market. In addition, the curriculum must prepare students for life-long learning, including the on-hand work experience and communication skills, team work and ethics and teach them to appreciate the importance of abstraction in order to unify their theoretical and practical knowledge.

This paper describes the decomposition of key concepts of the field of Computing such as: knowledge domains and their parts, academic courses, learning objects and outcomes, as well as work places and required skills. A data model has been designed together with an experimental set of data describing the Computer Science Curriculum. Several queries have been constructed that can be used to obtain information on learning aims and outcomes, required competencies on the job market, and the ability of students to find employment, as well as the possibility that the employers find candidates that match the required skills and competencies. The conceptual model was designed with a tool for knowledge representation that uses conceptual graphs. Data and queries were designed and built in a relational database.

Key words: *conceptual modeling, data modeling, curriculum, Computer science*

Zelene metalne konstrukcije

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Sažetak. Razvoj današnjih metalnih konstrukcija, koje su sastavni dio modernih sve zahtjevnijih građevinskih konstrukcija, bazira se na tzv. zelenoj tehnologiji. Odgovarajući odabir materijala modernih građevinskih konstrukcija, te njihov utjecaj na energetske učinkovitost, a da se pri tome pridonosi zaštiti i očuvanju okoliša, svjetski je trend. Sve navedeno ima i svoju ekonomsku opravdanost. Naime, moderne građevinske konstrukcije na pojedinim objektima čine i 100% vanjske ovojnice. Kako je osnovni, tj. nosivi dio modernih građevinskih konstrukcija, metalna konstrukcija, ovim radom dat je njen značajan utjecaj na navedeno. Prikazan je postupak formiranja metalne konstrukcije statičkim proračunom, tj. odabir vrste materijala, najpovoljnijeg oblika poprečnog presjeka i njegovih geometrijskih karakteristika, tj. presjeka profila. Osim čelika kao osnovnog materijala metalnih konstrukcija, ovaj rad posebnu pažnju daje prednostima aluminija. Kako profili metalnih konstrukcija u arhitekturi moraju zadovoljiti i estetske kriterije tražene od strane glavnih projekatara građevinskih objekata, aluminij kao materijal je posebno zahvalan. U radu je prikazan i veliki utjecaj profila metalnih konstrukcija na toplinsku zaštitu objekta. Različiti materijali i profili imaju različite toplinske karakteristike. U završnom dijelu rada, na konkretnom primjeru, prikazano je sve navedeno, od statičkog proračuna, pa do odabira materijala i profila metalne konstrukcije. Posebno je prikazan utjecaj različitih vrsta materijala i profila na toplinsku zaštitu objekta. Prikazani rezultati pokazuju energetske učinkovitost i ekonomsku opravdanost. U radu su korišteni specijalizirani programi, Schuco Statik i SchuCal+. Korišteni su i rezultati laboratorijskih ispitivanja ovlaštenih ustanova.

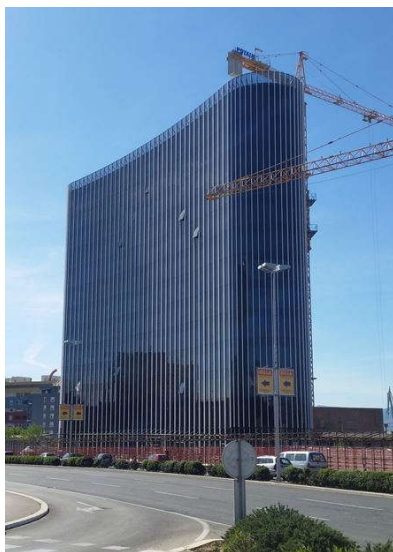
Ključne riječi: *metalna konstrukcija, zelena tehnologija, aluminij, profil, statika, toplinske karakteristike*

1. Uvod

Metalnu konstrukciju i sve njezine komponente, kao i vanjsku oblogu, treba dimenzionirati na način da može izdržati sva eksploatacijska opterećenja. Statički proračun metalne konstrukcije obuhvaća: nosivost vertikalnih nosača (profila), nosivost oslonaca (čeličnih sidara ugrađenih u AB konstrukciju), dimenzioniranje sidrenih vijaka, dimenzioniranje nastavaka nosača, proračun metalne konstrukcije AB parapeta atike i proračun obloge. U nastavku je prikazan odabir nosivog vertikalnog nosača, tj. odabir vrste materijala, najpovoljnijeg oblika poprečnog presjeka i njegovih geometrijskih karakteristika.

Kako se rad bazira na metalnim konstrukcijama koje pretežno za nosive vertikalne nosače imaju profile izrađene iz aluminija, a obloga je ostakljenje, ove konstrukcije u praksi imaju naziv aluminijske ostakljene fasadne konstrukcije. S obzirom na navedeno, aluminijska ostakljena fasadna konstrukcija često je i vanjska ovojnica modernih građevinskih konstrukcija (slika 1.).

Aluminijski profili koji se koriste za nosive vertikalne nosače modernih građevinskih konstrukcija dobivaju se procesom ekstrudiranja. Ekstrudirani aluminijski proizvodi čine više od 30% tržišta aluminijskih proizvoda u Europi, od čega se najveći dio pored građevinske koristi i u auto, željezničkoj, avio i brodo industriji. Ekstrudiranje je proces kojim se zagrijani cilindrični komad aluminija (tzv. trupac) presa kroz oblikovanu čeličnu matricu koja daje proizvod (profil) traženog poprečnog presjeka. Glavna prednost ekstrudiranja je široka mogućnost ponude različitih oblika i presjeka profila bez dodatne mehaničke obrade. Najveći udio na tržištu ekstrudiranih aluminijskih profila zauzimaju legure serije EN AW 6000 (AlMgSi). Legirani aluminij ima bolja mehanička svojstva, čvrstoća je 150-350 MPa, a sve sa dobrom žilavošću i sposobnošću oblikovanja. Široku primjenu imaju i legure serija EN AW 6060 i EN AW 6063 koje se mogu lako prešati. Sadrže nizak % Si i Mg, pa se prešaju brzinama i do 100 m/min sa dobrom kvalitetom površine. Profili mogu imati veliku složenost u kombinaciji sa veoma malim debljinama stjenki poprečnog presjeka. Lakoća s kojom se aluminijske legure mogu ekstrudirati u vrlo složene oblike glavna je prednost u odnosu na čelične profile koji zahtijevaju dodatnu mehaničku obradu. Ova prednost omogućuje projektantima da postignu željenu estetiku konstrukcije, uz uštedu materijala. Postignuta fleksibilnost u dizajnu u mnogim slučajevima nadvladava glavni nedostatak aluminijskih legura u odnosu na čelik, a to je čvrstoća. Međutim, kako čvrstoća ne ovisi samo o modulu elastičnosti E ($E_{Al \text{ legure}} = 1/3 E_{\text{č}}$), već i o geometriji poprečnog presjeka, moguće je npr. pažljivim projektiranjem poprečnog presjeka postići s aluminijskim nosačem koji ima samo 1,5 puta veći poprečni presjek, istu nosivost kao i s čeličnim nosačem 2 puta veće težine, s obzirom na otpornost konstrukcije deformiranju. Uz malo veće troškove za složeniju matricu, dobiva se oblik profila koji ima bolju uvojnu krutost. Dakle, osim što imaju nisku specifičnu težinu koja pruža velike prednosti u mnogim industrijskim aplikacijama, i ostale karakteristike idu u prilog aluminijskim legurama u odnosu na čelik, kao što su: dugi životni vijek, otpornost na koroziju (prirodni sloj zaštitnog oksida može biti povećan anodiziranjem, eloksiranjem - sloj oksida je 5-25 μm), dobra obradivost i oblikovanje, mogućnost zavarivanja..., a naknadnom toplinskom obradom poboljšavaju se mehanička svojstva. Aluminijske legure široko su dostupne i relativno jeftine.



Slika 1 West Gate (vanjska ovojnica)

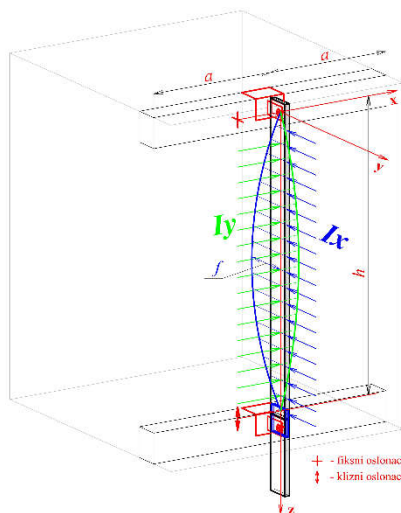
U današnjoj arhitekturi aluminijski profili čine osnovni dio modernih građevinskih konstrukcija. Zahtjevi za energetsom učinkovitosti uz zaštitu i očuvanje okoliša sve su veći.

Europski cilj za građevinske objekte, tzv. 20/20/20 je: 20% manja potrošnja energenata direktno vezanih uz emisiju CO₂, 20% potrošnje energije pokrivati kroz obnovljenu energiju i 20% redukcija ukupne potrošnje energije, dok je za novogradnje 2020. godina, godina proizvodnje vlastite energije. Postavljeni cilj ima veliki utjecaj na svakodnevni razvoj novih sistema aluminijskih ostakljenih fasadnih konstrukcija. Novi sistemi imaju veliki doprinos u uštedi energije (poboljšavaju toplinsku zaštitu objekta) i smanjenju emisije CO₂. Veliki značaj u tome ima nova generacija nosivih aluminijskih profila. Zbog sve većeg doprinosa ovih metalnih konstrukcija na navedeno nazivamo ih zelene metalne konstrukcije.

2. Statički proračun vertikalnog nosača

Proračun vertikalnog nosača podrazumijeva odabir vrste materijala, najpovoljnijeg oblika poprečnog presjeka i njegovih geometrijskih karakteristika. Da bi to bilo moguće potrebno je izvršiti proračun opterećenja, koji za nosive vertikalne nosače aluminijskih ostakljenih fasadnih konstrukcija ima sljedeći redoslijed (slika 2.):

- Proračun promjenjivog opterećenja – momenta inercije I_x (savijanje), i
- Proračun stalnog opterećenja – momenta inercije I_y (izvijanje).



Slika 2 Opterećenje vertikalnog nosača

2.1 Proračun promjenjivog opterećenja

Proračun promjenjivog opterećenja obuhvaća:

- proračun opterećenja djelovanjem vjetra (prema HRN ENV 1991-2-4, EN 1991-1-4), i
- proračun opterećenja djelovanjem snijega (prema HRN ENV 1991-2-3, EN 1991-1-3).

Radom je obuhvaćen proračun opterećenja djelovanjem vjetra (tlak i podtlak). Za krovne konstrukcije proračun opterećenja morao bi se proširiti na proračun opterećenja djelovanjem snijega.

Djelovanje vjetra uz potresno djelovanje čini dominantno horizontalno djelovanje kojima su izložene konstrukcije ili građevine u svom vijeku trajanja [8]. Prihvatanjem europskih norma za projektiranje konstrukcija, Republika Hrvatska je prihvatila i načelo da u pojedine norme ugradi nacionalne specifičnosti koje se ponajprije odnose na prirodne pojave, tj. da izradi posebne dodatke za pojedinu normu s definiranim nacionalnim parametrima, pa je 2005. u

okviru pred norme „HRN ENV 1991-2-4:2005 Djelovanja na konstrukcije - Opterećenje vjetrom“ definirala „Nacionalni dokument za primjenu“ - NAD, tzv. Nacionalne dodatke. Ovo se posebno odnosi na priobalje i otoke.

Istraživanje fenomena djelovanja vjetra na konstrukcije zasniva se na više znanstveno inženjerskih disciplina kao što su dinamika konstrukcija, mehanika fluida i aeroelastičnost.

2.1.1 Osnovni tlak izazvan brzinom vjetra i brzina vjetra

Osnovni tlak izazvan brzinom vjetra q_b definiran je u dijelu 7.1. HRN ENV 1991-2-4, te odgovara osnovnoj brzini vjetra v_b i određuje se izrazom [4]:

$$q_b = \frac{\rho}{2} \cdot v_b^2 \quad [\text{N/m}^2] \quad (1)$$

gdje je: v_b - osnovna brzina vjetra [m/s], ρ - gustoća zraka koja ovisi o nadmorskoj visini, temperaturi i tlaku zraka koji se očekuje u određenom vjetrovnom području za oluje (preporučena vrijednost prema HRN EN 1991-1-4:2012/NA $\rho = 1,25 \text{ kg/m}^3$).

Brzina vjetra sastoji se od dviju komponentata - prosječne i promjenljive komponente.

Prosječna komponenta brzine vjetra

Prosječna komponenta brzine vjetra $v_m(z)$ na visini z definirana je prema jednadžbi [8]:

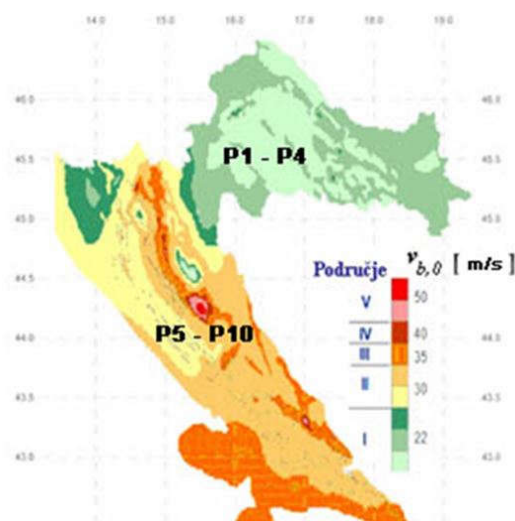
$$v_m(z) = v_b \cdot c_r(z) \cdot c_o(z) \quad [\text{m/s}] \quad (2)$$

gdje je: v_b - osnovna brzina vjetra, definirana kao funkcija smjera i godišnjeg doba na visini od 10 m iznad terena II. kategorije hrapavosti [m/s], $c_r(z)$ - koeficijent hrapavosti terena, $c_o(z)$ - koeficijent orografije terena.

Osnovna brzina vjetra v_b definirana je jednadžbom:

$$v_b = v_{b,0} \cdot c_{dir} \cdot c_{season} \quad [\text{m/s}] \quad (3)$$

gdje je: $v_{b,0}$ - temeljna vrijednost osnovne brzine vjetra, definirana kao karakteristična 10 minutna prosječna brzina vjetra na visini 10 m iznad terena II. kategorije hrapavosti [m/s], c_{dir} - koeficijent smjera vjetra (obično se uzima vrijednost 1,0), c_{season} - koeficijent ovisan o godišnjem dobu (obično se uzima vrijednost 1,0).



Slika 3 Zemljovid područja opterećenja vjetrom i raspodjele temeljne vrijednosti osnovne brzine vjetra $v_{b,0}$ za Republiku Hrvatsku

Temeljne vrijednosti osnovne brzine vjetra $v_{b,0}$ dane su po područjima unutar svake države koja se koristi Eurokodom. Vrijednost $v_{b,0}$ jedan je od najvažnijih podataka za proračun konstrukcija na opterećenje djelovanjem vjetra. Zemljovid raspodjele temeljne vrijednosti osnovne brzine vjetra $v_{b,0}$ prema područjima koji propisuje naš Državni zavod za normizaciju i mjeriteljstvo u okviru Državnog dokumenta za primjenu (DDP), a koji je sastavni dio Nacionalnog dodatka (za Republiku Hrvatsku HRN EN 1991-1-4:2012/NA), dan je na slici 3.

Koeficijent hrapavosti terena $c_r(z)$ uzima u obzir promjenu prosječne brzine vjetra $v_m(z)$ na mjestu konstrukcije ili građevine zbog visine iznad tla i hrapavosti zemljišta s privjetrene strane konstrukcije ili građevine u promatranom smjeru vjetra. Vrijednost koeficijenta hrapavosti određuje se na temelju logaritamske raspodjele brzine vjetra po visini (profilu), a definirana je jednadžbama (4) i (5) koje vrijede ako je privjetrena udaljenost dovoljno duga da stabilizira profil brzine vjetra:

$$c_r(z) = k_r \cdot \ln\left(\frac{z}{z_0}\right) \quad \text{za} \quad z_{\min} \leq z \leq z_{\max}, \quad (4)$$

$$c_r(z) = c_r(z_{\min}) \quad \text{za} \quad z \leq z_{\min}, \quad (5)$$

gdje je: k_r - koeficijent terena ovisan o visini hrapave površine z_0 , prema izrazu:

$$k_r = 0,19 \cdot \left[\frac{z_0}{z_{0,II}} \right]^{0,07}, \quad (6)$$

dok je: z_0 - visina hrapave površine ($z_0 = 0,3$ m - za kategoriju terena III), $z_{0,II}$ - visina hrapave površine terena II. kategorije ($z_{0,II} = 0,05$ m), z_{\min} - najmanja visina prema tablici 1., z_{\max} - uzima se 200 m ako nije drugačije određeno Nacionalnim dodatkom.

Hrapavost terena za dani smjer vjetra ovisi o hrapavosti tla i udaljenosti s jednolikom hrapavosti terena u kutnom isječku oko smjera vjetra. Mala područja s promjenljivom hrapavosti mogu se zanemariti. Vrijednosti veličina z_0 i z_{\min} potrebnih za određivanje koeficijenta terena k_r prikazane su u tablici 1. (Tablica 4.1 EN 1991-1-4:2005).

Koeficijent orografije terena $c_o(z)$ predstavlja povećanje brzine zbog utjecaja brežuljaka, stijena itd..., a uzima su u obzir tamo gdje se zbog orografije brzina vjetra povećava više od 5%. Učinci orografije mogu se zanemariti kada je prosječan nagib privjetrenog zemljišta manji od 3° .

Tablica 1 Kategorije terena

KATEGORIJA TERENA		z_0 [m]	z_{\min} [m]
0.	More ili priobalna područja izložena otvorenom moru	0,003	1
I.	Jezera ili ravna i horizontalna područja sa zanemarivom vegetacijom i bez prepreka	0,01	1
II.	Područja s niskom vegetacijom poput trave i izdvojenih prepreka (drveće, kuće) s razmacima od najmanje 20 visina prepreka	0,05	2
III.	Područje s jednolikim pokrovom vegetacije, zgrade ili izdvojene prepreke s razmacima od najviše 20 visina prepreka (šume, predgrađa, sela)	0,3	5
IV.	Područja u kojima je najmanje 15% površine izgrađeno i čija prosječna visina zgrada prelazi 15 metara	1,0	10

Promjenjiva komponenta brzine vjetra

Promjenjiva komponenta brzine vjetra određuje se uz pomoć intenziteta turbulencije $I_v(z)$ na visini z , koji je definiran kao standardna devijacija turbulencije σ_v , podijeljena s prosječnom brzinom vjetra $v_m(z)$ na visini z .

Promjenjiva komponenta brzine vjetra ima prosječnu vrijednost jednaku 0 i standardnu devijaciju σ_v , određenu jednadžbom [8]:

$$\sigma_v = k_r \cdot v_b \cdot k_I \quad (7)$$

gdje je: k_I - koeficijent turbulencije.

Intenzitet turbulencije $I_v(z)$ na visini z definiran je jednadžbama:

$$I_v(z) = \frac{\sigma_v}{v_m(z)} = \frac{k_I}{c_o(z) \cdot \ln\left(\frac{z}{z_0}\right)} \quad \text{za} \quad z_{\min} \leq z \leq z_{\max}, \quad (8)$$

$$I_v(z) = I_v(z_{\min}) \quad \text{za} \quad z \leq z_{\min}. \quad (9)$$

2.1.2 Vršni tlak izazvan brzinom vjetra

Vršni tlak izazvan brzinom vjetra $q_p(z)$ na visini z uključuje prosječne i kratkotrajne promjene brzine vjetra. Ovaj se tlak može definirati Nacionalnim dodatkom, a preporučena vrijednost prema normi EN 1991-1-4:2005 određena je jednadžbom [8]:

$$q_p(z) = [1 + 7 \cdot I_v(z)] \cdot \frac{\rho}{2} \cdot v_m^2(z) = c_e(z) \cdot q_b \quad [\text{N/m}^2] \quad (10)$$

gdje je: $c_e(z)$ - koeficijent izloženosti vjetru.

Koeficijent izloženosti vjetru $c_e(z)$, definira vjetrove prilike na promatranom području određene zemljopisnim položajem. Prijašnja istraživanja djelovanja vjetra na nekoliko priobalnih lokacija pokazala su određena odstupanja od standardnih europskih vrijednosti prema ENV 1991-2-4:1995 i potvrđuju vrijednosti koeficijenta izloženosti $c_e(z)$ koje su bile predložene u „Nacionalnom dokumentu za primjenu“ - HRN ENV 1991-2-4:2005.

Glavna zadaća je daljnje istraživanje stvarnih vrijednosti koeficijenta izloženosti vjetru $c_e(z)$ na priobalnom i otočnom području Republike Hrvatske. Nužno je raspolagati podacima mjerenja smjera i brzine vjetra na velikom broju lokacija, posebno pošto se radi o orografski složenom području (izloženost, konkavnost i konveksnost reljefa, nadmorska visina,...), te utjecaju mora i kopnenog zaleđa u različitim vremenskim intervalima. Ove spoznaje i promišljanja bili su povod da se izrade nove podloge za nacionalni dodatak za buduću normu HRN EN 1991-1-4, pa se za koeficijent izloženosti $c_e(z)$ predlažu različite vrijednosti za pojedina područja Republike Hrvatske u odnosu koje se nalaze u europskoj normi (slika 4.).

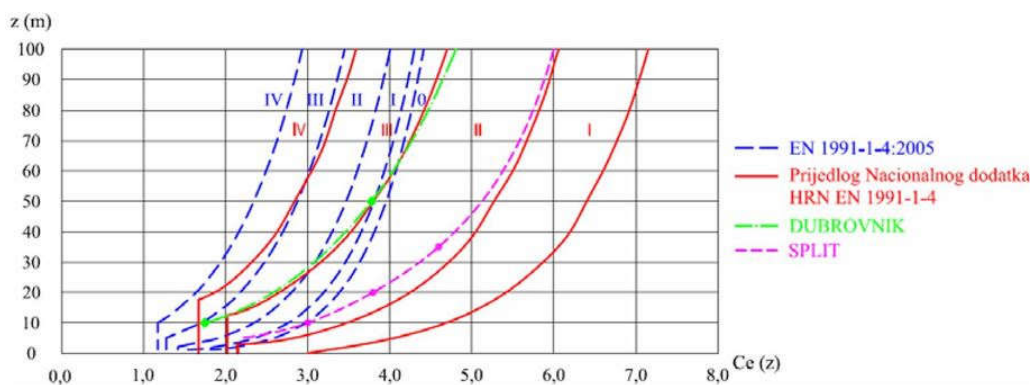
Tablica 2 Vrijednosti temeljne $v_{b,0}$ i trenutne $v_{ref,x}$ brzine vjetra na području Republike Hrvatske

Područja	$v_{b,0}$ [m/s]	$v_{ref,x}$ [m/s]
I	22	35
II	30	45
III	35	55
IV	40	65
V	50	75

Za regije P1-P4 (kontinentalno područje) intenzitet turbulencije $I_v(z)$ računa se prema izrazu (8) uz preporučenu vrijednost $k_I = 1,0$ (EN 1991-1-4:2005).

Za regije P5-P10 (priobalno i otočno područje - područja II., III., IV., i V. brzina vjetra) intenzitet turbulencije $I_v(z)$ posebno se računa [8], bazirajući se kako je navedeno na daljnja istraživanja, uzimajući u obzir trenutačnu brzinu vjetra $v_{ref,x}$ (tablica 2.). Sve navedeno prikazano je na slici 4. kao Prijedlog Nacionalnog dodatka HRN EN 1991-1-4.

Za ravan teren prema EN 1991-1-4:2005 [4], što uglavnom i je za konstrukcije, koeficijent orografije $c_o(z) = 1,0$, pa se koeficijent izloženosti vjetru $c_e(z)$ određuje ovisno o visini konstrukcije z iznad tla i kategoriji terena (tablica 1.), kako je prikazano na slici 4.



Slika 4 Koeficijent izloženosti vjetru $c_e(z)$

2.1.3 Tlak vjetra na površine konstrukcije

Tlak vjetra w_e koji djeluje na vanjske površine konstrukcije određuje se jednadžbom [4]:

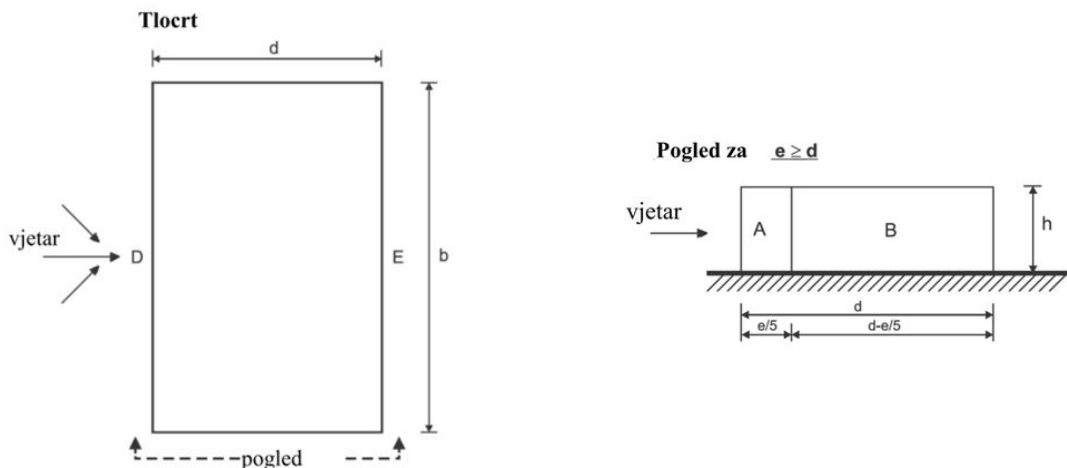
$$w_e = q_p(z_e) \cdot c_{pe} \quad \left[\text{N/m}^2 \right] \quad (11)$$

gdje je: $q_p(z_e)$ - vršni tlak izazvan brzinom vjetra (peak velocity pressure) na visini z_e , z_e - usporedna (referentna) visina za vanjski tlak, c_{pe} - koeficijent tlaka za vanjski tlak (koeficijent vanjskog tlaka).

Tlak vjetra w_i koji djeluje na unutarnje površine konstrukcije određuje se jednadžbom [4]:

$$w_i = q_p(z_i) \cdot c_{pi} \quad \left[\text{N/m}^2 \right] \quad (12)$$

gdje je: $q_p(z_i)$ - vršni tlak izazvan brzinom vjetra (peak velocity pressure) na visini z_i , z_i - usporedna (referentna) visina za unutarnji tlak, c_{pi} - koeficijent tlaka za unutarnji tlak (koeficijent unutarnjeg tlaka).



Slika 5 Koeficijent vanjskog tlaka c_{pe} za vertikalne površine konstrukcija pravokutnog tlocrta

Za ravne djelove konstrukcija do 200 m visine, djelovanje vjetra uzima se kao zamjenjujuće statičko opterećenje. Tlakovi vjetra djeluju okomito na površine konstrukcija. Neto tlak na površinu je algebarski zbroj unutarnjeg i vanjskog tlaka (djeluju istodobno) $w_e \pm w_i$. Koeficijent vanjskog tlaka vjetra c_{pe} za konstrukcije i dijelove konstrukcija ovisi o obliku i veličini površine opterećene zone konstrukcije. Za $A \geq 10 \text{ m}^2$ vrijedi $c_{pe} = c_{pe,10}$. Određivanje vrijednosti koeficijenta vanjskog tlaka c_{pe} za vertikalne površine konstrukcija pravokutnog tlocrta prikazano je na slici 5. i u tablici 3. prema 7.1 EN 1991-1-4., pri čemu je $e = b$ ili $2h$ (manja vrijednost) [4].

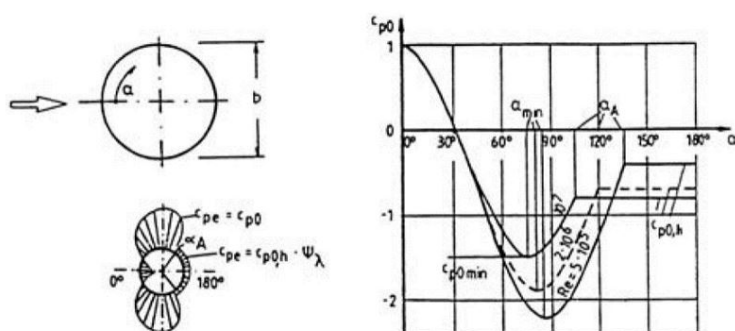
Tablica 3 Koeficijent vanjskog tlaka c_{pe} za vertikalne površine konstrukcija pravokutnog tlocrta

Područje	A		B		C		D		E	
h/d	$c_{pe,10}$	$c_{pe,1}$	$c_{pe,10}$	$c_{pe,1}$	$c_{pe,10}$	$c_{pe,1}$	$c_{pe,10}$	$c_{pe,1}$	$c_{pe,10}$	$c_{pe,1}$
5	-1,2	-1,4	-0,8	-1,1	-0,5		+0,8	+1,0	-0,7	
1	-1,2	-1,4	-0,8	-1,1	-0,5		+0,8	+1,0	-0,5	
$\leq 0,25$	-1,2	-1,4	-0,8	-1,1	-0,5		+0,7	+1,0	-0,3	

Koeficijent vanjskog tlaka c_{pe} za konstrukcije u obliku valjka, dakle kružnog poprečnog presjeka, definiran je u dijelu 10.8. ENV 1991-2-4 i ovisi o Reynoldsovu broju Re (slika 6.) [3]:

$$Re = \frac{b \cdot v_m(z_e)}{\nu} \quad (13)$$

gdje je: $\nu = 15 \cdot 10^{-6}$ - kinematska viskoznost zraka [m^2/s], b - promjer kružnog poprečnog presjeka konstrukcije [m].



Slika 6 Raspodjela tlaka c_{pe} za kružni poprečni presjek konstrukcije

U tablici 4. prikazane su tipične vrijednosti krivulja sa slike 6. (međuvrijednosti se smiju linearno interpolirati), gdje je: α_{min} - mjesto najmanjeg tlaka, $c_{p,o,min}$ - vrijednost najmanjeg koeficijenta tlaka, α_A - mjesto odvajanja strujanja, $c_{p,o,h}$ - koeficijent tlaka zavjetrenog dijela valjka.

Tablica 4 Tipične vrijednosti krivulja sa slike 6.

Re	α_{min}	$c_{p,o,min}$	α_A
$5 \cdot 10^5$	85	-2,2	135
$2 \cdot 10^6$	80	-1,9	120
10^7	75	-1,5	105

Koeficijent unutarnjeg tlaka vjetra c_{pi} za konstrukcije i dijelove konstrukcija ovisi o veličini i raspodjeli otvora po oplošju konstrukcije. Ukoliko u određenom slučaju nije moguće odrediti raspodjelu otvora, ili se ne smatra opravdanim, i ako su svi otvori konstrukcije zatvoreni pri opterećenju djelovanjem vjetrom, c_{pi} se može uzeti s vrijednostima $c_{pi} = 0,2$ i $c_{pi} = -0,3$ [4].

2.1.4 Sila vjetra na čitavu konstrukciju ili konstrukcijski element

Globalna sila vjetra F_W određuje se prema dijelu 6.1 ENV 1991-2-4, a proizlazi iz tlaka vjetra i sila trenja vjetra na površinu konstrukcije. Sila vjetra zbog tlaka na površinu konstrukcije određuje se na dva načina:

- proračunom sile vjetra s pomoću koeficijenata sila,
- proračunom sile vjetra s pomoću tlakova vjetra na površine.

Proračun sile vjetra F_W na konstrukciju ili konstrukcijski element pomoću koeficijenata sila može se odrediti izravno jednadžbom [5]:

$$F_W = c_s c_d \cdot c_f \cdot q_p(z_e) \cdot A_{ref} \quad [\text{N}] \quad (14)$$

gdje je: $c_s c_d$ - koeficijent konstrukcije (koeficijent veličine i dinamički koeficijent), c_f - koeficijent sile za konstrukciju ili konstrukcijski element, A_{ref} - usporedna (referentna) površina konstrukcije ili konstrukcijskog elementa za c_f (općenito projicirana ploha pročelja izložena vjetru) $[\text{m}^2]$.

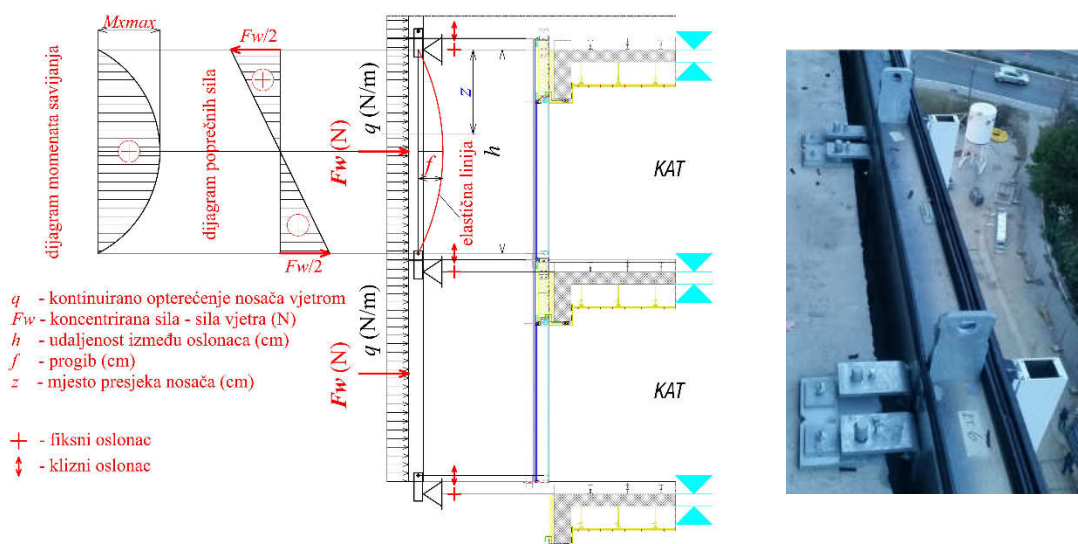
Za ovaj rad proračun koeficijenta sile c_f za konstrukciju ili konstrukcijski element dat je izrazom [5,10]:

$$c_f = c_{pe} + c_{pi} \quad (15)$$

Koeficijent konstrukcije $c_s c_d = 1$, za [10] konstrukcije visine $h < 15$ m, odnosno za konstrukcije s okvirima i konstruktivnim elementima visine $h < 100$ m, uz uvjet da je $h < 4d$ (d - širina konstrukcije u smjeru djelovanja vjetra).

Sila vjetra F_W na konstrukciju ili konstrukcijski element može se odrediti i vektorskim zbrojem sila $F_{w,e}$, $F_{w,i}$ i F_{fr} proračunanih iz vanjskih w_e i unutarnjih w_i tlakova vjetra i trenja vjetra c_{fr} (koeficijent trenja) usporedo na vanjske površine [8].

2.1.5 Dimenzioniranje vertikalnog nosača - momenta inercije I_x (savijanje)



Slika 7 Opterećenje vertikalnog nosača na savijanje s prikazom oslonca

Rješavanjem diferencijalne jednadžbe elastične linije za vertikalni nosač [1,9]:

$$\frac{d^2 f}{dz^2} = -\frac{M_x}{E \cdot I_x} \quad (16)$$

gdje je: M_x - moment savijanja [Ncm], E - modul elastičnosti ($E = 70 \text{ GPa} = 70 \cdot 10^5 \text{ N/cm}^2$ za aluminij), I_x - momenti inercije [cm^4], dolazi se do izraza za progibnu funkciju $f=f(z)$ na mjestu maksimalnog progiba $z = h/2$ (opasni presjek) prema slici 7., odnosno do izraza za potrebni moment inercije I_x poprečnog presjeka vertikalnog nosača koji je zglobo oslonjen [7]:

$$I_x = \frac{F_w \cdot 5 \cdot h^3}{E \cdot f \cdot 384} \quad [\text{cm}^4] \quad (17)$$

gdje je: F_w - sila vjetra (sila koja zamjenjuje kontinuirano opterećenje q) [N], f - progib [cm]. Progib f za vertikalne nosače koji su zglobo oslonjeni (uvjet krutosti) [9]:

$$f \leq \frac{h}{250} \leq 1,5 \text{ cm} \quad (18)$$

2.2 Proračun stalnog opterećenja

Proračun stalnog opterećenja obuhvaća proračun izvijanja, tj. kontrolu stabilnosti vertikalnog nosača na bočno izvijanje uslijed djelovanja vlastite težine nosača i obloge (prema HRN ENV 1991-2-1, EN 1991-1-1).

Vertikalni nosač je stabilan ako je zadovoljen uvjet da je $\sigma_{kr} > \sigma$, gdje je: σ_{kr} - kritično naprezanje, σ - stvarno naprezanje.

Kritično naprezanje σ_{kr} definirano je jednadžbom

$$\sigma_{kr} = \frac{F_{kr}}{A} \quad [\text{MPa}] \quad (19)$$

gdje je: F_{kr} - sila izvijanja (najmanja sila pri kojoj se pojavljuje izvijanje) [N], A - površina poprečnog presjeka vertikalnog nosača [mm^2], ili prema Eulerovoj jednadžbi za elastično izvijanje:

$$\sigma_{kr} = \pi^2 \cdot \frac{E}{\lambda^2} \quad [\text{MPa}] \quad (20)$$

ako vrijedi da je $\lambda > \lambda_p$, gdje je: λ - vitkost nosača, a λ_p - granična vitkost nosača.

Sila izvijanja F_{kr} i kritično naprezanje σ_{kr} ovise o vitkosti nosača λ , koje je definirano jednadžbom:

$$\lambda = \frac{h_0}{i_{\min}} \quad (21)$$

gdje je: h_0 - slobodna duljina izvijanja [cm], i_{\min} - polumjer tromosti [cm].

Slobodna duljina izvijanja h_0 za slučaj opterećenja vertikalnog nosača koji je zglobo oslonjen, prikazanog na slici 2. iznosi: $h_0 = h$.

Polumjer tromosti i_{\min} definiran je jednadžbom:

$$i_{\min} = \sqrt{\frac{I_{\min}}{A}} \quad (22)$$

gdje je: I_{\min} - najmanji aksijalni moment inercije ($I_{\min} = I_y$) [cm^4].

Stvarno naprezanje σ u vertikalnom nosaču definirano je jednadžbom:

$$\sigma = \frac{F}{A} \quad [\text{MPa}] \quad (23)$$

gdje je: F - stvarna sila kojom je opterećen vertikalni nosač [N] (vlastita težina nosača i obloge).

Stvarna sila F je koncentrirana uzdužna sila koja zamjenjuje kontinuirano uzdužno opterećenje vertikalnog nosača zbog vlastite težine konstrukcijskog elementa, te je definirana izrazom:

$$F = \frac{a \cdot h}{2} \cdot F_q \quad (24)$$

gdje je: F_q - vlastita težina konstrukcijskog elementa, koja je jednaka zbroju vlastitih težina nosača $F_{q,n}$ i obloge (staklo) $F_{q,o}$, $F_q = F_{q,n} + F_{q,o}$,
 a - širina konstrukcijskog elementa [m], i h - visina konstrukcijskog elementa (udaljenost između oslonaca) [m].

Granična vitkost λ_p nosača definirana je jednadžbom:

$$\lambda_p = \pi \cdot \sqrt{\frac{E}{\sigma_p}} \quad (25)$$

gdje je: σ_p - granica proporcionalnosti [MPa].

Granica proporcionalnosti σ_p definirana je jednadžbom [1]:

$$\sigma_p = 0,8 \cdot \sigma_T \quad [\text{MPa}] \quad (26)$$

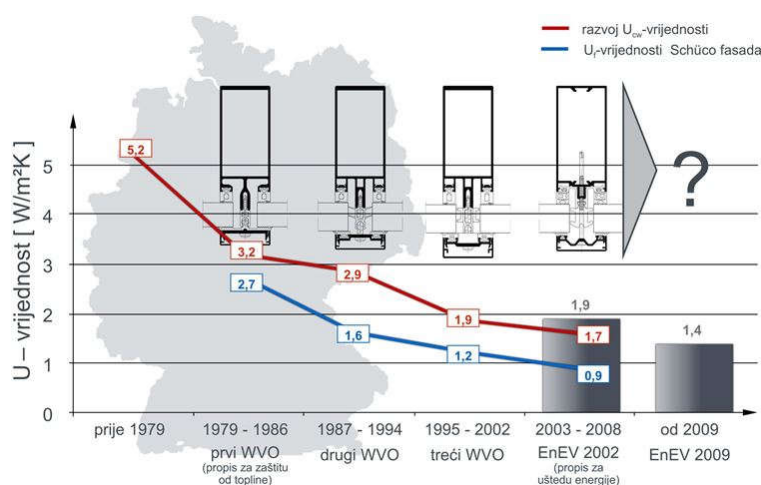
gdje je: σ_T - donja granica tečenja [MPa].

Za one materijale gdje granica tečenja nije jasno određena, pa tako i za aluminijske legure, donja granica tečenja σ_T je određena onim naprezanjem pri kojem nastaju trajne deformacije od 0,2 % u odnosu na prvobitnu duljinu, tj. $\sigma_T = \sigma_{0,2} = R_{p0,2}$ [7], gdje je:

$R_{p0,2}$ - konvencionalno naprezanje tečenja u plastičnom području deformacija od $\varepsilon = 0,2 \%$.

3. Utjecaj profila metalnih konstrukcija na toplinsku zaštitu objekta

Na slici 8. prikazan je razvoj aluminijskih profila obzirom na njihov utjecaj na toplinsku zaštitu objekta, tj. prikazan je utjecaj koeficijenta prolaska topline aluminijskog profila U_f na ukupni koeficijent prolaska topline aluminijskih ostakljenih fasadnih konstrukcija U_{cw} . Obzirom da moderne građevinske konstrukcije na pojedinim objektima čine i 100% vanjske ovojnice, kao na objektu prikazanom na slici 1. utjecaj profila na navedeno je značajan. Kontinuirano se razvijaju energetske učinkovitiji sistemi aluminijskih fasadnih konstrukcija, tj. energetski učinkoviti omotači objekata. Certifikati EnEV 2009. i certifikati pasivne kuće potvrđuju usklađenost metalnih konstrukcija s novim odredbama štednje energije [2].



Slika 8 Razvoj i utjecaj toplinskih vrijednosti aluminijskih profila na toplinsku zaštitu objekta

Danas su na tržištu prisutne novo razvijene SI varijante (Super Insulation) aluminijske fasadne konstrukcije, kao npr. Schüco sistemi. Schüco aluminijske konstrukcijske sisteme odlikuju

detalji usmjereni prema budućnosti, a to su novi izolacijski koncept, te prema unutrašnjosti usmjerene refleksijske površine pritisnih profila koje reduciraju gubitak energije na minimum i pridonose odličnoj U_f vrijednosti od 0,78 W/m²K. PHI (Passivhaus Institut iz Darmstadt-a) potvrdio je izolativnu vrijednost prema standardu pasivne kuće u pogledu pridržavanja referentnih vrijednosti toplinske ugodnosti od $U_{cw} \leq 0,8$ W/m²K. Ova vrijednost je izračunata i certificirana od strane PHI-a prema najnovijim kriterijima certificiranja fasadnih konstrukcijskih sistema, pod uvjetom primjene obloge čiji je $U_g = 0,7$ W/m²K. Isto vrijedi i za čelične konstrukcije s izolacijskom jezgrom od pjene čiji profili danas postižu čak $U_f = 0,74$ W/m²K.

Navedeni profili imaju utjecaja na energetske certifikat. Energetski učinkovito projektirani objekti razvrstavaju se prema godišnjoj potrebnoj toplini za grijanje Q_h na: niskoenergetske zgrade $\leq 40(50)$ kWh/m²a, pasivne zgrade $\leq 10(15)$ kWh/m²a i nulenergetske zgrade 0 kWh/m²a.

Oko 33% svih količina CO₂ nastaju zbog potrebe za toplinskom energijom, dok 50% svih toplinskih gubitaka su ventilacijski zbog loše ili dotrajale vanjske ovojnice objekta.

Da bi se globalno zagrijavanje Zemlje ograničilo na 2°, nužno je emisiju CO₂ smanjiti za 60 - 80 %. Na slici 9. prikazan je dio mogućnosti u metalu gradnji koji može pridonijeti energetske učinkovitosti uz zaštitu i očuvanje okoliša. Razvoj zelene tehnologije je naša obveza za buduće naraštaje. Racionalna rješenja u ovom segmentu industrije (metalne konstrukcije) data su u tablici 5.



Slika 9 Razvoj i utjecaj toplinskih vrijednosti aluminijskih profila na toplinsku zaštitu objekta

Tablica 5 Razvoj zelene tehnologije u metalogradnji

Energetska klasa	Opis	Funkcije
	Energy³ Buildings Pozitivna energetska bilanca Energetska autonomnost	Uštediti energiju Dobiti energiju Umrežiti energiju Sakupljati, upravljati, koristiti
	Energy² Buildings Minimalna primarna energetska potreba (≤ 40 kWh/m ² a)	Uštediti energiju Dobiti energiju Korištenje solarne energije, hibridna ventilacija, solarno hlađenje, automatizacija
	Energy Buildings Ispuniti minimalno sve svjetske standarde	Uštediti energiju Toplinska izolacija sa prozorima, vratima, fasadama; zaštita od sunca

4. Primjer proračuna za objekt West Gate

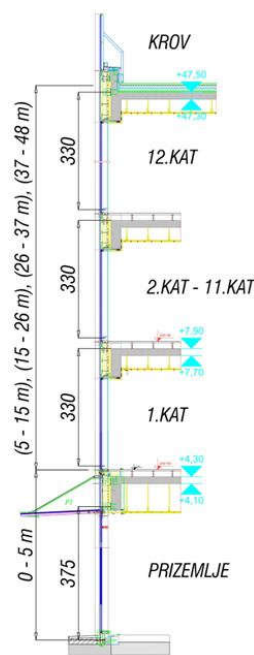
U nastavku rada prikazan je postupak proračuna vertikalnog nosača za objekat West Gate u Splitu. Objekt West Gate je osnovnih dimenzija: $b = 60$ m, $d = 23$ m i $h = 48$ m [10].

4.1 Statički proračun vertikalnog nosača

4.1.1 Proračun promjenjivog opterećenja - savijanje I_x

Vertikalni nosač je ekstrudirani (prešani) profil aluminijske legure EN AW 6060 T66. Kemijski sastav navedene legure prema EN 573-3 je AlMgSi, pri čemu je Al 98,85%. Oznaka T66 ukazuje na vrstu toplinske obrade profila aluminijske legure EN AW 6060, dakle rastopno žarenje na temperaturi od 500-570 °C, pa brzo hlađenje i naknadno umjetno starenje pri povišenoj temperaturi od 165-195 °C u vremenskom periodu od 10-50 h. Ovom toplinskom obradom s posebnom kontrolom (T66) dobivena su bolja mehanička svojstva profila nego kod toplinske obrade oznake T6. Mehanička svojstva vertikalnog nosača dobivenog procesom ekstrudiranja aluminijske legure EN AW 6060 kroz geometrijski oblikovane matrice za debljine stjenki profila do 3 mm, te s toplinskom obradom oznake T66, prema EN 755-2 su [6] $R_{p0,2} = 160$ MPa konvencionalno naprezanje tečenja u plastičnom području deformacija od $\varepsilon = 0,2$ % i $R_m = 215$ MPa vlačna čvrstoća.

Aluminijska ostakljena fasadna konstrukcija objekta West Gate u Splitu zbog statičkog proračuna vertikalnog nosača podijeljena je na 5 karakterističnih dijelova po visini, kako je prikazano na slici 10 [10].



Slika 10 Podjela vertikalnih nosača na objektu West Gate u Splitu

Odabrane (referentne) visine za usporedbu su: $z_1 = 5$ m, $z_2 = 15$ m, $z_3 = 26$ m, $z_4 = 37$ m, $z_5 = 48$ m.

Temeljna vrijednost osnovne brzine vjetra $v_{b,0}$ prema slici 3. je: $v_{b,0} = 35$ m/s. Osnovna brzina vjetra v_b prema izrazu 3. je: $v_b = 35$ m/s.

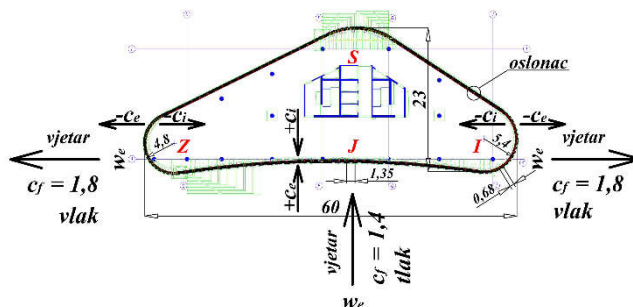
Osnovni tlak izazvan brzinom vjetra q_b prema izrazu 1. je: $q_b = 765,62$ N/m², za gustoću zraka $\rho = 1,25$ kg/m³.

Za izračun prosječne komponente brzine vjetra $v_m(z)$ uzima se da je za $c_r(z)$, $k_r = 0,215$ (dobiven prema izrazu 6.).

dio	referentne visine z_e [m]	intenzitet turbulencije $I_v(z)$ za: $k_l = 1,0$ $c_o(z) = 1,0$	prosječna komponenta brzine vjetra $v_m(z)$ [m/s]	vršni tlak izazvan brzinom vjetra $q_p(z_e)$ [N/m ²]
1	5	0,355	21,175	976,6
2	15	0,256	29,435	1511,9
3	26	0,224	33,565	1808,2
4	37	0,208	36,225	2014,3
5	48	0,197	38,185	2168,0

Ipak, do različitih rezultata dolazimo ako koristimo dijagrame prikazane na slici 4. prema Prijedlogu Nacionalnog dodatka HRN EN 1991-1-4 za kategoriju terena III (Split). Rezultati su prikazani u tablici 7. i mjerodavni su u nastavku proračuna.

dio	referentne visine z_e [m]	osnovni tlak izazvan brzinom vjetra q_b [N/m ²]	koeficijent izloženosti vjetru $c_e(z)$	vršni tlak izazvan brzinom vjetra $q_p(z_e)$ [N/m ²]
1	5	765,62	$\approx 2,0$	1531,2
2	15	765,62	$\approx 2,3$	1760,9
3	26	765,62	$\approx 2,9$	2220,3
4	37	765,62	$\approx 3,4$	2603,1
5	48	765,62	$\approx 3,7$	2832,8



Na slici 11. prikazan je tlocrt objekta West Gate u Splitu [10]. U tablici 8. prikazane su dobivene vrijednosti za silu vjetera F_w na konstrukciju ili konstrukcijski element (prema izrazu 14.) za J - južni dio konstrukcije, dok su u tablici 9. prikazane vrijednosti za Z/I - zapadni i istočni dio konstrukcije. Za potrebe izračuna sile vjetera F_w analizirano je glavno djelovanje vjetera na J -

južni dio konstrukcije (tlačno opterećenje - pozitivan tlak), te njegovo posljedično djelovanje na Z/I - zapadni i istočni dio konstrukcije (vlačno opterećenje - negativan tlak).

Koeficijent sile c_f za J - južni dio konstrukcije (tlak) je: $c_f = c_{pe} + c_{pi} = 1,4$, gdje je za $h/d = 48/23 = 2,09$ i $e = b = 60 \text{ m} > d = 48 \text{ m}$ ($e/5 = 60/5 = 12 \text{ m}$ - područje A prema slici 5. i tablici 3.), te s obzirom na specifičnost izgleda tlocrta konstrukcije vrijedi da je $c_{pe} = 1,2$, a $c_{pi} = 0,2$.

Koeficijent sile c_f za Z/I - zapadni i istočni dio konstrukcije (vlak) je: $c_f = c_{pe} + c_{pi} = -1,8$, gdje je za $R_e = 2,75 \cdot 10^7$ (prema izrazu 13., $b = 2 \cdot 5,4 \text{ m}$) i s obzirom na tlocrtnu poziciju konstrukcije u obliku valjka (kružni poprečni presjek prema slici 6. i tablici 4.) vrijedi da je $c_{pe} = c_{p,o,min} = -1,5$, a $c_{pi} = -0,3$.

Referentna površina konstrukcijskog elementa: $A_{ref} = a \cdot h \text{ [m}^2\text{]}$, gdje je: a - širina konstrukcijskog elementa [m] i h - visina konstrukcijskog elementa (udaljenost između oslonaca) [m].

Tablica 8 Sila vjetra F_w za J - južni dio konstrukcije

dio	referentne visine z_e [m]	vršni tlak izazvan brzinom vjetra $q_p(z_e)$ [N/m ²]	$c_s c_d$	c_f	referentna površina konstrukcije ili k. elementa $A_{ref} = a \cdot h \text{ [m}^2\text{]}$	sila vjetra F_w [N]
1	5	1531,2	1,0	1,4	$1,35 \cdot 3,75 = 5,06$	10847,3
2	15	1760,9	1,0	1,4	$1,35 \cdot 3,30 = 4,45$	10970,6
3	26	2220,3	1,0	1,4	$1,35 \cdot 3,30 = 4,45$	13832,5
4	37	2603,1	1,0	1,4	$1,35 \cdot 3,30 = 4,45$	16217,4
5	48	2832,8	1,0	1,4	$1,35 \cdot 3,30 = 4,45$	17648,3

Tablica 9 Sila vjetra F_w za Z/I - zapadni i istočni dio konstrukcije

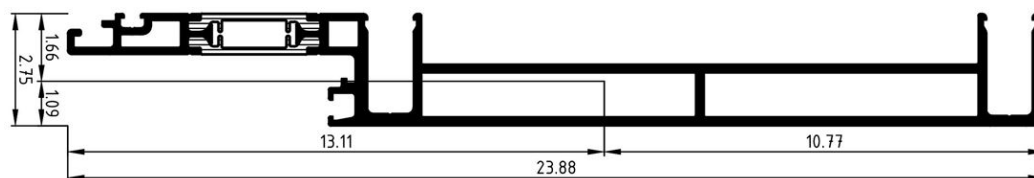
dio	referentne visine z_e [m]	vršni tlak izazvan brzinom vjetra $q_p(z_e)$ [N/m ²]	$c_s c_d$	c_f	referentna površina konstrukcije ili k. elementa $A_{ref} = a \cdot h \text{ [m}^2\text{]}$	sila vjetra F_w [N]
1	5	1531,2	1,0	1,8	$0,68 \cdot 3,75 = 2,55$	7028,4
2	15	1760,9	1,0	1,8	$0,68 \cdot 3,30 = 2,24$	7100,1
3	26	2220,3	1,0	1,8	$0,68 \cdot 3,30 = 2,24$	8952,2
4	37	2603,1	1,0	1,8	$0,68 \cdot 3,30 = 2,24$	10495,7
5	48	2832,8	1,0	1,8	$0,68 \cdot 3,30 = 2,24$	11421,8

Tablica 10 Moment inercije I_x poprečnog presjeka vertikalnog nosača

dio [m]	F_w [N] za J dio konstrukcije	F_w [N] za Z/I dio konstrukcije	h [cm]	f [cm]	I_x [cm ⁴] za J dio konstrukcije	I_x [cm ⁴] za Z/I dio konstrukcije
1	10847,3	7028,4	375	1,50	709,36	459,62
2	10970,6	7100,1	330	1,36	539,23	348,98
3	13832,5	8952,2	330	1,36	679,90	440,02
4	16217,4	10495,7	330	1,36	797,12	515,89
5	17648,3	11421,8	330	1,36	867,45	561,41

U tablici 10. prikazane su dobivene vrijednosti za moment inercije I_x poprečnog presjeka vertikalnog nosača konstrukcije (prema izrazu 17.).

Prema prikazanim rezultatima za I_x (tablica 10.) odabran je karakteristični presjek vertikalnog nosača. Nosač je aluminijski profil EN AW 6060 T66 serije Schüco USC 65 (slika 12.), koji ima sljedeće podatke: $I_x = 554,35 \text{ cm}^4$ (dva profila zajedno za savijanje, pa je: $I_x = 2 \cdot 554,35 = 1108,70 \text{ cm}^4$), $I_y = 8,35 \text{ cm}^4$ (jedan profil za izvijanje zbog dilatirajućih umetaka), $A = 11,61 \text{ cm}^2$, $m = 3,13526 \text{ kg/m}$, $E = 70 \text{ GPa}$, $R_{p0,2} = 160 \text{ MPa}$ [9,10].



Slika 12 Karakteristični presjek aluminijskog vertikalnog nosača serije Schüco USC 65

Navedeni podaci su potvrđeni i putem Schuco Statik programa.

Isti proračun je napravljen i za glavno djelovanje vjetrova na S - sjeverni dio konstrukcije. Dobiveni rezultati potvrđuju dobar izbor vertikalnog nosača.

4.1.2 Proračun stalnog opterećenja - izvijanje I_y

U radu je prikazana kratka kontrola stabilnosti vertikalnog nosača serije Schüco USC 65 poprečnog presjeka prikazanog na slici 12. čiji je $I_y = 8,35 \text{ cm}^4$ na bočno izvijanje (tj. kontrola zadanog I_y). Kako je vertikalni nosač bočno povezan horizontalnim nosačima, nema potrebe za kontrolom stabilnosti na bočno uvojno izvijanje. Kako je $F_q = 0,77 \text{ kN/m}^2$, stvarna sila F kojom je opterećen vertikalni nosač za proračun stalnog opterećenja u svrhu kontrole stabilnosti vertikalnog nosača na bočno izvijanje prema izrazu 24. iznosi:

$$F = \frac{1,35 \cdot 3,3}{2} \cdot 0,77 = 1,715 \text{ [kN]}.$$

Minimalni moment inercije I_{min} je: $I_{min} = I_y = 8,35 \text{ cm}^4$.

Polumjer tromosti i_{min} (prema izrazu 22.) je: $i_{min} = 0,85 \text{ cm}$, dok je za slobodnu duljinu izvijanja $h_o = h = 330 \text{ cm}$ vitkost vertikalnog nosača λ (prema izrazu 21.): $\lambda = 388,24$. Kako je $\lambda = 388,24 > \lambda_p = 73,47$ (prema izrazu 25., ako je $\sigma_p = 128 \text{ MPa}$ prema izrazu 26.), kritično naprezanje σ_{kr} ovog vertikalnog nosača određeno je pomoću Eulerove jednadžbe, dakle prema izrazu 20. σ_{kr} je: $\sigma_{kr} = 4,58 \text{ MPa}$.

Stvarno naprezanje σ u vertikalnom nosaču (prema izrazu 23.) je: $1,48 \text{ MPa}$. Vertikalni nosač je stabilan jer je zadovoljen uvjet da je: $\sigma_{kr} > \sigma$.

Provjera produljenja nosivog aluminijskog vertikalnog nosača uslijed temperaturnih promjena: $\Delta h = \alpha_{AlMgSi} \cdot h \cdot \Delta t = 0,000024 \cdot 3300 \cdot 50 = 3,96 \text{ mm}$. Konstruktivno je izvedena dilatacija od 10 mm između vertikalnih nosača pomoću oslonca (slika 7.).

4.2 Proračun ukupnog koeficijenta prolaska topline U_{cw}

Proračun ukupnog koeficijenta prolaska topline aluminijske ostakljene fasadne konstrukcije U_{cw} za objekat West Gate u Splitu (100% vanjske ovojnice) izvršen je pomoću SchuCal+ (U-Cal) programa dana 19.07.2015., a dobivena vrijednost je $U_{cw} = 1,3 \text{ W/m}^2\text{K}$, što je u skladu s certifikatom EnEV 2009 i to bez upotrebe dodatne zaštite od sunca (unutrašnjih sjenila).

5. Zaključak

U radu je prikazan postupak odabira nosivog vertikalnog nosača metalne konstrukcije temeljem statičkog proračuna. Dobivene geometrijske karakteristike aluminijskog profila potvrđene su i putem Schuco Statik programa. Posebna pažnja data je lokalnom utjecaju djelovanja vjetrova na

metalnu konstrukciju. Navedena je potreba za daljnjim istraživanjem, mjerenjem i analizom utjecaja koeficijenta izloženosti vjetru na silu vjetra. Toplinske karakteristike metalne konstrukcije, u ovom radu aluminijske fasadne ostakljene konstrukcije potvrđuju usklađenost iste s novim odredbama, ali isto tako primjenom prezentiranih rješenja zelene tehnologije u metalnoj industriji moguć je i potreban daljnji razvoj i napredak. Sve ima svoju energetska i ekonomsku opravdanost, a prije svega doprinosi se zaštiti i očuvanju okoliša.

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Green Metal Structures

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Abstract. The development of modern metal structures, which are an integral part of modern, ever more demanding building structures, is based on so-called “green technology”. The world trend is to select suitable materials for modern building structures that have a bearing on energy efficiency, while simultaneously contributing to the protection and preservation of the environment. All of the aforementioned is economically justifiable. Modern building structures in certain buildings involve the 100% use of external envelopes. This paper presents the significant impact that metal structures have as

the fundamental support of modern building structures. The procedure of forming metal structures is shown using static calculation, that is, the selection of materials and the most favorable geometric features or profiles. In addition to steel as the basic material of metal structures, this paper pays special attention to the benefits of aluminum. As metal structure profiles must also frequently satisfy the aesthetics and appearance set by the main architects of buildings, aluminum as a material is particularly favorable. This paper also presents the great impact that metal structure profiles have on building structure. Various materials and profiles have different thermal properties. In the final section of the paper, all of the above is shown using a concrete example, from static calculation to the selection of materials and profiles for metal structures. In particular, the impact of different types of materials and profiles on building structure is shown. The results presented demonstrate energy efficiency and economic feasibility. The specialized programs Schuco Statik and SchuCal + were used, as well as the laboratory test results of authorized institutions.

Key words: *metal structures, green technology, aluminum, profiles, static, thermal features*

Primjena simulatora za Arduino platformu u nastavi

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Sažetak. S obzirom na sve veću primjenu mikrokontrolera, mikroračunala i programibilnih elektroničkih sklopova u elektrotehnici, poznavanje programiranja neophodno je za studente elektrotehnike. Kroz kolegij Uporaba računala, koji slušaju studenti prve godine elektrotehnike, predviđeno je da se studenti upoznaju sa osnovama programiranja. Arduino je open-source platforma koju čini skup jednostavnih i fleksibilnih elektroničkih i softverskih komponenti koje se mogu jednostavno povezivati u složenije cjeline i upravo je ona odabrana za primjenu u nastavi. Međutim, uvođenje Arduino platforme u nastavu prate i brojni nedostaci. U prvom redu to je ulaganje u nabavu elektroničkih komponenti, osiguravanje potrebnog prostora za rad te promjena koncepta izvođenja nastave. Naime, sada se javlja potreba za povećanjem satnice kolegija jer studenti pored programiranja sklopova trebaju utrošiti vrijeme i na fizičko povezivanje istih. Da bi se izbjegli navedeni nedostaci, u nastavu je uveden rad sa simulatorom Arduino platforme, i to upravo *Autodesk 123D circuits*. Ovaj program omogućava studentima da prije praktične realizacije sklopa, koristeći računalo, dizajniraju sklop i analiziraju njegov rad. Simulatoru se pristupa putem web preglednika i upravo ovo svojstvo čini ga pogodnim za primjenu u e-učenju. U radu je prikazan rad sa simulatorom i njegove mogućnosti, s osvrtom na mogućnosti timskog rada na projektu.

Ključne riječi: *Arduino, programiranje, simulator*

1. Uvod

Danas su u procesu edukacije računalo i elektroničko učenje (engl. *e-learning*) pojmovi bez kojih je izvođenje nastave nezamislivo. Elektroničko učenje se definira kao korištenje multimedije i Interneta u svrhu poboljšanja kvalitete učenja, omogućavanja pristupa udaljenim izvorima i uslugama te omogućavanje suradnje i komunikacije na daljinu [1]. Upravo je razvoj ICT (engl. *Information and Communications Technology*) i njegovo uvođenje u nastavu utjecalo na razvoj elektroničkog učenja, tako da se danas razlikuje [1]:

- klasična nastava - nastava u učionici (f2f ili *face-to-face*)
- nastava uz pomoć ICT-a - tehnologija u službi poboljšanja klasične nastave (ICT *supported teaching and learning*)

- hibridna - mješovita nastava - kombinacija nastave u učionici i nastave uz pomoć tehnologija (*hybrid, mixed mode* ili *blended learning*)
- online nastava - nastava je uz pomoć ICT-a u potpunosti organizirana na daljinu (*fully online*).

Dostupnost računala i razvoj Interneta doveli su do promjene odnosa između studenta i predavača. Nekada je predavač bio izvor znanja koji je predvodio studente. Danas je predavač voditelj i savjetnik studenta, čija je uloga da procjeni mogućnosti studenta i usmjeri ga u sve prostranijoj riznici znanja čovječanstva [2]. Primjena elektroničkog učenja pruža mogućnost predavaču individualnog pristupa studentu, a prema njegovim sposobnostima i interesima, što je u skladu s nastavim konceptima poznatih pedagoga i psihologa (Jean Piaget, Lav Vygotski, Roger Schank ...) koji zagovaraju individualizaciju nastave, rad u parovima, timski rad i učenje otkrivanjem.

Važan segment u nastavnom procesu na tehničkim studijima su laboratorijske vježbe. Naime, one predstavljaju jedan od najvažnijih segmenata u inženjerskoj edukaciji jer se kroz njih omogućuje da studenti usvojena teoretska znanja primjene u praksi. Prema [3] praktične vještine su ključne u pogledu usvajanja ishoda programa. Zbog činjenice da se kod laboratorijskih vježbi radi s elektroničkim sklopovima, veliki izazov predstavlja njihovo uključivanje u koncept elektroničkog učenja. Stoga se veliki naponi čine da bi se laboratorijske vježbe na tehničkim studijima prilagodile elektroničkom učenju.

2. Laboratorijske vježbe u nastavnom procesu

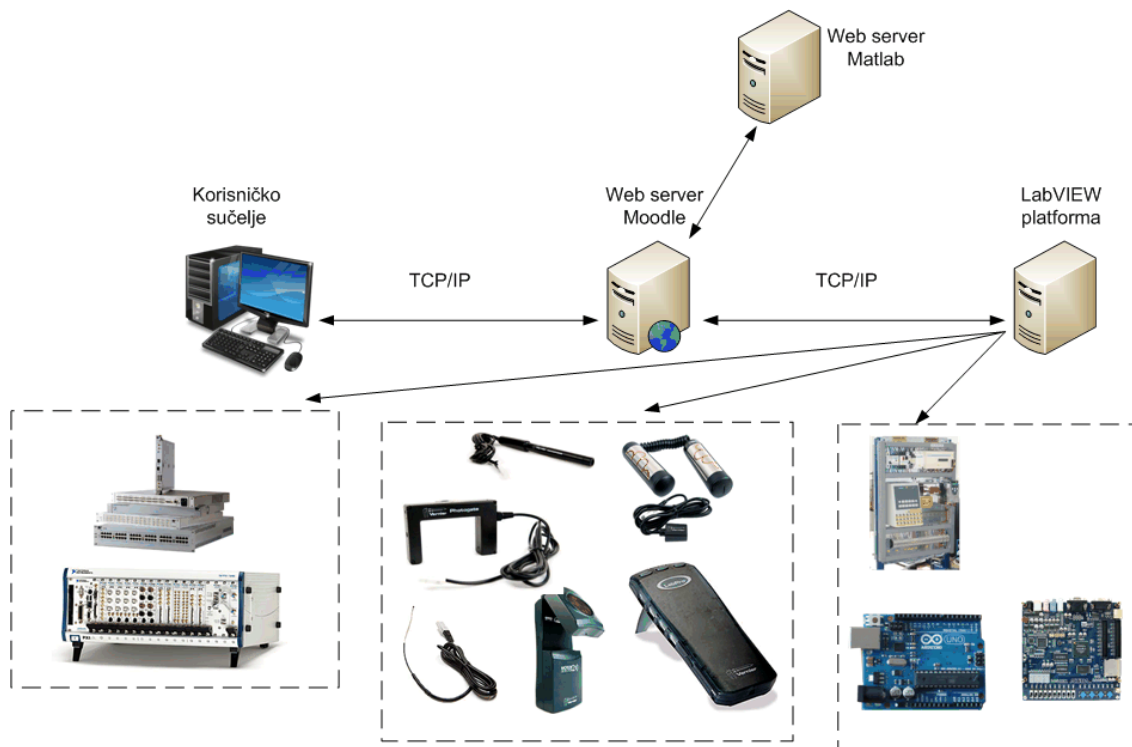
Laboratorijske vježbe uključene u nastavne strategije smatraju se najvažnijim obrazovnim alatima u inženjerskoj edukaciji, posebno za podučavanje složenih ili apstraktnih koncepata [4]. Njihov cilj je povezati teoriju s praksom te posebno pomoći studentima u stjecanju eksperimentalnih vještina te ih izložiti znanstvenom razmišljanju i tako utjecati na njihov razvoj. Vježbe mogu biti stvarne ili virtualne. Prednosti učenja kroz laboratorijske vježbe mogu biti čak i veće ako se vježba dizajnira na način da se omogući timski rad studenata [5,6]. Glavni nedostatak stvarnih laboratorija su visoki troškovi opremanja i potreba za nastavnim osobljem uz relativno slabu iskorištenost, s obzirom na to da studenti laboratorije koriste ograničeno vrijeme. Pored toga, razvoj laboratorija ili razvoj nove vježbe zahtijeva vrijeme za planiranje i testiranje.

Da bi se ovi nedostaci umanjili ulažu se naponi u razvoju udaljenih laboratorija. Udaljeni laboratorij definira se kao laboratorij upravljan računalom kojem se pristupa i upravlja izvana preko nekog komunikacijskog medija. Udaljeni laboratoriji omogućavaju studentima pristup laboratoriju i izvan njegovog radnog vremena. Povećanje vremena dostupnosti laboratorijske opreme i mogućnost pristupa laboratoriju bez obzira na pristupnu lokaciju dovodi do boljeg iskorištenja laboratorijskih resursa te povećanja kvalitete samog učenja. Također, studenti racionalnije koriste postojeće resurse uz niže troškove laboratorija.

Iako je koncept udaljenog laboratorija već odavno poznat, nije došlo do njihove šire praktične realizacije. Razlog tome je velika kompleksnost izrade, ne postojanje standarda i visoka cijena razvoja. Slika 1 prikazuje arhitekturu udaljenog laboratorija realiziranog na Sveučilišnom odjelu za stručne studije Sveučilišta u Splitu [7].

Alternativa udaljenim laboratorijima su virtualni laboratoriji. Kao i kod udaljenih laboratorija pristupa im se i upravlja s njima koristeći neki komunikacijski medij, ali se ne radi sa stvarnim sklopovima već simuliranim. Virtualne vježbe mogu se provoditi bez straha od nezgode ili pogrešaka, a zahtijevaju manje vremena za implementaciju od stvarnog laboratorija. Ne zahtijevaju specijaliziranu ili skupu opremu, a omogućuju studentima da posvete više vremena za razumijevanje pojava koje se istražuju, umjesto proučavanja

postupaka i uputa [8, 9]. Brojne studije su uspoređivale rezultate učenja u stvarnim i virtualnim laboratorijima. Pokazano je da ne postoje veće razlike, ali mala prednost je dana stvarnim laboratorijima [10, 11, 12]. Međutim, uočeno je da su studenti koji su koristili oba laboratorija postigli bolje rezultate od onih studenata koji su koristili samo jednu vrstu laboratorija, bilo stvarni, bilo virtualni [13,14].



Slika 1 Arhitektura udaljenog laboratorija na Sveučilišnom odjelu za stručne studije.

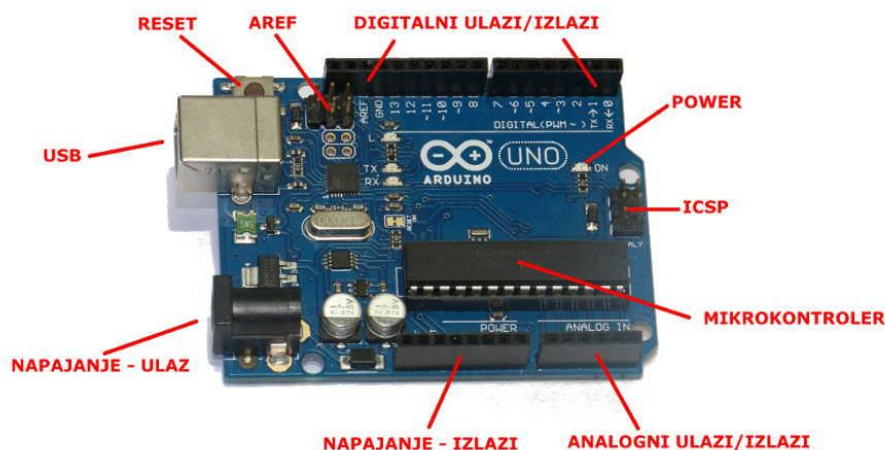
Zbog svega navedenog, u kolegij Uporaba računala na Sveučilišnom odjelu za stručne studije se uveo rad sa simulatorom prije rada sa stvarnim sklopovljem.

3. Arduino (Genuino) simulator

Arduino je platforma otvorenog koda i otvorenog sklopovlja (engl. *open-source*) koju čini skup jednostavnih i fleksibilnih elektroničkih i softverskih komponenti koje se mogu jednostavno povezivati u složenije cjeline [15]. Razvijen je u Italiji za poučavanje programiranja u C/C++ programskim jezicima. Osnova Arduina jesu mikrokontroleri. Mikrokontroler je malo računalo sadržano na jednom integriranom sklopu. Arduino okruženje najčešće koristi 8 bitne mikrokontrolere koje proizvodi tvrtka ATMEL. Najrasprostranjeniji model je ATMEGA328P koji se koristi na osnovnoj Arduino razvojnoj pločici prikazanoj na slici 2.

Glavna namjena mikrokontrolera je komuniciranje s različitim sklopovljem koje se na njega priključi putem ulazno-izlaznih konektora. Arduino razvojna pločica proširuje se s tzv. shieldovima, gotovim tiskanim pločicama (engl. *printed circuit board - PCB*) koji imaju različite funkcije. Tako postoje shieldovi za komunikaciju (*Wi-Fi, XBee, Ethernet, Bluetooth, GSM, Serial, USB ...*), priključak motora, s relejima, NCF/RFID, GPS ...

Upravo su popularnost, jednostavnost i niska cijena čimbenici koji se presudili u odabiru ove platforme za primjenu u nastavi. Pored toga, Arduino platforma ima mogućnost povezivanja s drugim programskim alatima koji se koriste na Sveučilišnom odjelu za stručne studije (*LabView, Matlab*), tako da zapravo predstavlja izvrsno polazište za edukaciju budućih prvostupnika tehničkih studija.



Slika 2 Arduino (Genuino) Uno razvojna pločica.

Glavni nedostatak je osjetljivost platforme. Postoje strujna ograničenja za ulaze i izlaze mikrokontrolera, kao i strujno ograničenje za izlaze napajanja. Pored toga, nepažljivim rukovanjem vrlo lako može doći do uništenja razvojne pločice [16]. Česta izgaranja opreme zbog nepažnje i brzopletosti studenata bili su dodatni motiv za uvođenje simulatora. Studenti trebaju koristeći simulator razviti određeni sklop zadan od strane predavača te ga nakon uspješne realizacije u simulatoru praktično izraditi i testirati (stvarni laboratorij). Projektni zadatak se određuje u dogovoru sa studentom te se na taj način postiže individualni pristup.

Od brojnih simulatora odabran je simulator *123D Circuits* tvrtke Autodesk. Glavna prednost u odnosu na konkurentne simulatore je u tome što *123D Circuits* doslovno simulira stvarni laboratorij i besplatan je za korištenje. Studentu su na raspolaganju brojne komponente koje povezuje koristeći virtualnu eksperimentalnu pločicu (engl. *solderless breadboard protoboard*). Na raspolaganju su pored otpornika i kondenzatora i brojni integrirani krugovi, instrumenti, LED ekran, indikatori itd. Programiranje u simulatoru je identično izvornom Arduino programskom okruženju. Korisniku su na raspolaganju brojne biblioteke te mogućnost pregleda podataka serijske komunikacije (engl. *serial monitor*).

Simulatoru se pristupa putem web sučelja s bilo kojeg računala spojenog na Internet, uz prethodnu registraciju i izradu korisničkog računa. Upravo registracija i izrada računa omogućava praćenje rada studenata te mogućnost formiranja timova koji zajednički rade na zadanom projektu. Uz simuliranje, student može koristeći program izraditi i shemu sklopa te tiskanu pločicu na koju će se zalemiti elementi u slučaju izrade sklopa (umjesto eksperimentalne pločice).

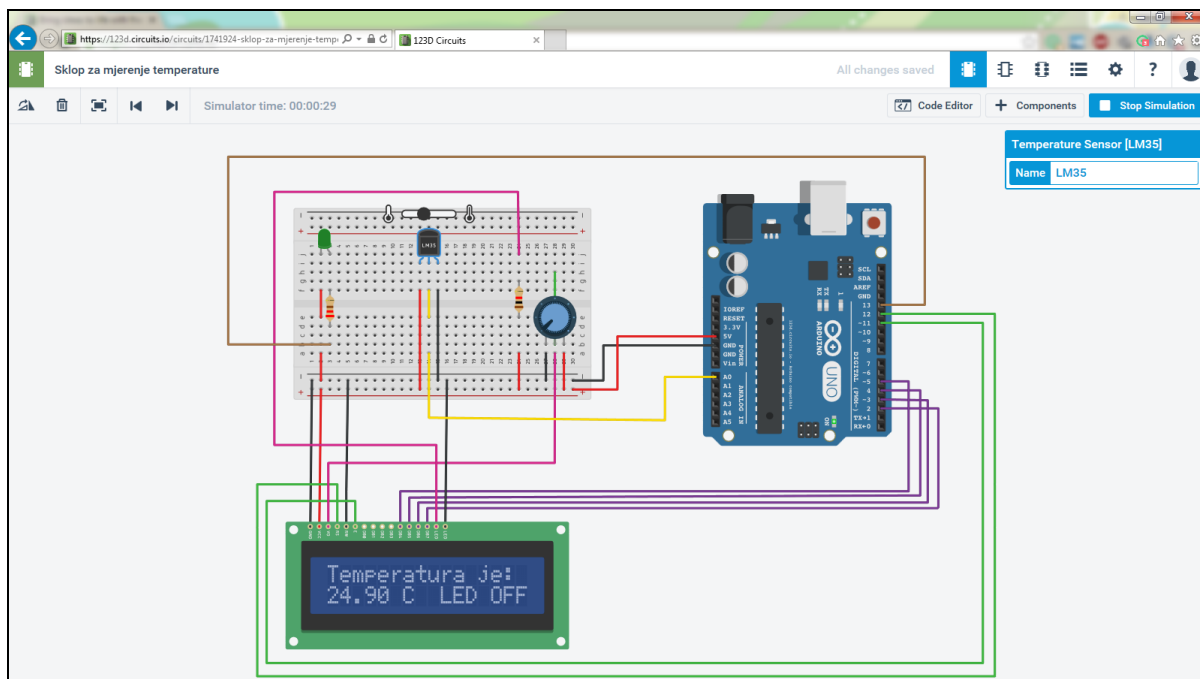
4. Primjer izrade sklopa za mjerenje temperature

Korištenje programa prikazano je kroz realizaciju sklopa za mjerenje temperature. Trenutna temperatura se treba prikazivati na LCD displeju. Sklop ima zadanu graničnu temperaturu pri kojoj se treba uključiti LED dioda. Umjesto LED diode može se priključiti ventilator, motor ili neki drugi uređaj. Sklop je prvo simuliran, a potom je realiziran stvarni sklop te su uspoređeni rezultati. Slika 3 prikazuje simulirani sklop. Sastoji se od Arduina Uno, LCD displeja 16×2 i temperaturnog senzora LM 35.

Sama izrada simulacije je vrlo jednostavna. Klikom na dugme **Components** otvara se izbornik s podržanim komponentama. Nakon umetanja i povezivanja komponenti klikom na **Code Editor** pokaže se prostor za pisanje programa.

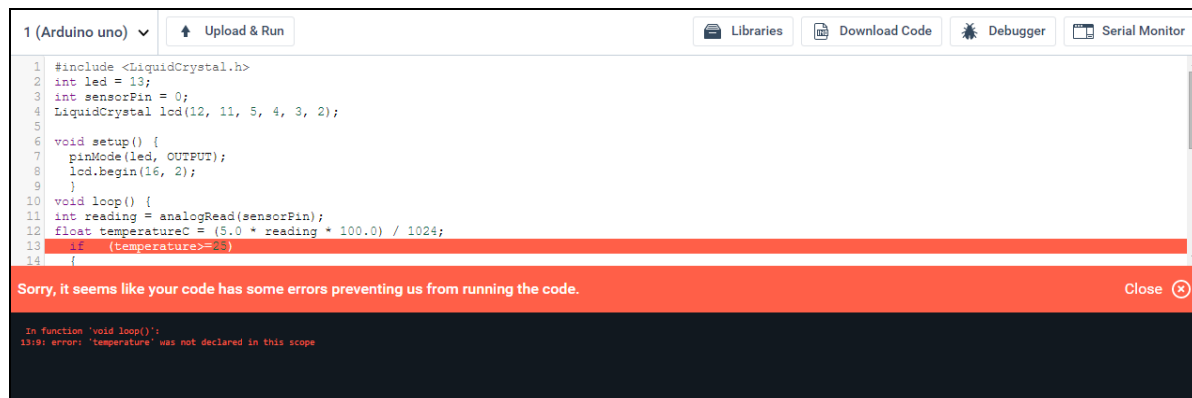
Programi pisani za Arduino mikrokontrolere nazivaju se *sketchevi*. Svaki *sketch* sastoji se od dva dijela – *setup* dio i *loop* dio. *Setup* dio koda izvodi se samo jednom na početku izvođenja

sketcha i u njega se upisuju početne postavke koje su potrebne mikrokontroleru za pojedini *sketch*. *Loop* dio izvodi se nakon *setup* dijela i on se izvodi cijelo vrijeme dok se mikrokontroler ne resetira ili isključi iz napajanja. U *loop* dio upisuju se većina koda mikrokontrolera i tu se definira što mikrokontroler radi.



Slika 3 Simulacija sklopa za mjerenje temperature.

Klikom na dugme **Upload & Run** vrši se provjera programa i pokretanje simulacije. Ako postoji greška u programu, simulator upozorava studenta i pokazuje mjesto s pogreškom u kodu programa, kako je to prikazano na slici 4.



Slika 4 Pogreška u kodu programa.

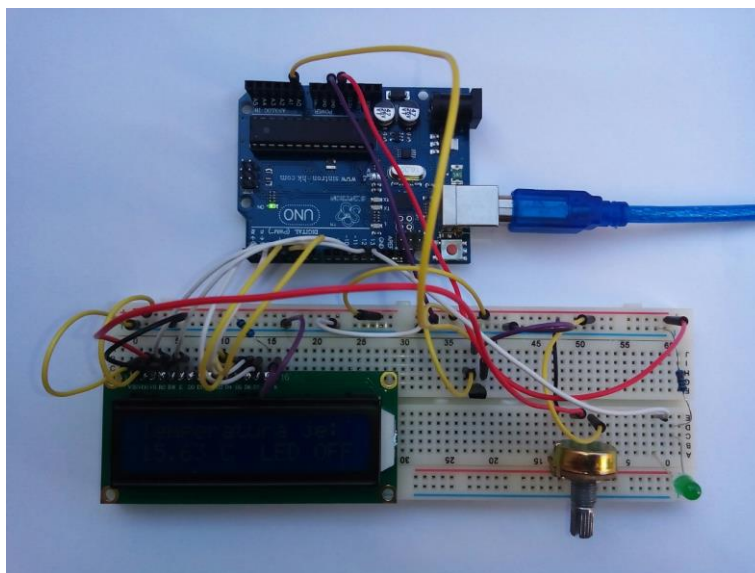
Sama simulacija, ako nema grešaka, može se uvijek pokrenuti klikom na dugme **Start Simulation**. Slika 5 prikazuje ispravan i funkcionalan programski kod koji je realiziran simulatorom.

Nakon realizacije sklopa simulacijom identičan sklop realiziran je u stvarnosti, a prikazan je na slici 6 te je za programiranje korišten programski kod napisan prethodno u simulatoru. Prilikom realizacije praktičnog sklopa pojavio se problem s prikazom temperature na LCD displeju. Promjena temperature bila je brza i učestala što je imalo za posljedicu da je očitavanje temperature na displeju bilo nečitko. Stoga je u programski kod umetnuta naredba *delay* (500) koja pauzira izvođenje programa na 500 ms čime je postignuta čitljivost temperature senzora

na LCD displeju. Ista izmjena učinjena je i u simulatoru, ali nije utjecala na rad simuliranog sklopa.

```
1 (Arduino uno) v Upload & Run
1 #include <LiquidCrystal.h>
2 int led = 13;
3 int sensorPin = 0;
4 LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
5
6 void setup() {
7     pinMode(led, OUTPUT);
8     lcd.begin(16, 2);
9 }
10 void loop() {
11     int reading = analogRead(sensorPin);
12     float temperatureC = (5.0 * reading * 100.0) / 1024;
13     if (temperatureC >= 25)
14     {
15         digitalWrite(led, HIGH);
16         lcd.setCursor(9, 1);
17         lcd.print("LED ON");
18     }
19     if (temperatureC < 25)
20     {
21         digitalWrite(led, LOW);
22         lcd.setCursor(9, 1);
23         lcd.print("LED OFF");
24     }
25     lcd.setCursor(0, 0);
26     lcd.print("Temperatura je:");
27     lcd.setCursor(0, 1);
28     lcd.print(temperatureC);
29     lcd.setCursor(6, 1);
30     lcd.print("C");
31     delay(500);
32 }
```

Slika 5 Programski kod.



Slika 6 Realizirani praktični sklop.

5. Zaključak

U radu je prikazan rad s besplatnim programom *123D Circuits* tvrtke Autodesk, čija je namjena simulacija rada s Arduino platformom. Simulirani sklop je praktično realiziran te je pokazano da ne postoje značajne razlike između simulacije i stvarnog sklopa. Realizacija sklopa u simulatoru je jednostavna i realistična. Umetanje komponenti, njihovo premještanje,

brisanje i povezivanje brzo je i intuitivno. Programiranje je identično programiranju stvarnog sklopa. Nedostatak je nepostojanje *shieldova* te nemogućnost simuliranja LAN, Wi-Fi ili *Xbee* komunikacija. Međutim, s obzirom na to da je upotreba simulatora predviđena kao uvod u svijet mikrokontrolera i njihovog programiranja, navedeni nedostatak nije ograničavajući faktor u njegovoj primjeni.

Naprotiv, primjena simulatora prije rada sa stvarnim sklopovima rezultira većoj trajnosti opreme u laboratorijima jer koristeći simulator studenti mogu eksperimentirati i pogrešno povezivati komponente bez ikakve opasnosti od oštećivanja istih.

Posljedica upotrebe simulatora je manje korištenje stvarnih laboratorija čime se smanjuju troškovi osoblja uz povećanje sigurnosti studenata. S obzirom na to da se za rad sa simulatorom koristi web preglednik, student mu može u bilo koje vrijeme i s bilo kojeg mjesta pristupiti. Na taj način eliminiran je najveći nedostatak stvarnih laboratorija: ograničeno vrijeme koje student može provesti u njemu.

S obzirom na to da u simulatoru nema ograničenja resursa, moguće je svakom studentu pristupiti individualno, i u skladu s njegovim sposobnostima i interesom zadati mu projektni zadatak. Štoviše, mogućnost rada više studenata na istoj simulaciji osigurava mogućnost timskog rada, a upravo sklonost timskom radu je vrlina koju danas traži većina poslodavaca od svojih zaposlenika.

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The use of Arduino simulator in education

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Abstract. Due to the increasing application of microcomputers, microcontrollers and programmable electronic circuits in electrical engineering, the knowledge of programming has become essential for students majoring in Electrical Engineering. In the Computer Usage course, attended by first-year students, they are expected to get introduced to the basics of programming. Since Arduino is an open-source platform that consists of a set of simple and flexible electronic and software components that can be easily interconnected into more complex sections, it has been selected for classroom use. However, teaching with the Arduino platform has numerous disadvantages. First of all, it is the investment in the electronic components, provision of facilities and change in the concept of teaching. In fact, it is

necessary to increase the number of total lessons per semester because in this case students are supposed to spend time not only on programming circuits, but on their physical connection as well. To avoid the above mentioned disadvantages, Arduino simulator Autodesk 123D circuits have been introduced. This program allows students to design and analyse electronic circuits using personal computers before the circuits are realised in practice. The Simulator is accessed through a web browser and this property makes it suitable for use in e-learning. This paper presents how to use the simulator and its capacities, with an emphasis on the possibility of teamwork on the project.

Key words: *Arduino, programming, simulation*

Uporaba programa za upravljanje računalnom učionicom u nastavnom procesu

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Sažetak. Do sada uvriježeni ili tradicionalni načini izvođenja nastave postupno se zamjenjuju suvremenijim informatičkim tehnologijama. Širokopojasni Internet i pad cijene računala rezultirali su trendom izvođenja nastave u računalnim učionicama i kolegija koji se ne bave poučavanjem rada na računalu. Upravo je ova promjena postavila nove zahtjeve u pogledu interakcije između studenta i nastavnika. Kao odgovor na ove zahtjeve pojavili su se programi za upravljanje računalnim učionicama. Danas takav program predstavlja jedan od nezaobilaznih alata u procesu poučavanja u računalnoj učionici. Osnovne značajke ovakvog programa su pored jednostavnije interakcije između nastavnika i studenta i pojednostavljeno dijeljenje datoteka, mogućnosti kratkih provjera znanja, istovremeno praćenje i kontrola rada studenta, postavljanje određenih ograničenja kao i mnoge druge. Mogućnost uvođenja ograničenja kao što su korištenje interneta, zabrana pristupa određenim mrežnim stranicama ili nedozvoljavanje pristupa vanjskim uređajima za pohranu podataka osiguravaju da studenti s punom pažnjom prate nastavni proces. Pored primjene u nastavi, ovakvi programi su važna ispomoć administratorima računalnih učionica jer omogućuju istovremeno rad s više računala. U ovom radu prikazan je program *LanSchool* koji se koristi u računalnim učionicama Sveučilišnog odjela za stručne studije. Prikazane su prednosti njegovog korištenja kod izvođenja nastave, ali i njegova primjena pri administriranju računala.

Ključne riječi: *LanSchool, upravljanje računalnom učionicom, interakcija nastavnik student*

1. Uvod

Nastavni proces u računalnoj učionici uvelike se razlikuje u usporedbi s nastavom u tradicionalnoj učionici. Prvenstveno je problematičan pristup kontroli, tj. upravljanju nastavnim procesom u dijelu koji se odnosi na sudjelovanje studenata. Na prvi pogled tehnologija bi trebala olakšati nastavniku izvođenje nastave u smislu povećanja razine kontrole, no to vrlo često nije slučaj. Naime, u suvremenom tehnološkom okruženju vrlo teško se postiže potpuna posvećenost konkretnoj zadaći uz praktički neprestanu *online*

dostupnost [1]. Tu su podjednako ranjivi, kako učenici u osnovnim i srednjim školama, tako i studenti na fakultetima. Već je sama radna površina zaslona pokrenutog računala remetički čimbenik čiji vizualni karakter odvlači pažnju. Iz navedenog je sasvim jasna potreba učinkovitog upravljanja računalnom učionicom. Rješenje problema su specijalizirani programi namijenjeni ne samo kontroli rada studenata, nego i isporuci nastavnog sadržaja primjerice, *NetOp School*, *Apple Remote Desktop* te u ovom radu detaljnije opisan *LanSchool* [2].

Uobičajeno, takvi programi podrazumijevaju mogućnost dijeljenja sadržaja zaslona nastavnika sa studentima. Osim što se studenti ne moraju naprezati pokušavajući uočiti detalje sadržaja na ploči, odnosno projekcijskom platnu, nema ni mogućnosti skretanja pažnje na druge sadržaje. Osim dijeljenja zaslona, programi za upravljanje računalnom učionicom obično imaju mogućnost zatamnjenja zaslona kad se traži trenutni prekid rada i puna pažnja studenata te mogućnost daljinskog upravljanja računalima što je od velike pomoći pri administriranju računala.

LanSchool se pojavio 1986. godine kao rezultat rada autora D. Doggetta, izvorno pod imenom *PC Chalkboard* [3]. *LanSchool* je vrlo jednostavno, iznimno učinkovito i pouzdano programsko rješenje za upravljanje računalnom učionicom. Program omogućuje nadzor rada studenata na računalima, komunikaciju nastavnika s pojedinim studentom ili pojedinog studenta s ostalim studentima, slanje poruka pojedincima ili grupi studenata, sastavljanje ispita i izvoz rezultata nakon završetka testiranja. Osim toga, vrlo jednostavno se izvodi isporuka i prikupljanje različitih dokumenata te blokiranje pristupa web stranicama na koje studentima nije dopušten pristup. Ne manje važna značajka programa je njegovo vrlo intuitivno, korisniku prilagođeno sučelje, kojim se ovlada u relativno kratkom vremenu.

2. Nastavničko sučelje (*LanSchool Teacher Console*)

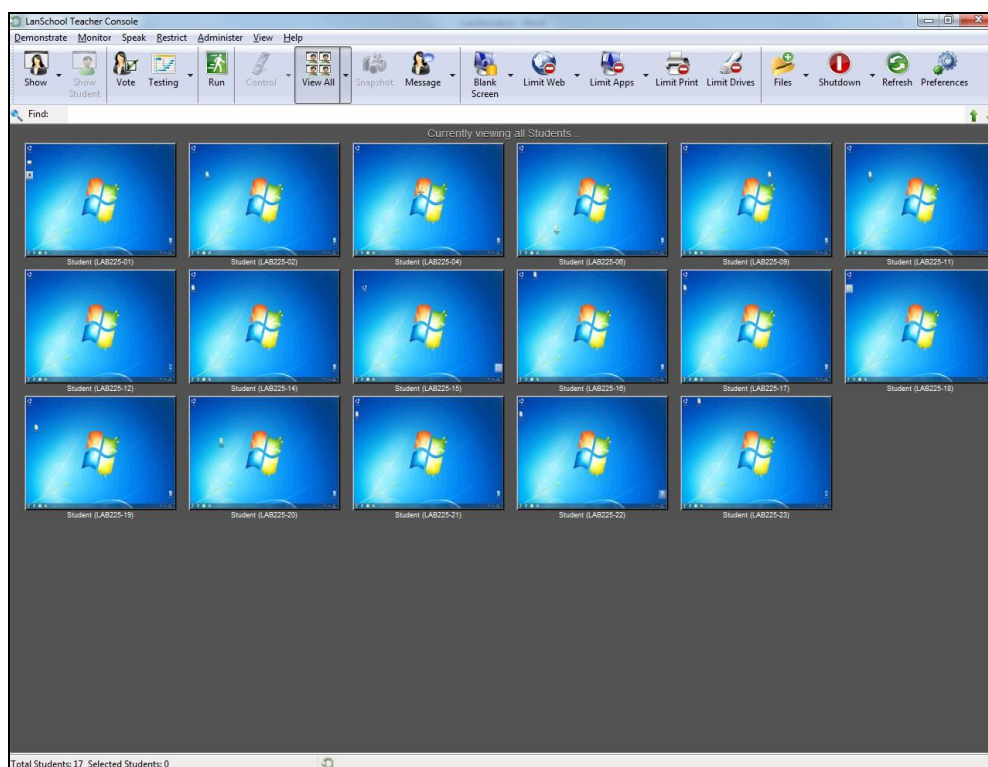
LanSchool [4] pruža nastavniku mogućnost upravljanja svim računalima u računalnoj učionici. Pored toga, funkcionalnost programa omogućava interakciju nastavnika sa studentima kroz čak 16000 tzv. kanala, slično isporuci TV programa. Brojni TV kanali emitiraju se na različite TV prijamnike, ali ipak svi prijamnici mogu istovremeno pratiti isti program. To praktički znači da nastavnik može upravljati sa 16000 različitih računalnih učionica s jednog mjesta.



Slika 1: *LanSchool* izbornik.

Pri uporabi nastavničkog sučelja, u sistemskoj traci (paleti sustava ili području obavijesti) nalazi se *LanSchool* ikona u obliku zelenog kruga. Desni klik na nju otvara izbornik s osnovnim funkcijama kao što su dijeljenje zaslona nastavnika s računalima studenata (*Show Teacher's Screen*), blokiranje zaslona studenata (*Blank All Screens*), ograničavanje pristupa web stranicama i aplikacijama (*Limit Web*, *Limit Applications*) te pristup uređivanju opcija (*Options*). Slika 1 prikazuje izbornik sa osnovnim funkcijama.

Ostalim funkcijama upravlja se koristeći konzolu (*LanSchool Console*) koja se pokreće lijevim klikom na ikonu u sistemskoj traci ili klikom na *LanSchol Console* u izborniku koje se dobije klikom desne tipke miša na ikonu programa. Na konzoli, prikazanoj na slici 2, pojedinim funkcijama pristupa se koristeći vrpce s padajućim izbornicima ili koristeći dugmad na alatnoj traci. Radnje se izvode na odabranim (označenim) računalima, najčešće svim u učionici, a moguće je odabrati i samo jedno računalo ili skupinu računala. Više susjednih računala se odabire klikom miša na pojedine minijature (*Thumbnails*) računala studenata uz pritisnutu tipku *Ctrl* na tipkovnici. Sva računala se odabiru kombinacijom tipki *Ctrl*+*A*. U prikazu sa minijaturama označena računala su uokvirena crveno, a u prikazu detalja redci označenih računala su istaknuti plavo.



Slika 2: Prozor programa *LanSchool*.

Tek kad su računala studenata označena moguće je primijeniti funkcije bilo desnim klikom na minijature označenih studenata, bilo putem kartica padajućeg izbornika ili dugmadi alatne trake. Poništavanje odabira vrši se klikom na prazni dio konzole. Ako ni jedan student nije označen, podrazumijeva se kao da su svi označeni pri aktiviranju ključnih opcija kao što su *Blank Screen* i *Show Teacher*.

U slučaju da se računalima u učionici upravlja s više nastavničkih konzola, što je moguće, akciju jednog nastavnika ne može prekinuti nastavnik s druge konzole, nego se ona prekida isključivo sa konzole s koje je i poduzeta. Na primjer, ako jedan nastavnik studentima zatamni zaslone (opcija *Blank Screen*), nastavnik na drugoj konzoli ih ne može deblokirati.

3. Računalo studenta (*LanSchool Student*)

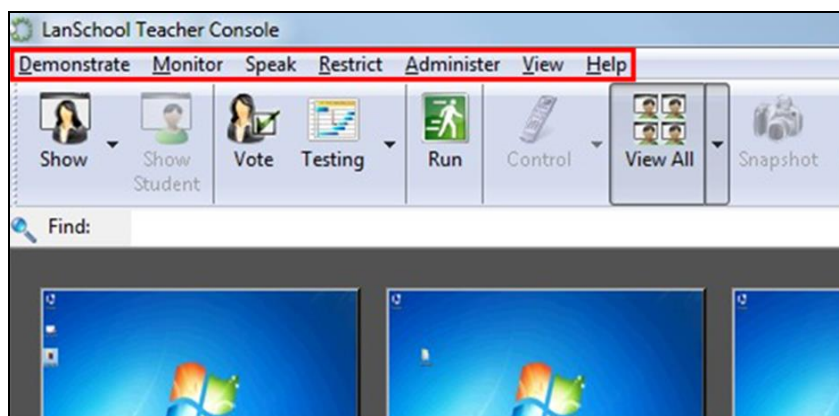
LanSchool instaliran je za rad u pozadini sustava računala studenta. Nastavnik će studente na svom sučelju automatski prepoznati na odgovarajućem kanalu. Studenti na svojim zaslonima, u desnom dijelu programske trake (područje obavijesti), mogu uočiti ikonu *LanSchool*. Postavljanjem pokazivača na ikonu student dobiva informaciju o kanalu na kojem je nastavnik. Klikom na ikonu student može zatražiti od nastavnika pomoć. U skočnom prozoru koji se pojavi student može unijeti pitanje. Nastavnik na svom sučelju vidi oznaku koja ga obavještava da određeni student ima pitanje. Oznaka nestaje kad nastavnik upotrijebi razgovor (*Chat*) ili opciju iz menija *Clear Student Question*. Desnim klikom na ikonu student otvara mapu u koju prima datoteke od nastavnika i u koju sprema datoteke za nastavnika (*Send/Collect* opcija u sučelju nastavnika). Treba napomenuti da se studentu prilikom instaliranja programa *LanSchool Student* može omogućiti biranje kanala. To znači da student, kad mu je to omogućeno, može kroz svoj izbornik napustiti kanal nastavnika u bilo kojem trenutku, što najčešće nije poželjno.

4. Prozor *LanSchool Teacher Console*

LanSchool osmišljen je za jednostavno i lagano rukovanje. Nastavničkoj konzoli (*LanSchool Teacher Console*) pristupa se preko ikone u sistemskoj traci. Prozor konzole sastoji se od naslovne trake, vrpce s padajućim izbornicima, trake s alatima, površine s minijaturama ili popisom računala studenata te statusne trake.

4.1 Vrpca s padajućim izbornicima

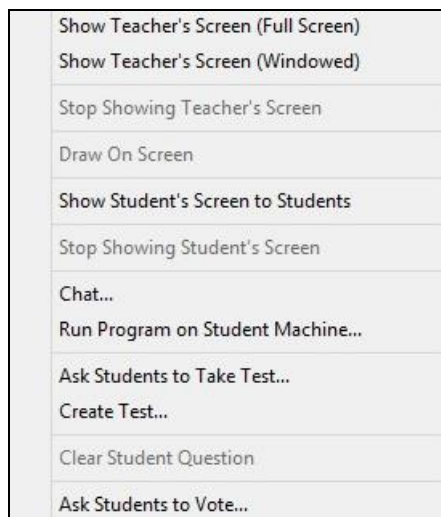
Vrpca s padajućim izbornicima sastoji se od sedam izbornika: *Demonstrate*, *Monitor*, *Speak*, *Restrict*, *Administer*, *View* i *Help*, kako je prikazano na slici 3. Izbornici sadrže naredbe za rad s programom.



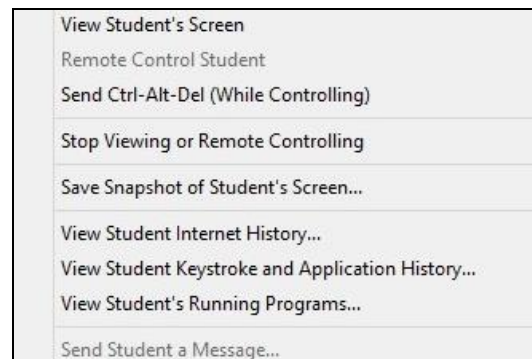
Slika 3: Kartice u vrpci menija

4.1.1 Izbornik *Demonstrate*

Slika 4 prikazuje izbornik *Demonstrate*. Koristi se za upravljanje prikazom minijatura računala studenta, *chat* sa studentom te izradu testova. Opcija *Draw on Screen* (crtanje po zaslonu) omogućena je tek nakon odabira opcije *Show Teacher's Screen*, a *Clear Student Question* nakon što je student postavio pitanje putem svog sučelja.



Slika 4: Izbornik *Demonstrate*.



Slika 5: Kartica *Monitor*

4.1.2 Izbornik *Monitor*

Ovaj izbornik koristi se za praćenje i kontroliranje računala studenata. Slika 5 prikazuje izbornik s prethodno uključenom opcijom *Remote Control Student*. Na računalu studenta moguće je pokrenuti upravitelj zadataka birajući opciju *Send Ctrl-Alt-Del*. Pored toga, nastavnik može vidjeti povijest pretraživanja Interneta i uporabe aplikacija, kao i trenutno pokrenute programe.

4.1.3 Izbornik *Speak*

Izbornik se koristi za audio komunikaciju sa studentima. Dostupne su sljedeće opcije:

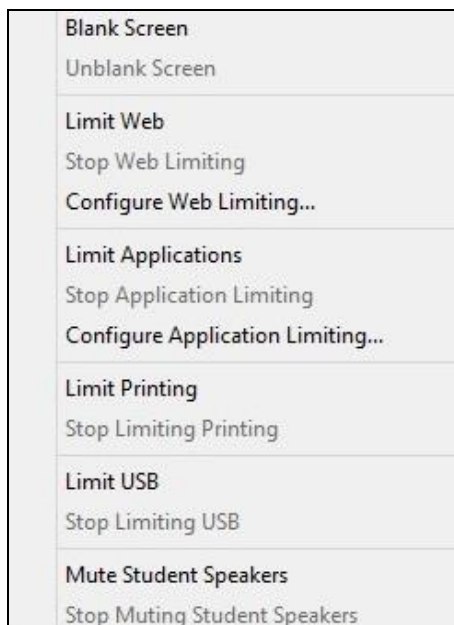
- *Speak to Class* – omogućava nastavniku audio obraćanje studentima koristeći zvučnike, odnosno slušalice.
- *Let Student Speak To Class* – omogućava odabranom studentu audio obraćanje ostalim studentima u učionici.
- *Talk with Student* – uključuje mikrofonski nastavnik i omogućuje razgovor s odabranim studentom.
- *Listen to Student* – uključuje mikrofonski odabranog studenta i omogućuje obraćanje nastavniku.

4.1.4 Izbornik *Restrict*

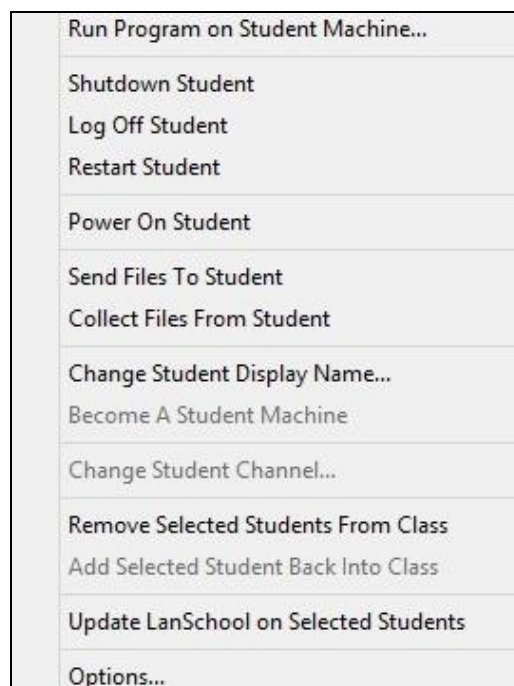
Izbornik upravlja ograničenjima studentskih računala, primjerice ograničenje pristupa Webu i određenim aplikacijama, ograničenje mogućnosti ispisa i uporabe USB spremnika. Na slici 6 prikazan je izbornik *Restrict*.

4.1.5 Izbornik *Administer*

Izbornik nudi mogućnosti administriranja računala studenata, a prikazan je na slici 7. Neke od mogućnosti su: pokretanje određenog programa, isključivanje ili resetiranje računala studenata. Vrlo korisne opcije su slanje datoteka studentima (*Send Files To Student*) i prikupljanje datoteka od studenata (*Collect Files From Student*). Moguće je isključiti označene studente iz razreda te ih naknadno uključiti. Putem ove kartice mogu se konfigurirati sve opcije koje program *LanSchool* pruža. Osim toga, pomoću ovog izbornika nastavnik može privremeno svoje računalo pretvoriti u računalo studenta, tako da odabere opciju *Become A Student Machine*. Računalo će izgledati kao računalo studenta sve dok se korisnik ne odlogira ili dok se računalo ne resetira.



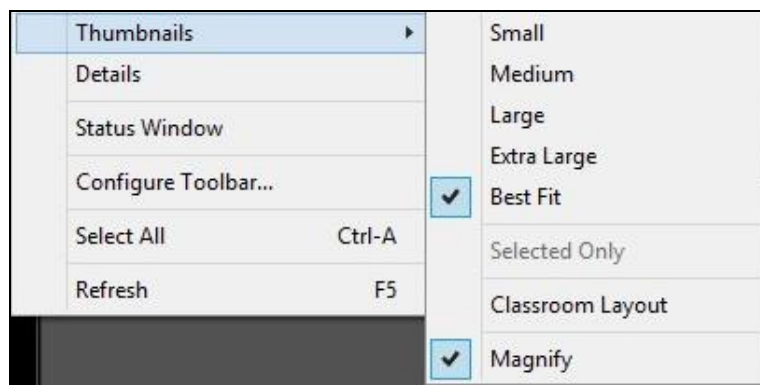
Slika 6: Izbornik *Restrict*.



Slika 7: Izbornik *Administer*.

4.1.6 Izbornik *View*

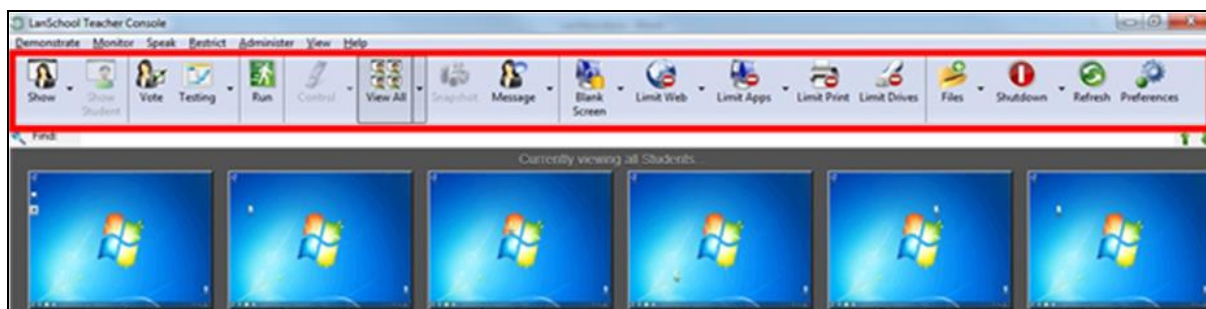
Izbornik *View*, prikazan na slici 8, koristi se za odabir na način prikaza računala studenata i za prilagodbu alatne trake. U pogledu s detaljima (*Details*) zadan je abecedni poredak u stupcu *Login Name*. Klikom na zaglavlje nekog drugog stupca lista će se sortirati prema odabranom stupcu.



Slika 8: Izbornik *View*.

4.2 Alatna traka

Na alatnoj traci, prikazanoj na slici 9, nalazi se dugmad s najčešće korištenim naredbama, a korisnik je može prilagoditi svojim potrebama. Da bi se pokrenula neka funkcija, potrebno je prethodno označiti računalo studenta ili više njih, a zatim pritisnuti željeno dugme na alatnoj traci. Pritisnuto dugme će dobiti obrub i promijeniti osvjetljenje. Prekid funkcije vrši se ponovnim pritiskom na isto dugme. Pojedina dugmad ima strelicu koja omogućuje dodatne opcije za određenu funkciju. Dugmad se može dodavati i pomicati na alatnoj traci koristeći opciju *Configure Toolbar* u izborniku *View*.



Slika 9: Alatna traka.

4.2.1 Dugme *Show*

Dugme prikazuje zaslon nastavnika na svim računalima koja su na istom kanalu. Moguće je odabrati prikaz u obliku prozora ili cijeli zaslon. U načinu s prikazom cijelog zaslona, zaslon nastavnika će na računalu studenta zauzeti cijeli zaslon te mu onemogućiti korištenje miša i tipkovnice. U načinu prikaza u prozoru, student može mijenjati položaj i veličinu prozora sa zaslonom nastavnika te raditi na svom računalu istovremeno prateći nastavnika. Kad nastavnik klikne na dugme *Show* začuje se zvuk na zvučnicima koji studente obavještava o poduzetoj akciji. Nastavnik može promijeniti zvuk u *C:\Program Files\lanschool\start.wav* i *stop.wav*.

4.2.2 Dugme *Show Student*

Ako nastavnik želi prikazati zaslon određenog studenta svim ostalim studentima, jednostavno označi određenog studenta i pritisne dugme *Show Student*. Sve dok je dugme omogućeno student ima kontrolu nad svojim računalom, a svi ostali studenti prate njegov rad na zaslonima vlastitih računala.

4.2.3 Dugme *Vote*

Pomoću ove naredbe nastavnik ima mogućnost dobivanja odgovora na pitanja točno/netočno (*True/False*) ili višestrukog izbora (*Multiple Choice*). U realnom vremenu nastavnik vidi koliko studenata je odgovorilo i kakvi su odgovori.

4.2.4 Dugme *Testing*

Ova opcija omogućava stvaranje testova s količinom do 100 pitanja uz mogućnost umetanja grafičkih elemenata (*.jpg*, *.png*, *.gif*, *.bmp*). Pitanja se mogu nasumično poredati, poslati jednom ili više studenata i pratiti u realnom vremenu. Nastavnici mogu vremenski ograničiti testiranje, pokazati rezultate studentima i izvesti rezultate u obliku *.csv* datoteke. Mogući oblici pitanja su točno/netočno (*True/False*), višestruki izbor (*Multiple Choice*), i kratki odgovor (*Short Answer*).

4.2.5 Dugme *Run*

Pomoću ove funkcije nastavnik pokreće određenu aplikaciju ili web stranicu na računalu odabranog studenta. Ovo može biti vrlo korisno kod studenta koji su početnici u radu s računalom, kao i za administriranje računala.

4.2.6 Dugme *Control*

Ova opcija pruža nastavniku mogućnost preuzimanja kontrole nad mišem i tipkovnicom odabranog studenta ili više njih. Kontroliranje više računala istodobno funkcionira samo ako računala nastavniku izgledaju potpuno isto pa on gledajući u zaslon jednog računala kontrolira i ostala.

4.2.7 Dugme *View All*

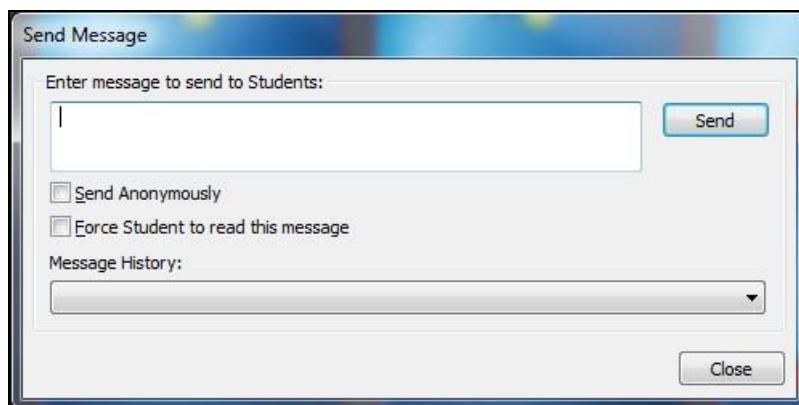
Ova opcija omogućava nastavniku da odabere veličinu prikaza zaslona studenta u obliku malih, srednjih, velikih ili ekstra velikih minijatura. Prelaskom miša preko pojedine minijature, u oblačiću se pojavljuje *login name* studenta i *computer name* računala. Ako student postavi pitanje, ono se također vidi u oblačiću. Malo dužim zadržavanjem miša minijatura se povećava. Desni klik na minijaturu otvara izbornik s opcijama za upravljanje računalom studenta. Osim prelaska na prikaz s detaljima (*Details*), klik na strelicu sa strane dugmeta *View All* nudi još nekoliko mogućnosti. U pogledu s minijaturama moguće je pratiti nekoliko označenih računala odabirom *Selected Only*. Opcija *Classroom Layout* omogućava raspoređivanje minijatura na zaslonu nastavnika u obliku rasporeda računala studenata u učionici. Opcija *Snap to Grid* olakšava poravnavanje minijatura, a *Lock Layout* osigurava očuvanje određenog rasporeda minijatura.

4.2.8 Dugme *Snapshot*

Pritiskom na ovo dugme nastavnik sprema sliku zaslona studenta u standardnom obliku (.jpg ili .bmp). Datum, vrijeme i *login name* studenta također su sačuvani u spremljenoj datoteci.

4.2.9 Dugme *Message*

Na ovaj način nastavnik može poslati svima ili samo odabranim studentima tekstualnu poruku koristeći dijaloški okvir *Send Message*, prikazan na slici 10. Poruka se pojavi u donjem desnom kutu zaslona studenta. Osim poruke, nastavnik sa studentom može pokrenuti razgovor (*Chat*).



Slika 10: Poruka studentima.

4.2.10 Dugme *Blank Screen*

Pritiskom na ovo dugme zaslon studenata se zatamni uz prateću poruku te se onemogućuje miš i tipkovnica. Ova mogućnost korisna je kad nastavnik želi trenutno privući pažnju studenata ili predavati bez ometanja. Poruka koja se pojavljuje na zaslonima može se mijenjati kroz opcije u *Preferences*. Može ih biti i više pa se po potrebi mogu izmjenjivati. Osim toga, poruke se mogu i personalizirati za svakog studenta uključujući u poruku opcije;

- %student name% - ime studenta,
- %login name% - korisničko ime,
- %machine name% - ime računala.

4.2.11 Dugmad *Limit Web* i *Limit Apps*

Da bi se aktiviralo ograničenje bilo Weba bilo pojedinih aplikacija, potrebno je prethodno izvršiti konfiguraciju ograničenja u izborniku kojem se pristupa pritiskom na dugme *Preferences*.

4.2.12 Dugme *Limit Print*

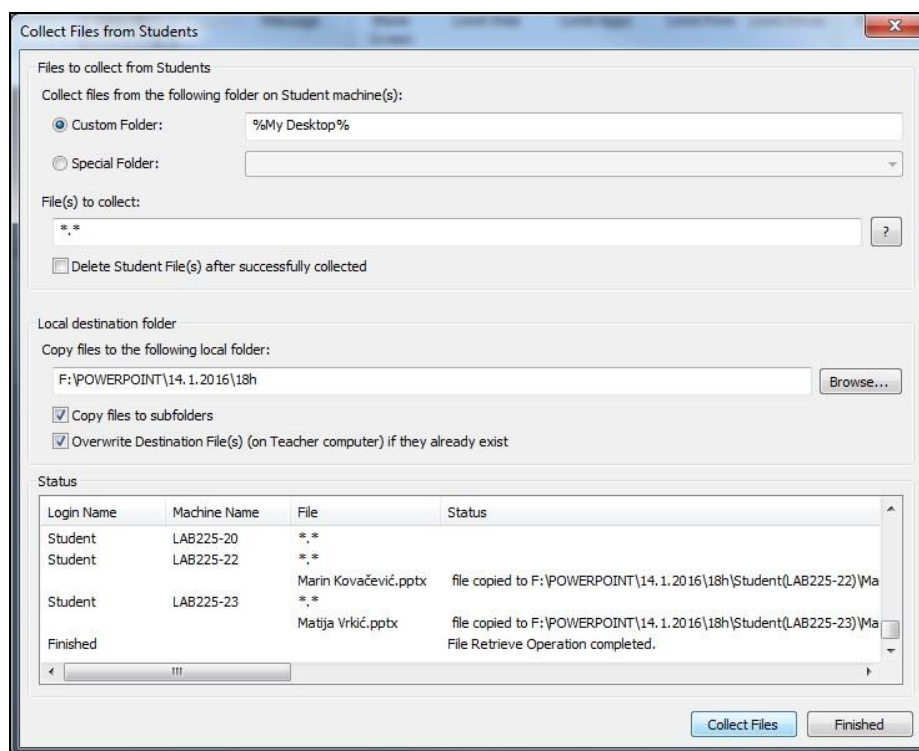
Funkcija ovog dugmeta je privremeno onemogućavanje ispisa za sve ili samo za označene studente.

4.2.13 Dugme *Limit Drives*

Pomoću ove opcije studentima se može ograničiti pristup USB spremnicima i CD-ROM/DVD pogonima.

4.2.14 Dugme *Files*

Pritiskom na ovo dugme otvara se dijaloški okvir za slanje, odnosno prikupljanje datoteka, ovisno koja se opcija odabere koristeći strelicu sa strane (*Send Files* ili *Collect Files*). U dijaloškom okviru za slanje odabire se putanja datoteke, dok dijaloški okvir za prikupljanje datoteka, osim putanje, podržava mogućnost korištenja zamjenskih znakova u imenu datoteke te na taj način uvelike olakšava prikupljanje datoteka. Slika 11 prikazuje dijaloški okvir za prikupljanje datoteka s odabranih računala.



Slika 11: Prikupljanje datoteka.

4.2.15 Dugme *Shutdown*

Pomoću ove opcije označena računala nastavnik može isključiti ili ponovno pokrenuti, a studente odjaviti.

4.2.16 Dugme *Refresh*

Pritiskom na tipku F5 na tipkovnici, koristeći izbornik *View* na vrpci s padajućim izbornicima ili pritiskom na istoimeno dugme na alatnoj traci, osvježava se konzola ponovnim prepoznavanjem računala studenata na određenom kanalu. Lista računala studenata automatski se obnavlja svake 3 minute.

4.2.17 Dugme *Preferences*

Koristeći ovu opciju poziva se dijaloški okvir *LanSchool Teacher Console*, koji se sastoji od sedam kartica kojima korisnik može podesiti program *LanSchool* svojim potrebama.

5. Zaključak

U suvremenom tehnološkom okruženju izvođenje nastave u računalnim učionicama nailazi na izazove učinkovite kontrole nastavnog procesa, kako u smjeru nastavnik - student, tako i obrnuto. Odgovor na ove zahtjeve su specijalizirani programi za upravljanje računalnim učionicama. U ovom radu su prikazane osnovne značajke programa za upravljanje računalnom učionicom *LanSchool* koji se koristi na Sveučilišnom odjelu za stručne studije u Splitu. Nastavnik sadržaje isporučuje izravno na računala studenata u obliku datoteka ili dijeljenjem zaslona svoga računala sa studentima. U bilo kojem trenutku može preuzeti kontrolu nad računalima jednog ili više studenata na nekoliko različitih razina. Interakcijom, koja može biti obostrana, upravlja nastavnik, a može biti tekstualna, zvučna, vizualna. Do povratne informacije u obliku anketa, testova ili prikupljanjem datoteka nastavnik dolazi vrlo jednostavno. Nastavničko računalo ima priključena dva zaslona: jedno se projektorom prikazuje studentima na platnu, dok je na drugom zaslonu prikazan *LanSchool*. Na ovaj način nastavnik tijekom izvođenja nastave prati rad studenata. Program je jednostavan za korištenje, izuzetno dobro je prihvaćen od strane svih nastavnika koji koriste informatičke učionice i postao je nezaobilazni alat u nastavnom procesu.

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The use of classroom management software in education

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Abstract. Modern computer technology is gradually replacing rooted or traditional ways of teaching. Broadband Internet and the decline of computer prices have resulted in the trend of using computer classrooms for courses that are not engaged in teaching computer skills. This

change has set new demands in terms of student-teacher interaction. Programs for the management of computer classrooms have appeared in response to these demands. Nowadays, such a program presents one of the many tools in the process of teaching in a computer classroom. The basic features of this program type are simpler interaction between teachers and students, simplified file sharing, the possibility of quick testing, monitoring and controlling the work of students, the option to specify certain limits, as well as many others. The ability to introduce restrictions such as use of the Internet, access to certain websites or to external devices for data storage, ensures that students are fully involved in the teaching process. In addition, these programs are important tools for administrators of computer classrooms, because they allow one to work on more than one computer at the same time. This paper describes the LanSchool program used in computer classrooms at the University Department of Professional Studies. The benefits of its use in education and its application in administering the computer classroom are shown.

Key words: *LanSchool, computer classroom management, teacher student interaction*

Konstruiranje brodske opreme smanjene mase

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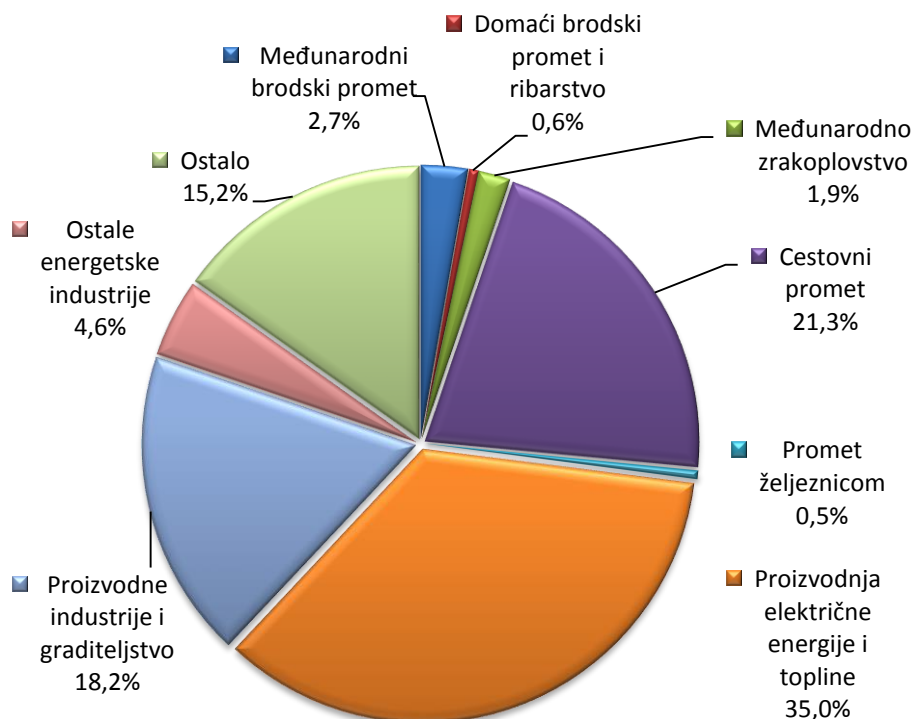
Sažetak: U radu se analiziraju moguće posljedice za proizvođače brodske opreme od *IMO rezolucije MEPC.203(62)* kojom je za većinu novih brodova obvezno ishođenje EEDI svjedodžbe („Certifikata projektnog indeksa energetske učinkovitosti“). Od proizvođača brodske opreme zahtijevat će se energetski učinkovitija oprema manje mase. Uspoređeni su najčešći pogoni brodske opreme po različitim kriterijima, a zbog veće energetske učinkovitosti predviđa se sve veća uporaba reguliranih elektromotornih pogona. Potreba smanjenja mase opreme zahtijevat će složenije tehničke proračune, metode optimizacije, kao i zahtjevnije proizvodne tehnologije. U radu se ukazuje na moguće probleme s kojima će se u budućnosti suočavati proizvođači brodske opreme. Povećani investicijski troškovi „lake opreme“ bit će nadoknadivi nižim eksploatacijskim troškovima.

Ključne riječi: *EEDI, GHG, konstruiranje, oprema broda, mala masa*

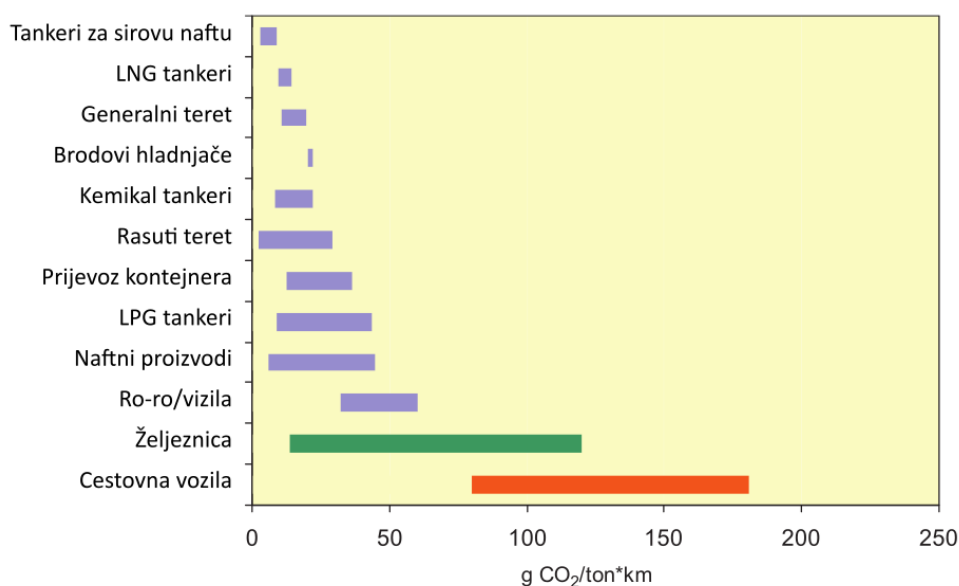
1. Uvod

Neupitno globalno zatopljenje utječe na klimu i vremenske prilike na Zemlji. Najveći utjecaj na globalno zatopljenje imaju emisije stakleničkih plinova koji su uglavnom posljedica korištenja fosilnih goriva. Vlade velikog broja zemalja potpisale su *Protokol iz Kyota* čiji je cilj smanjivanje emisije stakleničkih plinova (GHG). Nastavljanje povećavanja emisije stakleničkih plinova dovelo bi do velikih, a za neke dijelove čovječanstva do katastrofalnih posljedica. Na globalno zagrijavanje najviše utječe količina ugljikovog dioksida (CO_2) u atmosferi. Postoji znanstvena suglasnost o potrebi zadržavanja globalnog zatopljenja Zemlje u granicama do 2°C u odnosu na predindustrijsko razdoblje. Udio emisije CO_2 različitih djelatnosti u ukupnoj emisiji CO_2 u godini 2007. prikazan je na slici 1, IMO (2009.).

Udio prometa u ukupnoj emisiji CO_2 veći je od jedne četvrtine, Hayashi, Y., Morichi, S., & Rothengatter, W. (2015.). Najekonomičniji i energetski najučinkovitiji je brodski prijevoz. Iz tog se razloga, prema podacima Međunarodne pomorske organizacije (*International Maritime Organisation, IMO*), oko 90 % roba svjetske trgovine prevozi morima i zbog toga je brodski prijevoz bitan čimbenik svjetske trgovine, razvoja i prosperiteta. Na slici 2 prikazana je emisija CO_2 za različite vrste brodova i transportnih sredstava, IMO (2009.).



Slika 1 Udio emisije CO₂ različitih djelatnosti u ukupnoj emisiji CO₂



Slika 2 Emisija CO₂ za različite vrste brodova i transportnih sredstava

Brodovi u međunarodnoj plovidbi u 2012. godini, prema podacima IMO-a, IMO (2014.), ispuštali su 796 milijuna tona CO₂, što iznosi oko 2.2 % ukupne emisije CO₂ za tu godinu. Zbog globalnog rasta, učinkovitosti i manjeg utjecaja na okoliš izvjestan je daljnji porast brodskog prijevoza. Do 2050. godine predviđa se porast od 50 do 250 %, a sve zavisno o općem ekonomskom rastu, energetskej situaciji i politici.

Iako je brodski promet energetske najučinkovitiji, ulažu se napor da se smanji emisija CO₂. U tom cilju IMO izdvojio je tipove brodova koji su odgovorni za oko 80 % emisije CO₂ pomorskog transporta i propisao obvezu smanjenja emisije CO₂ za nove brodove te usvojio ambiciozni operativni plan postupnog povećanja energetske učinkovitosti, odnosno smanjenja emisije CO₂ u tri koraka od po 5 godina. Za brodove isporučene od 2015. do 2019. smanjenje je 10 %, od 2020. do 2024. iznosi 20 %, a za brodove isporučene poslije 2025. predviđa se

smanjenje emisije CO₂ i do 30 %. Ostvari li se ova dinamika povećanja energetske učinkovitosti brodova smanjit će se emisija CO₂ poslije 2025., za približno 260 Mt godišnje. Potrebna ulaganja u novi dizajn brodova i pratećih tehnologija vratit će se uštedama goriva u iznosu od oko 75 Mt godišnje. Uzme li se da trgovački brodovi imaju životni vijek 25 do 35 godina za očekivati je da će poslije 2050. svi teretni brodovi u međunarodnom prometu podlijevati zahtjevima energetske učinkovitosti.

Kao mjeru energetske učinkovitosti broda IMO utvrdio je „projektni indeks energetske učinkovitosti“ (*Energy Efficiency Design Index* - EEDI) koji je definiran kao:

$$EEDI = \frac{\text{Utjecaj na okoliš}}{\text{Dobitak za zajednicu}} = \frac{\text{Emisija CO}_2}{\text{Transportni učinak}} \left(\frac{\text{g CO}_2}{\text{t} \cdot \text{milja}} \right)$$

i primjenjuje na teretne brodove bruto tonaže (GT) iznad 400, a koji se grade od 01. siječnja 2013., odnosno za brodove koji se predaju poslije srpnja 2015. EEDI svjedodžba je obvezatna i brodovi moraju imati EEDI manji ili jednak zahtijevanom za tu vrstu i veličinu broda.

Primjena EEDI se ne odnosi na brodove bruto tonaže ispod 400 i općenito na brodove koji nisu namijenjeni prijevozu tereta, kao što su:

- putnički brodovi, trajekti, cruiseri
- Ro-ro teretni brodovi
- tegljači
- ribarski brodovi
- radni brodovi
- brodovi s električnim, hibridnom ili turbinskim porivnim sustavom.

Metodologija izračunavanja EEDI-a dana je u MEPC.1/Circ.681, a pojednostavljeno se može sažeti u izraz:

$$EEDI = \frac{C_F \cdot S_{FC} \cdot P}{\text{Kapacitet} \cdot v_{ref}} \quad \text{gdje je:}$$

P – 75 % nominalno instalirane snage broskog vijka, kW

S_{FC} - specifična potrošnja goriva, g/kWh

C_F - faktor konverzije potrošnje goriva u emisiju CO₂, ($C_F \cong 3.15$)

Kapacitet (DWT) – nosivost broda, t

v_{ref} – brzina broda u čvorovima pri: najvećem gazu i velikoj dubini, bez utjecaja vjetrova i valova te pri snazi od 75 % nominalno ugrađene snage broskog vijka, M/h (=čvor)

U tijeku je široka rasprava o poboljšanju definicije EEDI-a, metodologiji izračunavanja, Ančić, I., Šestan, A. (2015.), primjeni novih efikasnijih tehnologija te njegova primjena i na preostale vrste plovila.

Osim EEDI-a obavezna je primjena „brodskog plana upravljanja energetsom učinkovitošću“ (*Ship Energy Efficiency Management Plan, SEEMP*), kojim se zahtijeva da novi i stari brodovi imaju razvijen i primijenjen operativni plan koji maksimira efikasnost broda u službi. Prema *Second IMO GHG Study 2009* sama primjena SEEMP-a omogućava smanjenje emisije CO₂ sveukupne svjetske flote za 10 do 15 %. U Hrvatskoj ovo je uređeno *Pravilima za statutarnu certifikaciju pomorskih brodova, sprječavanje onečišćenja*, NN 97/(2015.).

Suočeni s nastavkom globalnog zatopljenja moguće je očekivati i primjenu tržišnih mehanizama u obliku trošarina na fosilna goriva, obaveznu primjenu energetski učinkovitijih tehničkih rješenja itd.

Povećanje energetske učinkovitosti brodovlja ima potporu vlada, industrijskih i strukovnih udruga, kao i organizacija civilnog društva. Studijom *IMO GHG Study Report 2009* procijenjena su moguća smanjenja emisije CO₂ korištenjem poznatih tehnologija i prakse, tablica 1.

Tablica 1 Procjene potencijalnih redukcija CO₂ u brodarstvu koristeći poznate tehnologije i praksu

	Smanjena emisija CO ₂ g CO ₂ /tona milji	Kombinirano	Kombinirano
PROJEKT (novi brodovi)			
Koncept, brzina, nosivost	2% ÷ 50% ⁺		
Brodsko forma i nadgrađe	2% ÷ 20%		
Snaga i porivni sustav	5% ÷ 15%	10% ÷ 50% ⁺	
Gorivo s niskim sadržajem ugljika	5% ÷ 15%*		
Energija iz obnovljivih izvora	1% ÷ 10%		
Redukcija CO ₂ iz ispušnih plinova	0%		25% ÷ 75% ⁺
SLUŽBA (svi brodovi)			
Upravljanje flotom, logistika i poticaji	5% ÷ 50% ⁺		
Optimizacija plovidbe	1% ÷ 10%	10% ÷ 50% ⁺	
Upravljanje energijom	1% ÷ 10%		

Napomena:

⁺ smanjenje na ovu razinu zahtijeva smanjenje brzine

* ekvivalent CO₂ temeljen na uporabi LNG

Izvor podataka: *IMO GHG Study Report 2009*

Razvidno je kako se najveći potencijal za smanjenje emisije CO₂ nalazi u konceptu broda, brzini i nosivosti broda. Ostale mogućnosti su:

- smanjenje ugrađene snage pogonskih strojeva zahvaljujući poboljšanju forme broda, smanjenju otpora i poboljšanju efikasnosti brodskog vijka
- smanjenje specifične potrošnje goriva zahvaljujući poboljšanju stupnja korisnog učinka motora
- povećavanje brzine broda bez povećanja snage poriva
- uporaba goriva – izvora energije s manjim sadržajem ugljika, npr. ukapljeni prirodni plin (LNG)
- koristiti obnovljive izvore energije
- povećavanje nosivosti broda (DWT) smanjujući masu broda i brodske opreme.

Optimizirajući uporabu trgovačke flote i brodovlja (SEEMP) moguće je već sada smanjenje emisije CO₂ i bez ulaganja u nove energetske efikasnije brodove. Optimizacija treba obuhvatiti: ukrcaj i iskrcaj tereta, rute i plan putovanja, brzinu plovidbe, balast, učinkovito održavanje broda, obuku itd.

U cilju postizanja planiranih smanjenja emisije stakleničkih plinova (GHG) i zadovoljenja zahtjeva za energetskom učinkovitošću i od proizvođača brodske opreme zahtijevat će se oprema visoke energetske učinkovitosti, a male mase.

Za brodove specijalne namjene, koji za sada nisu obvezni ispunjavati zahtjeve EEDI-a (teglači, ledolomci, ribarski brodovi, jaružala, spasilački brodovi, istraživački brodovi) također će se zahtijevati brodska oprema visoke energetske učinkovitosti sa što manjim utjecajem na okoliš.

Usvojeni plan smanjenja emisije CO₂ (30 % poslije 2025.) vrlo je ambiciozan. Za ostvarenje plana potrebna je međunarodna suradnja na svim razinama, edukacija odgovarajućih stručnjaka, nova inovativna rješenja i tehnologije, korištenje obnovljivih izvora energije.

2. Energetski učinkovita brodska oprema

Učinkovita je ona brodska oprema čiji su pogoni energetski učinkoviti, tj. imaju visok stupanj korisnog učinka, odgovarajući životni vijek, malu masu. Mala masa opreme omogućava prijevoz veće količine korisnog tereta, povećava ekonomsku efikasnost, smanjuje potrošnju neobnovljivih resursa, poboljšava dinamičko ponašanje opreme.

2.1 Energetski učinkoviti pogoni brodske opreme

Za pogon brodske opreme i prijenos energije primjenjuju se u pravilu hidraulički i elektromotorni pogoni.

Hidraulički pogoni se mogu podijeliti na:

- elektro-hidrauličke pogone
- hidrauličke pogone.

Elektro pogoni su najčešće indukcijski motori izmjenične struje (AC) i to:

- jednobrzinski elektromotori
- višebnzinski - polno preklopivi elektromotori
- AC indukcijski motori napajani preko pretvarača frekvencije – regulirani elektromotorni pogoni.

Elektro-hidraulički pogon (EHP) se sastoji od: jednobrzinskog AC elektromotora, hidrauličke pumpe, spremnika hidrauličkog ulja, hidromotora, upravljačkog elementa za promjenu brzine, sustava kočenja i hladnjaka hidrauličkog ulja, pri čemu jedna pumpa napaja samo jedan hidromotor. Radi veće energetske učinkovitosti pumpa i hidromotor u pravilu rade u zatvorenom hidrauličkom krugu, tzv. hidrostaticki prijenosnici.

Hidraulički pogon (HP) je sličan elektro-hidrauličkom, s tim da jedan hidraulički agregat (elektromotor, hidraulička pumpa, spremnik hidrauličkog ulja, kontrolna oprema, hladnjak) napaja više hidromotora.

Regulirani elektromotorni pogon (REP) tvore: AC indukcijski elektromotor, pretvarač frekvencije, enkoder, kočni otpornici s hladnjakom i prijenosnik čiji je izlazni moment usporediv s momentom hidromotora. Umjesto otpornika za kočenje može se primijeniti frekvencijski pretvarač s regenerativnim modulom koji generiranu električnu energiju vraća u mrežu.

Usporedit će se opisani elektro-hidraulički, hidraulički i regulirani elekomotorni pogon. Kao kriteriji usporedbe će se uzeti:








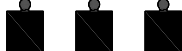


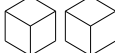

- potrebna tlocrtna površina, obujam i masa
- energetska efikasnost, odnosno stupanj korisnog učinka
- pouzdanost pogona
- potrebno održavanje
- investicijski troškovi

- upravljanje brzinom vrtnje i okretnim momentom
- potreba za grijanjem i hlađenjem
- utjecaj pogona na okoliš
- rad pogona u ekstremnim klimatskim uvjetima.

2.1.1 Usporedba tlocrtne površine, zapremnine i mase različitih pogona

REP nema potrebu za hidrauličkom pumpom, spremnikom ulja, hidrauličkim cijevima i armaturom. Hidraulički cjevovodi, pribor i spojni elementi zamjenjuju se električnim kabelima koji zauzimaju manje prostora i imaju manju masu. Hidraulička pumpa i spremnik zamjenjuju se frekventnim pretvaračem koji ima znatno manji obujam i masu. Nedostatak REP-a je što elektromotor i prijenosnik imaju veći obujam i masu u usporedbi s hidromotorom jednakog momenta. Usporedba različitih pogona prikazana je u tablici 2.

Tablica 2 Usporedba različitih pogona po površini, obujmu i masi

	Potrebna tlocrtna površina i obujam na palubi	Masa na palubi	Ukupni obujam sustava	Ukupna masa sustava
REP				
EHP				
HP				

Napomena:

Ukupni volumen i ukupna masa sustava uključuje i cjevovode, fittinge, hidrauličke agregate, električne kabele, elektroormare.

2.1.2 Usporedba potrošnje energije, odnosno stupanja korisnog učinka

Stupanj korisnog učinka REP-a uključuje stupanj korisnog učinka frekvencijskog pretvarača, elektromotora i mehaničkog prijenosnika, a iznosi između 75 do 85 %, ovisno o veličini elektromotora, vrsti prijenosnika i opterećenju. U slučaju primjene frekvencijskog pretvarača s regenerativnim modulom moguće je u slučajevima kočenja vraćati generiranu električnu energiju u mrežu pa su zato osobito energetski učinkoviti kod vitala dizalica koje češće spuštaju nego podižu teret (regenerativno kočenje) i velikih ribarskih vitala.

Stupanj korisnog učinka EHP-a uključuje stupanj korisnog učinka elektromotora, pumpe i hidromotora. Zbog mehaničkih i volumetričkih gubitaka u pumpi i hidromotoru stupanj korisnog učinka u odnosu na REP je za 20 do 25 % manji, a što ovisi o tipu pumpe i hidromotora, radnom tlaku, brzini vrtnje. Stupanj korisnog učinka EHP-a koji se koriste u brodskoj opremi je od 55 % do 70 %.

HP-a kojih je više na jednom hidrauličkom agregatu imaju manji stupanj korisnog učinka prvenstveno zbog pumpe koja održava najveći tlak koji odgovara samo jednom od pogona. Ovisno o konfiguraciji hidrauličkog sustava i broja hidromotora stupanj korisnog učinka je od 20 do 30 % manji u odnosu na EHP i iznosi od 35 % do 60 %.

2.1.3 Usporedba po kriteriju pouzdanosti rada pogona

Hidraulički pogoni se uspješno koriste desetljećima na različitim tipovima brodova u ekstremnim radnim uvjetima. Primjenom hidroakumulatora moguće je jednostavno izvršavanje sigurnosnih funkcija u kritičnim situacijama (*blackout*). Za REP nema još

dovoljno podataka o učestalosti i vrsti otkaza. Zbog manjeg broja pokretnih dijelova u sustavu REP bi mogli biti u prednosti. S druge strane, nepovoljni radni i klimatski uvjeti (vibracije, velika vlaga, sol u zraku) ne idu na ruku elementima energetske elektronike.

2.1.4 Usporedba po kriteriju zahtjevnosti održavanja pogona

Nadzor i upravljanje REP-ovima na brodu zahtijevaju specijaliziranu stručnu osobu koja može utvrditi i riješiti probleme ovih pogona. Za osiguravanje funkcionalnosti sustava i brzo vraćanje u funkciju u slučaju otkaza potrebna je i vanjska podrška i to vjerojatno najpovoljnije od proizvođača opreme. Dodatni nedostatak REP-a je potreba velikog broja pričuvnih dijelova. Kod hidrauličkih pogona održavanje je jednostavnije, potreban je manji broj pričuvnih dijelova. Prednost REP-a znatno je manje preventivno održavanje, koje se sastoji uglavnom od inspekcijskih pregleda. EHP i HP zahtijevaju veći opseg preventivnog održavanja, koje uključuje provjeru eventualnog propuštanja hidrauličkog ulja, zamjenu hidrauličkog ulja, filtera, fleksibilnih crijeva te ispiranje hidrauličke instalacije. Usporedba pogona sa stajališta zahtjevnosti održavanja dana je u tablici 3.

Tablica 3 Usporedba pogona sa stajališta zahtjevnosti održavanja

	REP	EHP i HP
Rutinsko održavanje	• minimalno	• značajno veće
Preventivno održavanje	• minimalno	• značajno veće
Utvrđivanje kvarova i popravci	• dulje vrijeme otklanjanja kvara • specijalizirana znanja i obuka	• lakše otklanjanje kvara • poznate tehnologije
Pričuvni dijelovi	• manje potrošnog materijala • veća količina pričuvnih dijelova • ograničenje na određene dobavljače	• mogući dobavljači širom svijeta • mogu se koristiti pričuvni dijelovi drugih sustava
Potrebna podrška	• vanjska (proizvođača) uz dodatne troškove	• unutarnja potpora u organizaciji

2.1.5 Upravljanje brzinom vrtnje i okretnom momentom

REP mogu osigurati upravljanje brzinom vrtnje i okretnim momentom motora u širokom rasponu. Područje brzina vrtnje je od 2 % do 100 % najveće brzine uz puni moment, čak i pri nultoj brzini vrtnje. EHP koji rade u zatvorenom hidrauličkom krugu mogu osigurati slične radne karakteristike kao REP.

2.1.6 Potreba za grijanjem i hlađenjem

Glavni problem REP-a na brodu je hlađenje. Hlađenje zrakom puno je nedostataka osobito pri malim brzinama vrtnje. Temperatura zraka može varirati od -40° do $+45^{\circ}\text{C}$. Za hlađenje pri malim brzinama koriste se neovisno pogonjeni ventilatori. Za motore veće snage preferira se vodeno hlađenje. Za sprječavanje kondenziranja vode u namotima motora potrebni su električni grijači.

Hidraulički prijenosnici mogu imati hidraulički agregat u nadziranim radnim uvjetima u potpalublju. Hidraulička oprema smještena na palubi, pri niskim temperaturama, radi održavanja viskoznosti hidrauličkog ulja u radnom području zahtijeva grijače ili treba imati optok toplim hidrauličkim uljem, a što znatno poskupljuje izvedbu i povećava eksploatacijske troškove.

2.1.7 Utjecaj različitih pogona na okoliš

Moguća propuštanja hidrauličkog ulja predstavljaju ekološku opasnost i sigurnosni problem za posadu. U slučajevima gdje rizici ispuštanja hidrauličkog ulja u okoliš nisu prihvatljivi (npr. ekološki zaštićena područja, *live fish carrieri*, *fish farming*) koriste se biorazgradiva i jestiva ulja. Staro hidrauličko ulje, filteri i sredstva za čišćenje trebaju biti zbrinuti na propisani način. Zbog pulsiranja tlaka u sustavu javljaju se vibracije cjevovoda, odnosno hidraulički prijenosnici su bučniji. REP-ovi su po ovom kriteriju bez sumnje u prednosti. Rezultati usporedbe pogona zbirno su dani u tablici 4.

Tablica 4 Usporedba pogona brodske opreme po različitim kriterijima

Kriterij usporedbe	REP	EHP	HP
Obujam i masa pogona	dobro	loše	zadovoljavajuće
Stupanj korisnog učinka	vrlo dobro	dobro	loše
Pouzdanost rada pogona	vrlo dobro	vrlo dobro	vrlo dobro
Zahtjevnost održavanja	zadovoljavajuće	vrlo dobro	vrlo dobro
Investicijski troškovi	visoki	srednji	niski
Upravljanje brzinom i momentom	vrlo dobro	vrlo dobro	zadovoljavajuće
Potreba za grijanjem i hlađenjem	dobro	dobro	vrlo dobro
Rad u ekstremnim klimatskim uvjetima	vrlo dobar	loš	zadovoljavajući
Utjecaj na okoliš	vrlo mali	srednji	velik

Zbog prednosti REP-ova u odnosu na EHP i HP po značajnim kriterijima kao što su: manji obujam i masa, bolji stupanj korisnog učinka, jednostavno upravljanje brzinom i momentom, mogućnost rada u ekstremnim klimatskim uvjetima, mali utjecaj na okoliš, razumno je pretpostaviti da će se oni u buduću preferirati u pogonima brodske opreme. Osim za brodsku opremu regulirani elektromotorni pogoni mogu se očekivati i u drugim područjima npr. kod pogona za dinamičko pozicioniranje broda. Dodatno povećanje korisnog učinka i dinamike pogona može se postići primjenom motora s permanentnim magnetima.

3. Brodska oprema smanjene mase

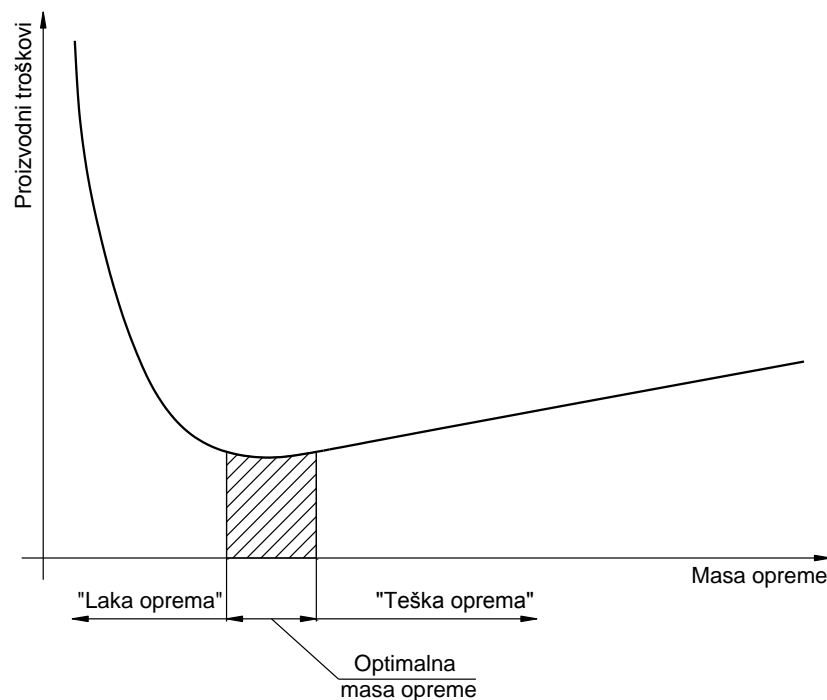
Proizvođači brodske opreme dizajniraju proizvode na način da ispunjavaju funkciju u očekivanom životnom vijeku, zadovolje važeće propise i pravila klasifikacijskih društava, nastojeći pri tome minimizirati proizvodne troškove.

Na proizvodne troškove primarno utječe koncept, geometrija, količina i vrsta materijala te proizvodne tehnologije.

Masa proizvoda koji ispunjava funkciju, uvjete sigurnosti, pouzdanost, životni vijek, a pri tome zadovoljava sve propise i pravila klasifikacijskih društava utječe na proizvodne troškove prema slici 3.

Temeljem proračuna, ispitivanja i iskustva proizvođači brodske opreme masu brodske opreme drže u području koje im omogućava postizanje najmanjih proizvodnih troškova, a s tim i kupcu najmanje investicijske troškove.

Povećavanjem mase opreme iznad troškovno optimalne (područje „teške opreme“ na slici) proizvodni troškovi lagano rastu. Proizvoditi opremu koja po masi spada u ovo područje nema tehničkog ni ekonomskog smisla. Proizvode je proizvođači koji se u nedostatku pouzdanih proračuna osiguravaju „debljinom materijala“ ili se ne odriču starih „teških“ rješenja koji još uvijek prolaze kod kupaca.



Slika 3 Ovisnost proizvodnih troškova o masi opreme

Smanjenjem mase opreme ispod troškovno optimalne (područje „lake opreme“) povećavaju se eksponencijalno razvojni i proizvodni troškovi. Razlozi povećanja troškova su veći udio inženjerskog i visokostručnog rada, složeniji proračuni, zahtjevnije oblikovanje, primjena materijala veće čvrstoće i lakših materijala bitno veće cijene, duži, složeniji i skuplji tehnološki postupci, skuplji alati, složeniji postupci osiguravanja kvalitete i ispitivanja proizvoda. U ovom području nalazi se oprema specijalnih plovila gdje manja masa opreme povećava uporabna svojstva, kao što su ratni brodovi, plovila velike brzine, brodovi za sport i razonodu te općenito oprema kopnenih vozila i zrakoplovna tehnika.

Neizbježni dodatni troškovi za smanjenje mase opreme su općenito manji kada se smanjenje mase postiže boljim konceptom i oblikovanjem, a bitno su veći kada se smanjenje ostvaruje primjenom novih, lakših materijala i tehnologija.

Izrada troškovnog modela proizvodnih troškova o masi opreme složen je zadatak i ovisi o osposobljenosti proizvođača te tehnologija koje su mu na raspolaganju, Wiedemann, J. (2007.). Proizvođači brodske opreme u pravilu ne razmatraju troškove u životnom vijeku opreme, a naročito ne indirektno troškove nastale kao posljedica smanjenja nosivosti broda i veće potrošnje goriva. Težeći najmanjim proizvodnim troškovima opreme, troškovi se prebacuju na kasnije faze životnog ciklusa (pogonski troškovi, troškovi održavanja, troškovi recikliranja). Rijetko se uzima u obzir utjecaj pojedinih konceptijskih rješenja i konstrukcijskih izvedbi opreme na emisiju stakleničkih plinova. Obaveza zadovoljenja EEDI-a navest će i proizvođače brodske opreme da promijene pristup pri razvoju opreme.

Smanjenje mase opreme povećava troškove proizvodnje, ali s druge strane rezultira:

- smanjenjem eksploatacijskih troškova zbog manjeg utroška energije
- većom nosivošću broda
- manjom emisijom stakleničkih plinova.

Smanjenje mase brodske opreme, odnosno dodatna ulaganja u „laku opremu“ moraju imati opravdanje u višoj uporabnoj vrijednosti proizvoda, odnosno moraju biti isplativa u životnom vijeku opreme.

4. Razvoj i proizvodnja lake brodske opreme

Za razvoj i proizvodnju lake brodske opreme ključno je poznavanje opterećenja (djelovanja) po intenzitetu i učestalosti, a koja se mogu očekivati u životnom vijeku opreme. Za veliki broj brodske opreme nema dostupnih podataka. Klasifikacijska društva propisuju opterećenja za opremu koja se smatra sigurnosnom. Iskustva su proizvođača opreme da su ponekad ta opterećenja podcijenjena, npr. sidrena vitla za velike riječno-morske brodove. Za vitla radnih brodova kao jaružala, tegljača, ribarskih i istraživačkih brodova nema pouzdanih podataka. Opterećenja često zavise i o načinu kako se oprema koristi. Primjenom REP-a mogu se, razmjerno jednostavno i uz minimalne dodatne troškove, dobiti spektri opterećenja opreme koja se koristi, a što bi bila dobra osnova za daljnja poboljšanja.

Za razvoj lake konstrukcije bitno je poznavati pomake i raspodjelu naprezanja gotovo u svim točkama konstrukcije pa je nužna primjena suvremenih analitičkih i numeričkih metoda proračuna čvrstoće, krutosti, elastične stabilnosti i zamora. Optimizacija mehaničkih struktura postat će nezaobilazan dio tehničkih proračuna, Schumacher, A. (2013.).

Potrebno je izabrati odgovarajući koncept koji će omogućiti pouzdano funkcioniranje opreme u uvjetima povećanih pomaka nosive konstrukcije, a koji su posljedica većih naprezanja ili primjene materijala manjeg modula elastičnosti.

Lake konstrukcije izvode se od tanjih limova veće čvrstoće pa je oblikovanje konstrukcije bitno zahtjevnije. Povećava se opasnost pojave zaostalih naprezanja te distorzije konstrukcije. Potreba smanjenja mase opreme dovest će do potrebe integracije više dijelova različitih funkcija u jedan složeniji dio.

Izbor materijala veće čvrstoće (čelici povišene čvrstoće) direktno će smanjiti masu opreme. Veća prosječna naprezanja povećat će elastične pomake, a porast će i lokalna naprezanja. Brodska oprema je najčešće dinamički opterećena pa je proračun zamora materijala od najveće važnosti.

Izbor lakših materijala (aluminijske i titanove legure, kompozitni materijali) otvorit će probleme spajanja različitih materijala, elektrokemijske korozije, potrebu galvanskog izoliranja različitih materijala, degradacije materijala, puzanja materijala.

Koristit će se strukturno lakši konstrukcijski elementi (tankostijeni profili, sendvič ploče itd.).

Nove proizvodne tehnologije i tehnike spajanja (lasersko rezanje i zavarivanje, lijepljenje, savijanje) tražit će posebnu pažnju inženjera konstruktora i opsežnije postupke ispitivanja.

S druge strane brodska oprema male mase u eksploataciji će iziskivati češće inspekcije i eventualne popravke. Iz ovih razloga treba oblikovati konstrukciju tako da su vitalni dijelovi dostupni za pregled nerazornim metodama te da su predviđeni i propisani postupci popravaka.

Dugoročni utjecaji konstrukcije na okoliš i okoliša na konstrukciju zahtijevaju obraćanje posebne pažnje površinskoj zaštiti, otpornosti protiv korozije, jednostavnosti recikliranja, utjecajima na okoliš pri otkazu ili pri katastrofalnim otkazima npr. pri potonuću opreme. Dok je oko 70 % aluminija u uporabi prethodno reciklirano, problem učinkovitog recikliranja kompozitnih materijala veliki je izazov.

5. Troškovni model lake konstrukcije

Cilj je, uz zahtjeve koji se postavljaju na opremu, razviti i proizvesti konstrukciju smanjene mase uz zadržavanje životnog vijeka, sigurnosti i pouzdanosti opreme. Snižavanje težine opreme ne može biti cilj sam po sebi. Od najveće je važnosti izgraditi odgovarajuće modele „troškovi – masa konstrukcije“ za različite vrste brodske opreme, Bronner, A. (2008.). Optimalno rješenje može se postići samo sveobuhvatnim pristupom koji obuhvaća:

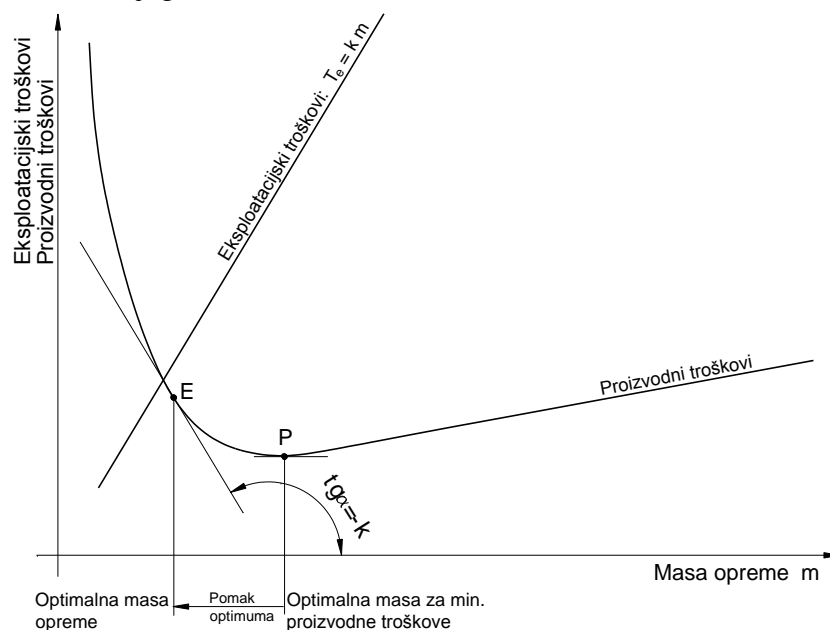
- troškove razvoja

- troškove materijala
- troškove proizvodnje
- troškove ispitivanja
- pogonske troškove
- troškove pregleda, održavanja i popravaka
- troškove recikliranja, oporabe ili odlaganja.

Za određivanje optimalne mase opreme, troškovima razvoja i proizvodnje prikazanih na slici 3, potrebno je pribrojiti eksploatacijske troškove. Radi pojednostavljenja modela pretpostavit će se da su troškovi brodske opreme u eksploataciji srazmjerni njenoj masi (veća masa opreme, a manji korisni teret), slika 4.

$$T_e = k \cdot m$$

Koeficijent proporcionalnosti eksploatacijskih troškova o masi opreme k (\$/t) može se dobiti kao omjer prihoda broda i njegove nosivosti (DWT).



Slika 4 Ovisnost optimalne mase i proizvodnih troškova od eksploatacijskih troškova opreme

Ukupni troškovi su sad:

$$T(m) = T_p(m) + km$$

a imat će svoj minimum za masu opreme koja ispunjava uvjet:

$$T'(m) = T'_p(m) + k = 0$$

odnosno

$$T'_p(m) = -k$$

Masa opreme za koju su ukupni troškovi minimalni je apscisa dirališta (E) tangente s koeficijentom smjera $(-k)$ na krivulju proizvodnih troškova, slika 4. Uzimajući u obzir i eksploatacijske troškove, optimalna masa opreme se tako pomiče u područje „lake opreme“. Povećavanjem faktora proporcionalnosti eksploatacijskih troškova s masom opreme, optimalna masa dublje ulazi u područje „lake opreme“.

6. Zaključno

IMO–ov Odbor za zaštitu pomorskog okoliša (MEPC) usvojio je rezoluciju *MEPC.203(62)* kojom je za nove brodove bruto tonaže iznad 400 obvezno ishođenje EEDI svjedodžbe (*Potvrde o projektnom indeksu energetske učinkovitosti*) te za sve brodove (nove i stare) primjena *Brodskog plana upravljanja energetsom učinkovitošću* (SEEMP). Namjera je smanjiti emisiju stakleničkih plinova brodovlja u međunarodnoj plovidbi. Za očekivati je obveznu primjenu EEDI-a i za brodove koji su do sada bili izuzeti. Od proizvođača brodske opreme zahtijevat će se energetski učinkovitija oprema manje mase. Iz razloga energetske učinkovitosti i male mase, u broskoj se opremi predviđa sve veća uporaba reguliranih elektromotornih pogona. Potreba smanjenja mase opreme zahtijevat će složenije tehničke proračune, metode optimizacije, kao i proizvodne tehnologije. Povećani investicijski troškovi „lake opreme“ nadoknadit će se nižim eksploatacijskim troškovima. Novi izazovi koje donosi potreba zaustavljanja globalnog zagrijavanja prilika su za nove tvrtke da se na vrijeme uključe u rješavanje problema koji se naziru. Pri ovom je nužna međunarodna suradnja i potpora društvene zajednice, kako bi se uključili znanstveni potencijali te educiralo odgovarajuće stručnjake.

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Design of marine lightweight equipment

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Abstract. The paper gives analysis of the possible consequences for manufacturers of marine equipment of IMO resolution MEPC.203(62) which is for most new ships mandatory to obtain EEDI certificate ("Energy Efficiency Design Index"). More energy efficient equipment with lower weight will be required of marine equipment manufacturers. According to different criteria the most common

plants of marine equipment were compared, and because of higher energy efficiency a wider use of regulated electric drives is predicted. The need for weight reduction of the equipment will require more complex technical calculations, optimization methods, as well as more demanding manufacturing technologies. The paper points to possible problems that the marine equipment manufacturers will face in the future. Increased investment costs of "light equipment" will be compensated with lower exploitation costs.

Key words: *EEDI, GHG, design, ships equipment, lightweight*

Uporaba SQL Server Management Data Warehouse za otkrivanje uzroka sporosti u radu SQL Servera

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Sažetak: Otkrivanje uzroka smanjenja performansi SQL Servera je uobičajeni, a često frustrirajući zadatak za administratore baze podataka (DBA), između ostalog, što informacije o sporosti u radu ili *time-out* greškama koje korisnici dobivaju često dođu naknadno, ponekad i kada problem već prođe i teško je uvijek otkriti pravog „krivca“. Uobičajen odgovor administratora baze podataka na pritužbe je uspostavljanje nadzora sljedećih nekoliko dana bez garancije da će se problem ponoviti. U SQL Server verziji 2008 Microsoft je predstavio *Management Data Warehouse* (MDW) bazu podataka koja omogućava nadzor SQL Servera. U tu bazu se skupljaju svi standardni mjerači performansi koji se inače koriste kod analiziranja performansi. Prednost korištenja MDW-a je u tome što se stalno snimaju na stotine brojača koji mjere performanse, a uz jako mali utjecaj toga skupljanja na postojeće performanse. Tako nadzor baza podataka prelazi iz reaktivnog u proaktivni nadzor. Ako se zna točno vrijeme pojave određenog problema lako se može dobiti detaljniji uvid u situaciju koja je u tom trenutku bila na serveru.

U ovom radu prikazano je kako se pokreće MDW, koje izvještaje pruža MDW, a koji se koriste za nadzor rada SQL Servera. Dana su četiri primjera kako je uz pomoć MDW-a SQL DBA grupa u Hrvatskom Telekomu otkrila uzroke blokiranja, pojave zastoja (*time-out*) i globalnog usporenja rada aplikativne podrške koja koristi SQL Server bazu podataka. Naposljetku prikazano je kako se može kreirati novi MDW kolektor za skupljanje *SQL Server Analysis Services* (SSAS) 2008 brojača performansi.

Ključne riječi: otklanjanje poteškoća, dijagnostički nadzor, SQL Server

1 Uvod

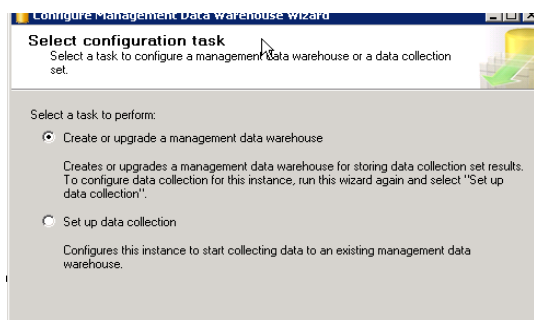
U SQL Server verziji 2008 Microsoft je predstavio *Management Data Warehouse* (MDW) bazu podataka koja omogućava nadzor SQL Servera. MDW sastoji se od skupa komponenti koje omogućavaju skupljanje *PerfMon* brojača kao i unutarnjih SQL Server brojača te spremanje skupljenih podataka u bazu podataka, čime se olakšava administratorima baza podataka otkrivanje problema koji uzrokuju sporost u radu SQL Servera. Pri tome komponente koje rade funkciju snimanja podataka o performansama poznate kao *Performance Data Collector* omogućavaju skupljanje podataka i s više SQL Servera na jedan središnji server i spremanje podataka u dijeljenoj bazi podataka. MDW tako omogućava stalni nadzor performansi na svim postojećim instancama SQL Servera. Također, postoje tri vrste izvještaja koji omogućavaju brzo otkrivanje problema koji mogu uzrokovati smanjenje performansi.

2 Aktiviranje Management Data Warehouse

MDW instalira se zajedno s instalacijom SQL Servera što znači da je besplatan, za razliku od većine dostupnih i kvalitetnih alata za nadzor SQL Servera, ali potrebna je aktivacija za

njegovo korištenje. Prvi korak koji treba napraviti je odabrati SQL Server na kome će se nalaziti MDW baza i na njemu je kreirati. Preporuka je da se koristi poseban SQL Server za nadzor i da se na njega spremaju podaci s više SQL Server instanci.

MDW baza kreira se preko SQL Server Management studija i Management direktorija, izborom čarobnjaka “Configuration Management Data Warehouse”, nakon čega treba odabrati „Create or upgrade a management data warehouse“ (slika 1) i na kraju se unese naziv servera i baze koja će se kreirati na tom serveru (slika 2).



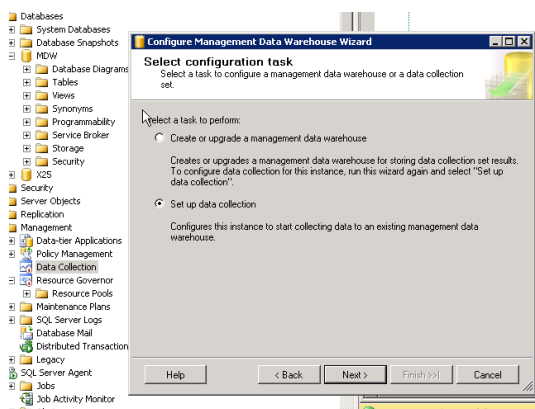
Slika 1. Kreiranje management data warehouse



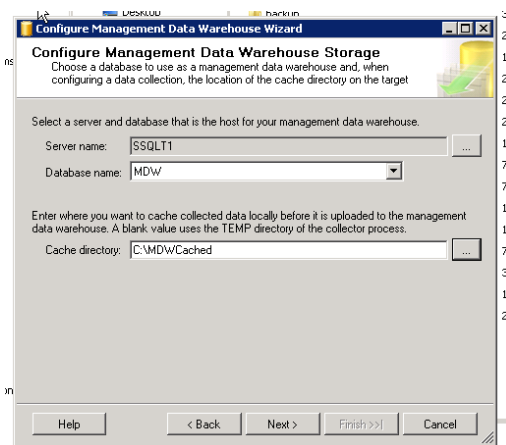
Slika 2. Izbor servera i definiranje naziva baze

3 Startanje Performance Data Collectora

Nakon uspješno završene konfiguracija *Management Data Warehouse* potrebno je startati skupljače podataka preko Management direktorija izborom „DataCollection/Enable Data Collection“, a nakon toga „Set up data Collection“ (slika 3). U posljednjem koraku izabire se SQL Server na kome se nalazi MDW baza i samu bazu te direktorij na disku gdje će se spremati podaci prije prebacivanja u MDW bazu.



Slika 3. Enable Data Collection



Slika 4. Izbor servera, baze i direktorija na disku gdje će se spremati podaci prije prebacivanja u MDW bazu.

Management Data Warehouse Overview: MDW

on SSQLT1 at 25.1.2016 13:48:29

This report provides an overview of the data collector instances that record their data in this management data warehouse. Click on the last snapshot upload time hyperlink to display the report for the associated system collection set.

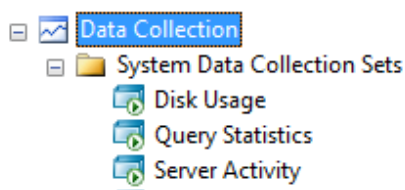
Instance Name	Last Snapshot Upload Times for System Collection Sets		
	Server Activity	Query Statistics	Disk Usage
SSQLT1	25.1.2016 13:45:00	25.1.2016 13:45:00	25.1.2016 13:20:04
SSQLT2	25.1.2016 13:45:00	25.1.2016 13:45:00	25.1.2016 13:23:23
SSQLT3	25.1.2016 13:45:00	25.1.2016 13:45:00	25.1.2016 13:24:28

Slika 5. Primjer kada se u jednoj MDW bazi skupljaju podaci s više SQL servera

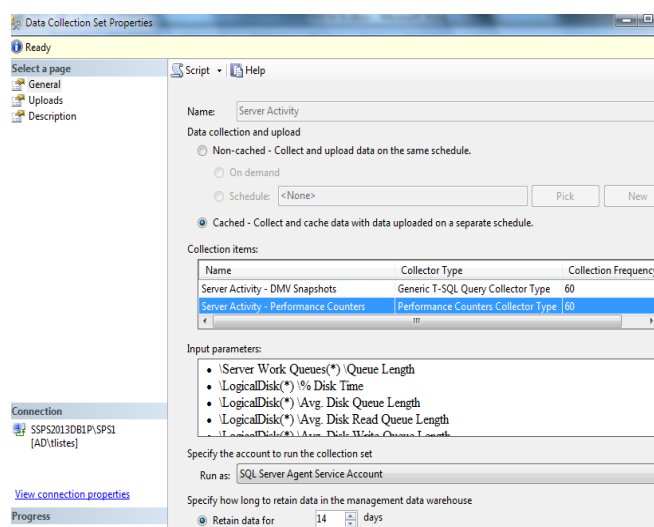
Na ostalim serverima se radi samo korak startanja *Performance Data Collectora* i nakon toga se na zajedničkom serveru počinju skupljati podaci s više servera. Time je omogućen nadzor svih servera s jednog mjesta.

SQL Server 2008 omogućava startanje tri različita skupa kolektora podataka: *Disk Usage*, *Query Statistics*, i *Server Activity*. Nakon startanja skupljanja podataka pojavi se zelena sličica pored svakog kolektora (slika 6).

Ako se pogledaju svojstva pojedinog kolektora, npr. *Server Activity* kolektora može se vidjeti koje sve performanse brojače skuplja ovaj kolektor (*Input Parameter*), kako često, koliko ih dugo čuva te način skupljanja podataka. Kada se odabere *cached* način, kolektor stalno skuplja podatke i sprema ih u direktorij na disku i nakon toga periodički prebacuje u MDW bazu. Npr. *Query Statistics* skuplja podatke svakih 10 sekundi, a *Server Activity* svakih 60 sekundi. U polju „Retain data for“ unosi se broj dana koliko se dugo čuvaju podaci za pojedini kolektor.



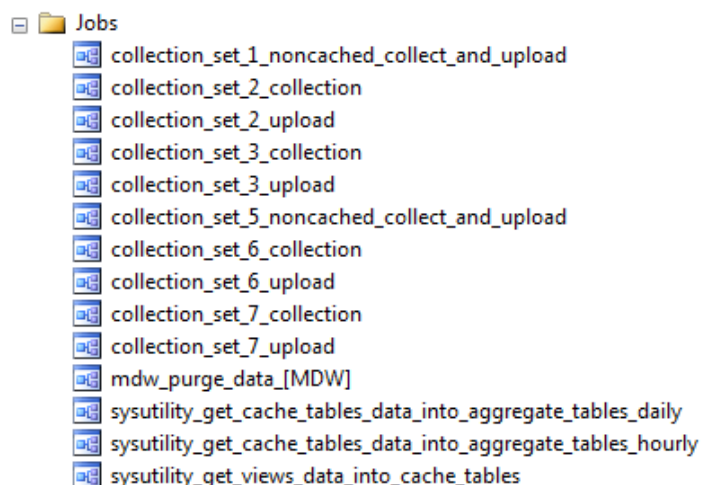
Slika 6. Data collection u SQL Server 2008



Slika 7. Svojstva Server Activity Data collection

Svaki od ovih kolektora ima pridružen niz SSIS (*SQL Server Integration Services*) paketa koji skupljaju podatke, spremaju ih u direktorij na lokalnom disku i zatim prebacuju u MDW bazu kao i skup SQL Agent jobova koji su zaduženi za pozivanje ovih paketa u određenim intervalima.

Nakon startanja *Performance Data Collectora* kreira se više SQL Agent jobova (slika 8) koji su nužni za ispravno funkcioniranje MDW-a.



Slika 8. Job-ovi koji se kreiraju na SQL serveru prilikom startanja skupljanja podataka.

4 Izvještaji dostupni u MDW bazi podataka

MDW baza uključuje tri izvještaja, jedan za svaki vrstu kolektora podataka. Svaki izvještaj ima mogućnost dubljeg ulaska u niže razine zbog analize i detaljnijeg pregleda uzročnika usporenja.

Instance Name	Server Activity	Query Statistics	Disk Usage
SAASDBSQL2\SQL2014	22.2.2016. 17:45:02	22.2.2016. 17:45:02	22.2.2016. 12:00:09

Slika 9. Izvještaji u MDW bazi

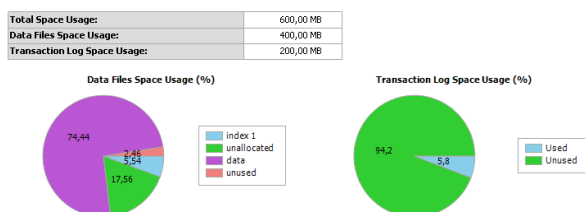
4.1 Zauzeće diska

Prvi izvještaj *Disk Usage* prikazuje koliko koja baza zauzima prostora na disku kao i trend porasta baze. Tako DB administrator može unaprijed reagirati i predvidjeti moguće probleme s prostorom na disku.

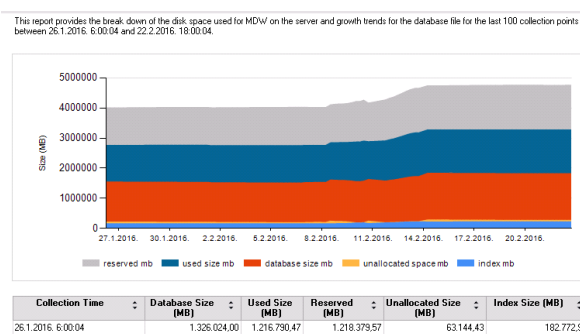
Database Name	Database				Log			
	Start Size (MB)	Trend	Current Size (MB)	Average Growth (MB/Day)	Start Size (MB)	Trend	Current Size (MB)	Average Growth (MB/Day)
T_SQLDBA	488,31		488,31	0	68,38		68,38	0
master	128,00		128,00	0	50,00		50,00	0
lobilisis_Solution	1.281.524,00		1.507.524,00	8370,37	44.500,00		40.500,00	(148,148)
lobilisis_Solution_Log	562.076,63		572.576,63	388,889	18.700,00		24.000,00	196,296
lobilisis_trace	128,00		128,00	0	50,00		50,00	0

Slika 10. Izvještaj Disk Usage

Ako se odabere pojedina baza, dobije se izvještaj koji pokazuje detaljnije podatke o toj bazi podataka (slika 11), a ako se odabere graf koji pokazuje trend porasta dobiju se detalji za pojedinu bazu.



Slika 11. Disk Usage za pojedinu bazu podataka



Slika 12. Trend porast baze podataka

4.2 Rad SQL Servera

Izvještaj *Server Activity* koristi i performanse brojače i unutrašnje brojače SQL Servera. *Server Activity* omogućava izbor vremenskog intervala unatrag onoliko dana koliko je definirano da se čuvaju podaci u bazi za pojedini kolektor.

MDW - 22.2.2016. 18:30:54 - SZGSERVERC3

Specify the start date, start time, and duration of the data that you want to report on.

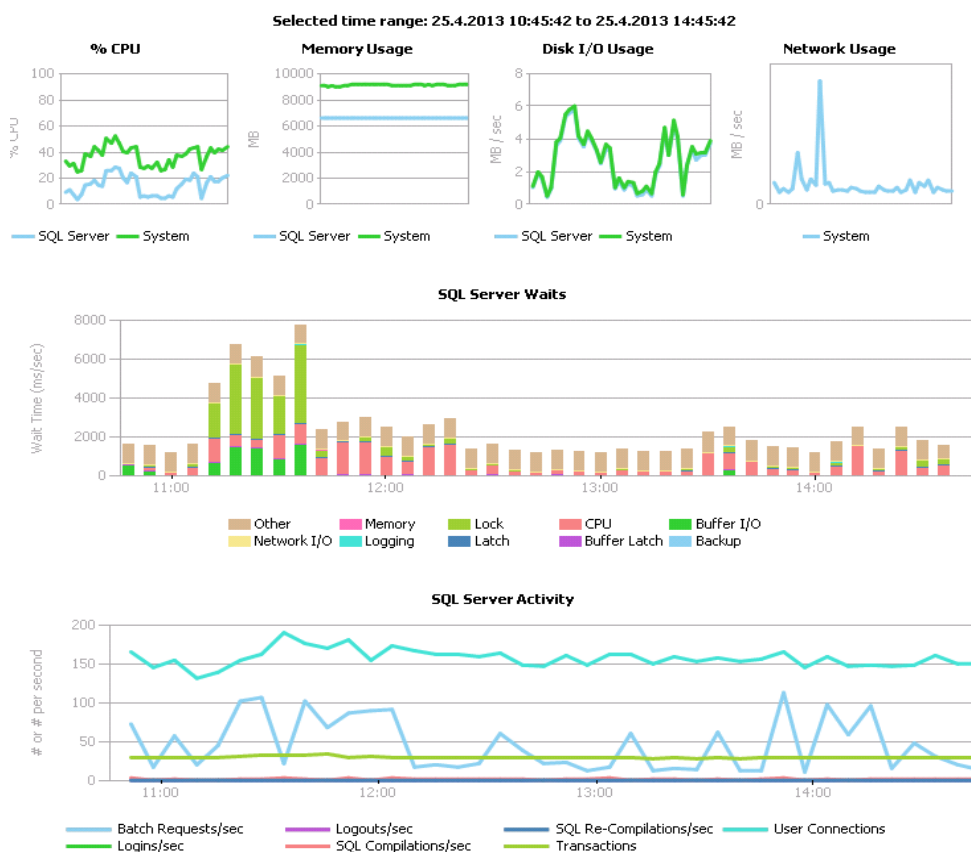
Start date: 22. veljače 2016.

Start time: 14:15:02

Duration: 4 hours

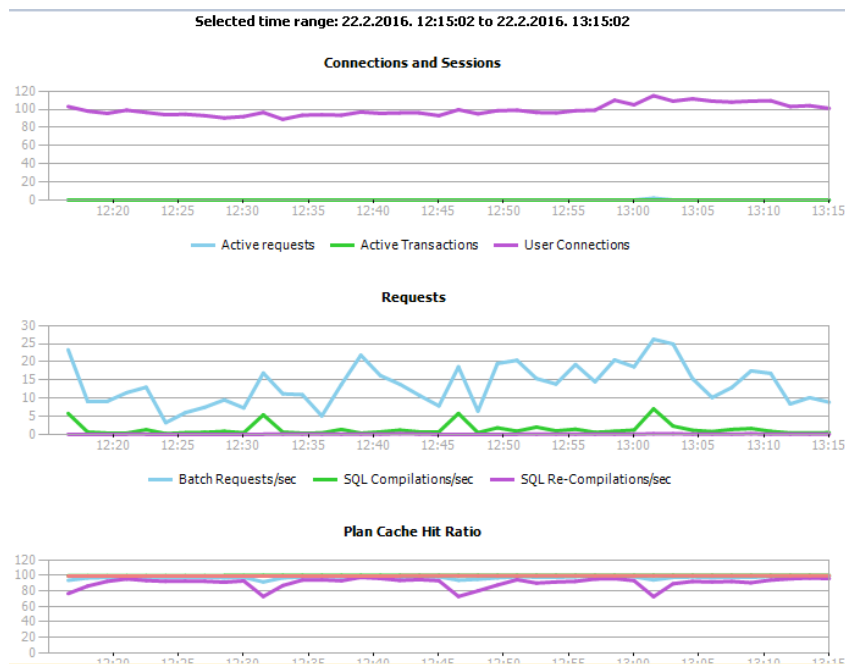
Slika 13. Izbor vremena za koje će biti prikazan izvještaj

Server Activity pruža informacije o korištenju CPU-a, memorije, diska i mreže kako od strane SQL servera tako i od operativnog sustava. Dodatno pokazuje najveće SQL Server waitove kao i ostale aktivnosti na SQL Serveru kao što su broj *Logins/Second*, *Transactions*, *User Connections* itd.



Slika 14. Server activity history

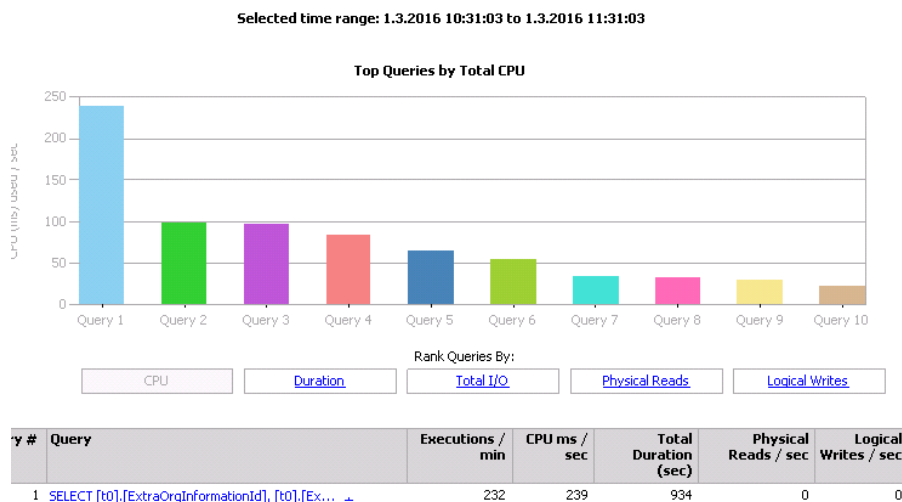
Dalje se može klikom na skoro sve informacije na ekranu ići dublje u podizvještaj za detaljniji prikaz informacija.



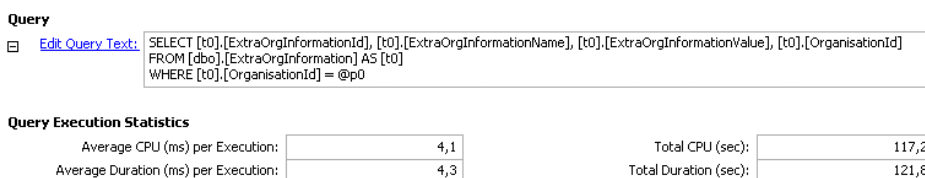
Slika 15. Podizveštaj Server activity history

4.3 Statistika izvršavanja upita

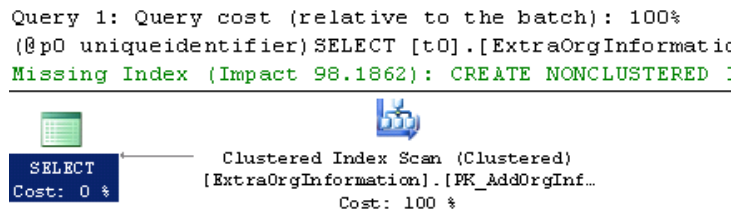
Query Statistics daje izvještaj o izvršavanju upita, pri čemu prikazuje 10 najzahtjevnijih upita po zauzeću CPU resursa. Upite je moguće posložiti po duljini trajanja, ukupnom broju I/O operacija, broju čitanja s diska (*physical reads*) kao i broju čitanja iz memorije (*logical reads*). Nakon identificiranja problematičnih upita, može se detaljnije pogledati i dobiti informacije o upitu uključujući i tekst upita (*query text*) kao i plan izvođenja (*execution plan*) te tako uočiti moguće probleme kao npr. nedostajući indksi (*missing indexes*).



Slika 16. Query Statistics History



Slika 17. Query Details



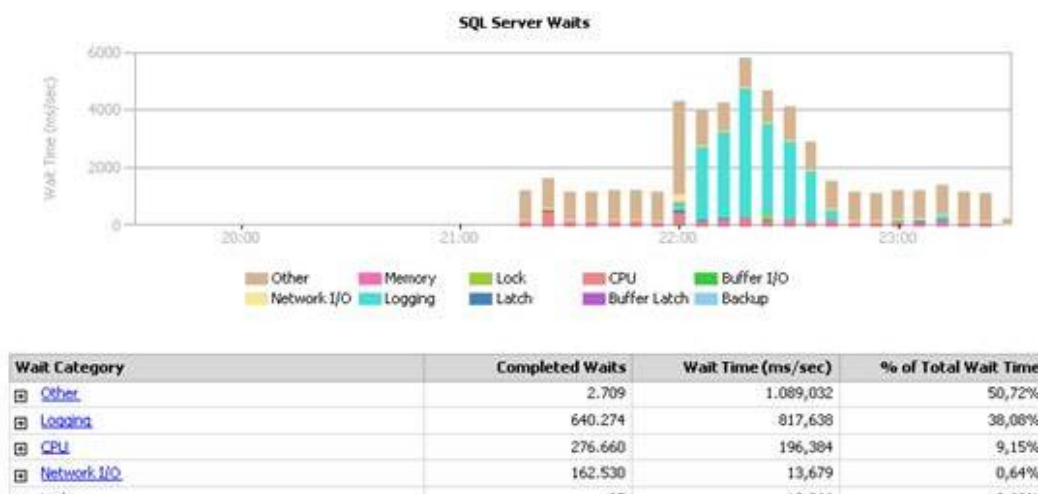
Slika 18. Execution plan of bad query

5 Primjeri korištenja MDW za otkrivanje uzroka sporosti u radu SQL Servera u Hrvatskom Telekomu

Od početka korištenja, MDW se pokazao kao iznimno dobar alat za otkrivanje sporosti u radu SQL Servera kao i uzroka pojave *time-out* poruka korisnicima aplikativne podrške. Osim što je besplatan i dolazi s instalacijom SQL Servera, velika prednost je što se ne mora voditi računa o novim verzijama SQL Servera kao npr. kod komercijalnih alata gdje pojavom nove verzije SQL Servera treba čekati određeno vrijeme da se izda konektor za tu verziju.

5.1 Primjer - sporost diska

Na jednom od sustava korisnici su se žalili na spori rad sustava. Pokretanjem *Server Activity* izvještaja moglo se vidjeti da je *Logging* uzrok najvećim čekanjima na SQL Serveru (*SQL Server Waits*), što ukazuje na problem s diskom na kome se nalaze *transaction log* datoteke jer SQL Server najviše vremena mora čekati da zapiše podatke na disk. Nakon prebacivanja *transaction log* datoteka na drugi brži disk rad aplikacije se znatno ubrzao.

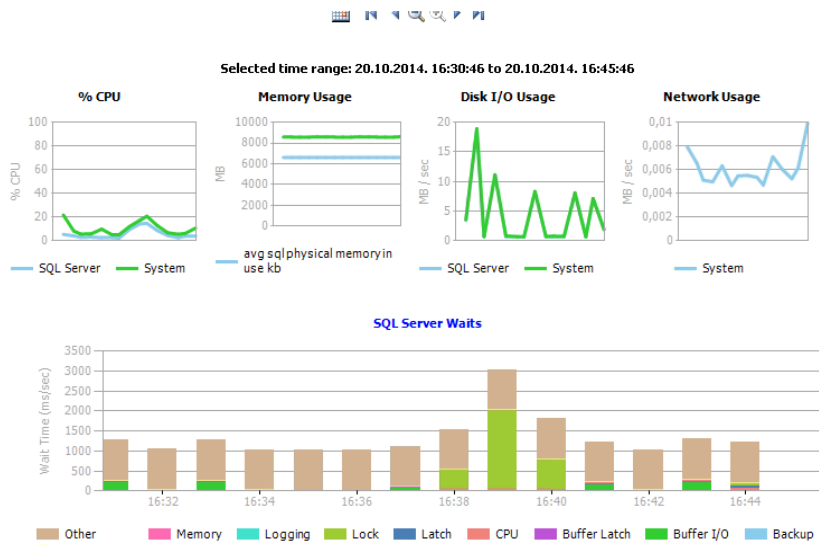


Slika 19. SQL Server Waitovi na serveru sa sporim diskom

5.2 Primjer - problem *time-out* greške

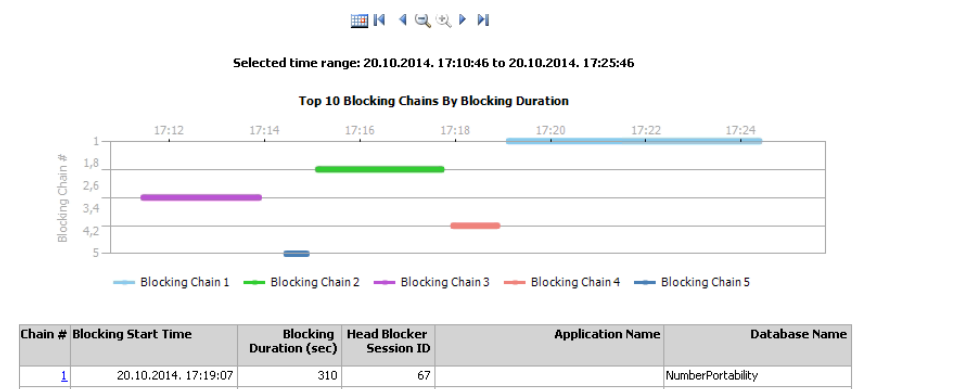
Sljedeći primjer pokazuje kako se pomoću MDW baze podataka mogu otkriti uzroci pojave *time-out* greške na bazi.

Nakon pritužbi korisnika na iznenadnu pojavu *time-out* grešaka iza 16 sati na SQL Server *Activity Reportu* uočeno je postojanje neuobičajeno velikih zaključavanja (*locks*) na bazi u spomenuto vrijeme.



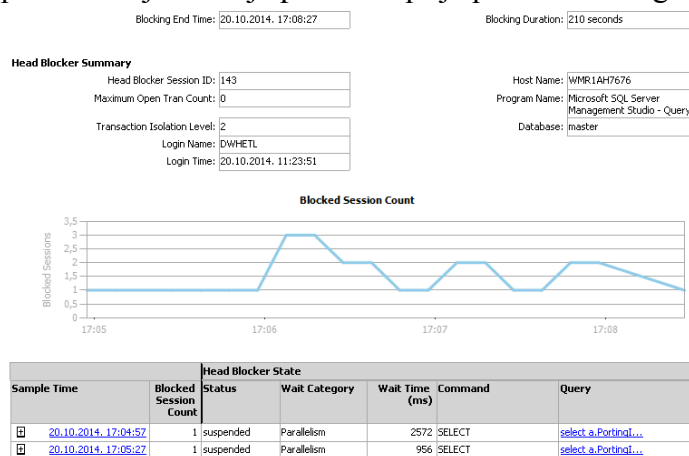
Slika 20. SQL Server Waitovi na serveru s većim zaključavanjima na bazi

Klikom na dio grafa koji pokazuje povećano zaključavanje može se doći do grafa koji prikazuje niz blokiranja s vremenskim rasponima trajanja.



Slika 21. Blocking Chaines

Daljnjim uvidom u izvještaj dobije se konkretan upit koji je izazvao zaključavanje kao i koji korisnik ga je izvršavao te s kojeg računala. Dogovoreno je s korisnikom da pozivanje upita koje je puštao za potrebe izvještavanja pomakne prije početka radnog vremena.



Slika 22. Upit koji je izazvao blokiranje na bazi

U ovom se primjeru može vidjeti kako se zapravo problem prijavljuje često naknadno i DBA grupi je jako teško detektirati uzrok bez posjedovanja ovakvog alata koji omogućava izbor

prošlih vremenskih intervala, i to do razdiobe na 15 min, i tako pregledavati protekle događaje.

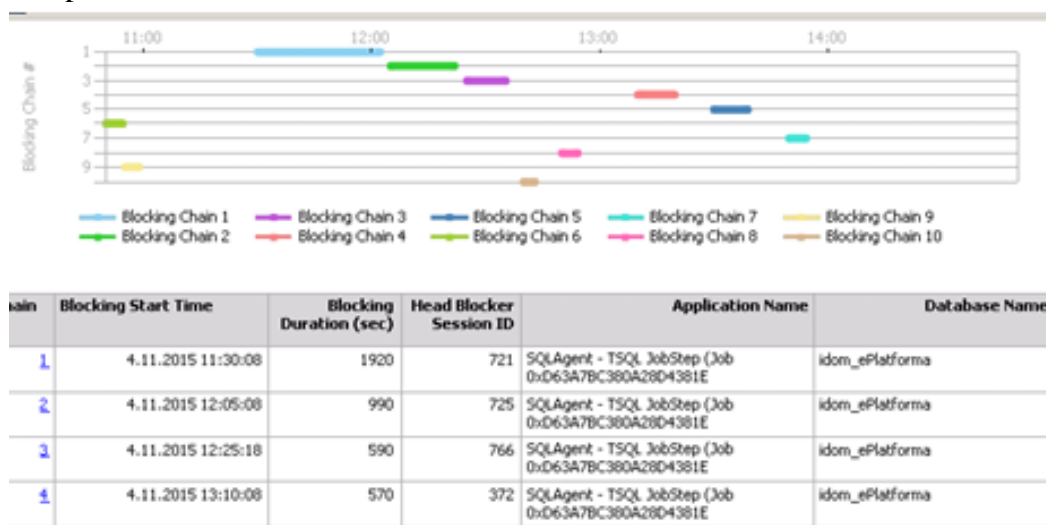
5.3 Primjer – blokiranje upita

Primjer je sličan prethodnom jer se također radi o *time-outima* na bazi za prethodno jutro i traženo je da se otkrije uzrok pojave *time-outa*. Uočena je pojava izrazitih zaključavanja na bazi od 11 - 12 sati upravo kada su se korisnici žalili.



Slika 23. SQL Server Activity report

Klikom na zaključavanja na grafu je vidljiv detaljniji prikaz *Blocking Chain*, kada je započelo blokiranje drugih transakcija i koliko dugo je trajalo, koja aplikacija je izazvala blokiranje i na kojoj bazi podataka.



Slika 24. Blocking Chain

Otvaranjem detalja blokiranih sesija može se vidjeti da se isti upit koji je izazvao blokiranje pozivao i kroz aplikaciju i preko SQL Server agent joba.

Session	Blocked By	Wait Category (Wait Type)	Wait Time (ms)	Command	Program Name	Host Name
351:0:0	0		0	UPDATE	SQLAgent - TSQL JobStep (Job 0xD63A7BC380A28D4381E)	SAASDB
Query: UPDATE [dbo].[DocumentSubscriptionPropertyProcess] SET [DocumentSubscriptionProp... Status: running Login Name: TCloud\sqlsaas Database Name: idom_ePlatforma Request Duration: 9059948 ms Pending IO Count: Request CPU: 677903 ms Session CPU: 0 ms Request Physical Reads: 108 Session Physical Reads: 0 Request Writes: 10680 Session Writes: 0 Last Request Start: 4.11.2015 10:25:01 Last Request End: 4.11.2015 10:25:01						
146:0:0	351	Lock (LCK_M_TX)	0	UPDATE	.Net SqlClient Data Provider	EBPPBIZTALK2
Query: Update DocumentSubscriptionPropertyProcess Set CurrentPropertyProcessStateID = @... Status: suspended, waiting for OBJECT: 34:1264163699:9 Login Name: TCloud\idom_BizHostInst Database Name: idom_ePlatforma Request Duration: 6512 ms Pending IO Count: Request CPU: 0 ms Session CPU: 0 ms Request Physical Reads: 0 Session Physical Reads: 0 Request Writes: 0 Session Writes: 0 Last Request Start: 4.11.2015 10:42:11 Last Request End: 4.11.2015 10:42:11						
152:0:0	351	Lock (LCK_M_TX)	0	UPDATE	.Net SqlClient Data Provider	EBPPBIZTALK2
Query: Update DocumentSubscriptionPropertyProcess Set CurrentPropertyProcessStateID = @... Status: suspended, waiting for OBJECT: 34:1264163699:8 Login Name: TCloud\idom_BizHostInst Database Name: idom_ePlatforma Request Duration: 45379 ms Pending IO Count: Request CPU: 0 ms Session CPU: 0 ms						

Slika 25. Blocking session

Jednostavno se može dobiti SQL Text upita koji je izazvao blokiranje drugih transakcija.

UPDATE [dbo].[DocumentSubscriptionPropertyProcess]

SET

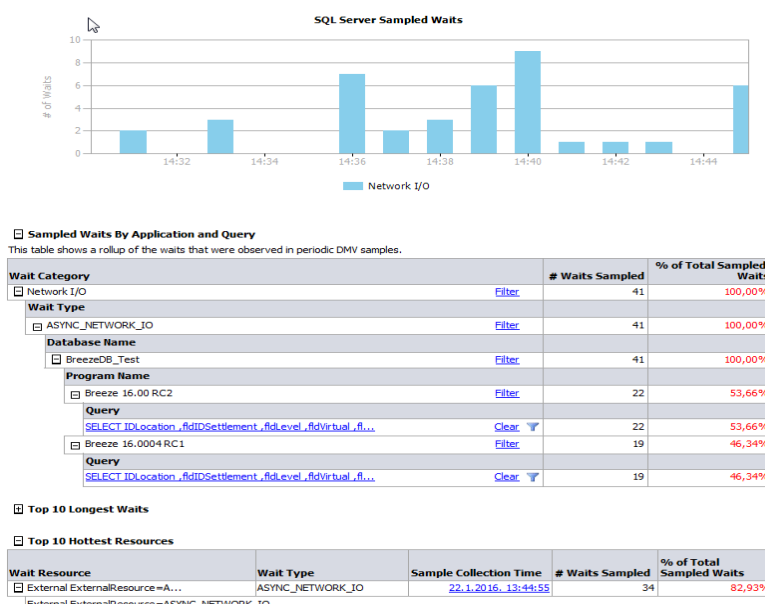
[DocumentSubscriptionPropertyProcess].[SubscriptionPropertyGuid] = [SubscriptionProperty].[Guid], [DocumentSubscriptionPropertyProcess].[SubscriptionPropertyStatusID] = [SubscriptionProperty].[StatusID]

.....

Da bi se spriječili slični problemi dogovoreno je zaustavljanje izvođenja joba i povremeno pokretanje u vrijeme najmanjih aktivnosti na aplikaciji.

5.4 Primjer - problemi na mreži

Prijavljeni su problemi u radu aplikacije na pojedinim lokacijama. Uvidom u MDW izvještaje uočen je velik broj *Network I/O waitova*. Ovakvi *waitovi* se mogu javiti i u situacijama kada SQL Server šalje veće količine podataka klijentu koji ih ne stiže u kratkom vremenu učitati. Međutim, pokazalo se da su u ovom slučaju problemi u radu uzrokovani slabom propusnošću mreže.



Slika 26. Problemi na lokalnoj mreži

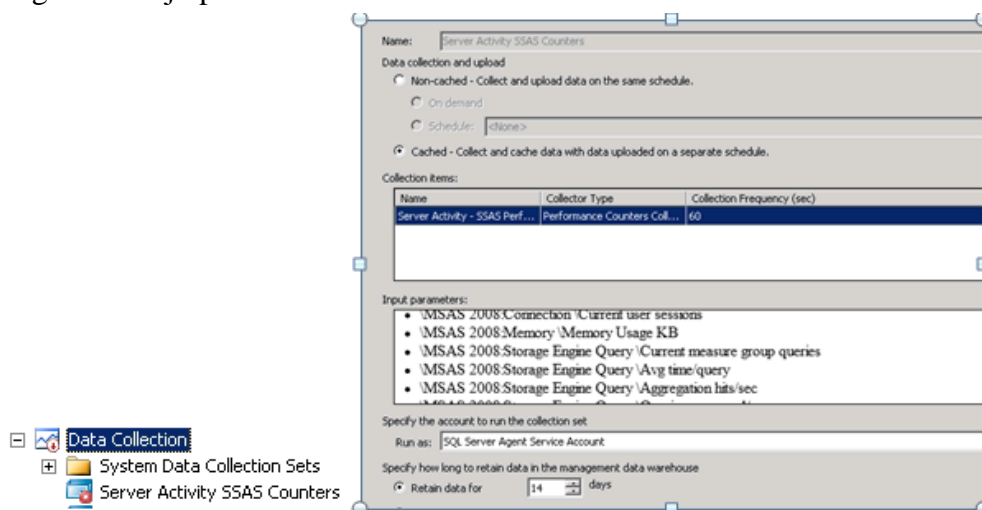
6 Kreiranje vlastitog kolektora za skupljanja Microsoft SQL Server 2008 Analysis Services (SSAS) performanse brojača

Iako MDW inicijalno nema definiran kolektor koji skuplja podatke o *Analysis Services*, a kako postoji potreba za nadzorom SSAS-a, MDW omogućava kreiranje novog kolektora za skupljanje SQL Server 2008 Analysis Services performanse brojača. [2] Prvo je potrebno napraviti skriptu za kreiranje kolektora koju treba izvesti u MDW bazi. Prikazan je dio skripte za kreiranje kolektora *Server Activity SSAS Counters* za skupljanje dijela SSAS performanse brojača:

```
Begin Transaction
Begin Try
Declare @collection_set_id_1 int
Declare @collection_set_uid_2 uniqueidentifier
EXEC [msdb].[dbo].[sp_syscollector_create_collection_set] @name=N'Server Activity SSAS Counters'
, @collection_mode=0
, @description=N'Collects top-level performance indicators for the computer and the Database Engine. Enables analysis of
resource use, resource bottlenecks, and Database Engine activity.'
, @logging_level=0, @days_until_expiration=14
, @schedule_name=N'CollectorSchedule_Every_15min'
, @collection_set_id=@collection_set_id_1 OUTPUT
, @collection_set_uid=@collection_set_uid_2 OUTPUT
Select @collection_set_id_1, @collection_set_uid_2
Declare @collector_type_uid_5 uniqueidentifier
Select @collector_type_uid_5 = collector_type_uid From [msdb].[dbo].[syscollector_collector_types]
Where name = N'Performance Counters Collector Type';
Declare @collection_item_id_6 int
EXEC [msdb].[dbo].[sp_syscollector_create_collection_item] @name=N'Server Activity - SSAS Performance Counters'
, @parameters=N'<ns:PerformanceCountersCollector xmlns:ns="DataCollectorType">
<PerformanceCounters Objects="Processor" Counters="%Processor Time" Instances="_Total" />
<PerformanceCounters Objects="Process" Counters="%Processor Time"
End Catch; [2]
```

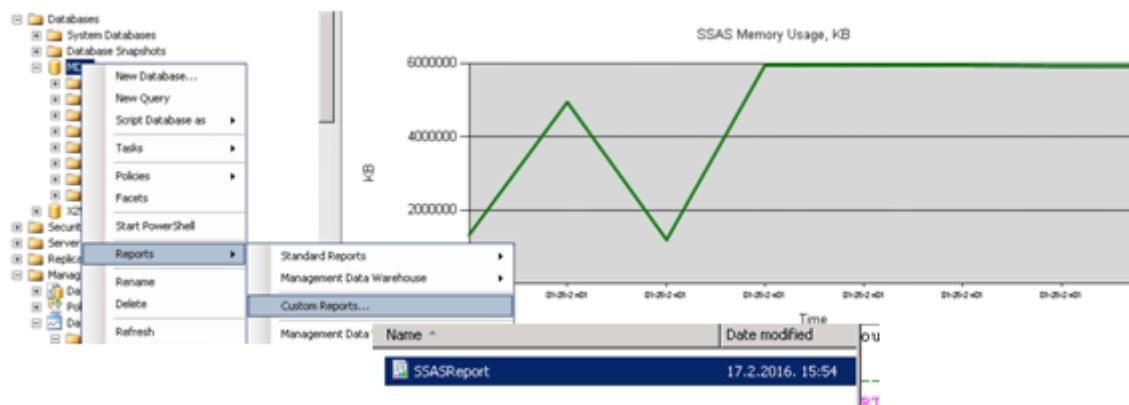
Nakon izvođenja skripte u popisu *Data Collection* pojavi se novi kolektor *Server Activity SSAS Counters* koji je potrebno aktivirati da bi počeo skupljati podatke.

Nakon aktiviranja se mogu pogledati i svojstva tog kolektora. Vidi se koje sve brojače skuplja i koliko dugo se čuvaju podaci u bazi.



Slika 27. Karakteristike Server Activity SSAS Counter

Nakon kreiranja i startanja kolektora potrebno je napraviti izvještaj za prikazivanje tih podataka jer u MDW ne postoji takav izvještaj.



Slika 28. Izvještaj SSAS Memory Usage kreiran u MDW bazi podataka

7 Zaključak

Management Data Warehouse (MDW) nova je komponenta SQL Server Management Studija koja predstavlja skup SQL Server komponenti koje administratorima SQL Server baza podataka omogućava znatno kraći proces otkrivanja uzroka pada performansi i blokiranja u radu. Osnovne komponente MDW-a su kolektori podataka koji skupljaju sve podatke o performansama SQL Servera. MDW je baza podataka u koju se spremaju svi ti podaci i interaktivni izvještaji koji omogućavaju lako pretraživanja podataka. Značajna prednost je što se svi ti podaci mogu skupljati na jednom serveru i s njega nadzirati sve postojeće instalacije SQL Servera verzije 2008 i više. Tako MDW omogućava proaktivno podešavanje, analizu prošlih događaja, statistiku izvođenja upita u određenom vremenskom periodu, predviđanja porasta veličine pojedine baze podataka te planiranje potrebnog diskovnog prostora. U radu je pokazano kako se lako dobije odgovor na pitanje što ili tko je uzrok najvećih čekanja (*waits*) na pojedinoj instanci, koji upit blokira druge i zašto, koji upiti troše najviše resursa, koja baza najbrže raste i slično. Interaktivnost upita omogućava dublji uvid u područje interesa i dobivanje detaljnih podataka o uzroku problema.

Dodatno je pokazano kako se MDW može proširiti s vlastitim skupom kolektora i prikupljati podatke koji se inače ne prikupljaju u osnovnoj instalaciji MDW-a.

Velika prednost ovog alata je u tome što je lako dostupan i besplatan te dolazi sa svakom novom instalacijom SQL Servera. U SQL Serveru 2014 MDW je dodatno proširen s kolektorom *Transaction Performance Collection Sets* pomoću kojeg se u MDW bazi dobije pregled *Transaction Performance Analysis* koji nakon određenog perioda skupljanja podataka preporučuje koje tablice i pohranjene procedure bi bilo dobro prebaciti u memoriju i na taj način značajno povećati performanse korištenjem nove mogućnosti koju donosi SQL Server 2014 In-Memory OLTP (tzv. Hekaton).

Može se postaviti pitanje u kojoj mjeri uspostavljanje skupljanja brojača performansi može dodatno opteretiti SQL Server. Istraživanja su pokazala da je opterećenje zanemarivo prema prednostima i može se odraziti na povećanu iskoristivost CPU-a za oko 4 % i na povećanje zauzeća prostora na disku za 250 - 300 MB dnevno.

Ovim radom pokušalo se potaknuti administratore SQL Server baze podataka na korištenje *Management Data Warehouse* jer im može uvelike olakšati rad, ali u praksi je trenutačno malo zastupljen.

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Using SQL Server Management Data Warehouse for performance troubleshooting

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Abstract: Troubleshooting SQL Server performance problems is a common and often frustrating task for SQL Server DBAs. Performance problem reports arrive after they have occurred. The typical response is to setup limited monitoring for a few days or to attempt to replicate the problem on a copied database.

SQL Server 2008 introduces the Management Data Warehouse (MDW) to SQL Server Management Studio for streamlined performance troubleshooting. MDW is a set of components that enable a database developer or administrator to quickly track down the problems that could be causing performance degradation. The advantage of MDW is that it is possible to store performance data from a number of SQL Servers in one central location, an isolated server and collect in parallel SQL Server and Operating System performance counters. This data is collected by a collection set on each server and stored in a shareable management data warehouse (MDW). After collecting data, the built-in reports can be used for streamlined performance troubleshooting.

The advent of the Management Data Warehouse (MDW) changes the environment by allowing continuous performance monitoring hundreds of performance counters with little effort or performance impact. This is a significant change from reactive to proactive management. The DBA needs to know the time when the problem occurred and MDW allows immediate detail analysis.

This paper shows how to run MDW, after that reports provided by MDW, which is used to monitor operation of SQL Server, and presented. A few examples illustrate how the use of MDW SQL DBA helped a group in the Croatian Telekom to discover the causes of blocking, downtime (time-out) occurrences, and slowing global operation application using SQL Server data base. Finally, it is shown how one can create a new MDW collector for collecting SQL Server Analysis Services (SSAS) 2008 performance counters.

Key words: *troubleshooting, performance and diagnostic monitoring, SQL Server*

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Cross-structural quality within a VET provider organization

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Abstract: In this paper we show how certain management tools may be applied to a Vocational Education and Training (VET) provider organization. Firstly, we introduce the tools we view as important and useful in management. We apply three frames for managing an organization: evaluation/self-assessment, risk analysis and strategy. Secondly, in order to get a holistic view of quality at organizational level, we apply our process diagrams and quality manual and use the metrics defined by the Ministry of Education and Culture in Finland. Thirdly, we show what using these tools leads to when talking about human resource management and ICT in education. For human resource management, we have made a personnel program that is based on strategy and is evaluated annually as a part of quality assessment. In the personnel program, the management tools and the professional competence requirements are defined. Also, employee training is included in the personnel program and ICT plays an important part in it. In our strategy, we find points that emphasize the use of ICT. When all this is combined with current trends in education and learning, we get a well-defined plan for the development of ICT in education. Included in the paper is an example of our plan and our experiences and positive results when applying these tools in a holistic way across the organization.

Key words: *Educational quality frame, self assessment, ICT-strategy in VET, HRD and participation*

1. Introduction

In this article, vocational education and training (VET) is discussed with an eye toward the future, and the conventional quality framework classification (EFQM/CAF) partly used in the subchapters. This allows for a comprehensive overview of operations and achievement of results. First, we talk about the future plans of vocational education in Finland. Then we tell about the challenges that especially Point College meets from the management's and educational point of view. In chapter four we introduce three different frameworks: /self-assessment, risk analysis and strategy and then we also discuss some points to be considered when analyzing the assessment results. After that we present our personnel program (chapter 5) and plans for developing the pedagogical use of ICT

(chapter 6). In chapter 7 we introduce our positive results when applying this model and in the last chapter we talk about the future of vocational education in Finland.

2. Future state and issues in vocational education in Finland – the coming reform

2.1 Strategy and decision-making

The status of VET as part of the Finnish education system has undergone radical changes over the past 20-30 years. Curricula were also reformed in 2015. A reform, which will generate EUR 190 million in savings and introduce a new funding model, is being implemented. The flexibility of the education system to meet the needs of its clients and employers are being put to the test with numerous structural and content changes.

It will become impossible to anticipate future trends over the long term due to the rapid rate of change, even if a Finnish education provider, such as Point College, has gotten accustomed to doing strategy work for years. It will be necessary to come up with new funding models and development work carried out using project funding can no longer be done in an isolated, fragmented and redundant manner (or with funding from multiple funding agencies). Instead, national and regional coherence is of the utmost importance in achieving cooperation, trust and real results. Funding is shrinking, which requires the development of creative solutions for Finland's highly functional system and the absolutely necessary streamlining of bureaucracy and administration. This means the radical restructuring of VET.

Finland is adopting entirely new models for authorizations to provide education. These models provide Point College with a certain amount of freedom to target its offerings to working life in its own field. Common regional policy programs for the provision of education are binding together all education providers. The regions will see the formation of synergistic innovation alliances, which promote regional vitality and competitiveness through education and development projects. In Porvoo, this also means close physical proximity between universities of applied sciences and Point College.

From a VET standpoint, the anticipation of real, regional labor and educational needs becomes extremely important, where a specification of needs leads to decisions on what education services will be offered in what field. At the same time, it will be possible to discontinue old services, in which employment is no longer possible. Correspondingly, new professions/products and qualifications must be created quickly. Qualifications are combined creatively and the education provider's ability to create a new combination for a qualification/degree (combined electrician and builder and plumber, for example). VET creates a concrete innovation ecosystem. Indeed, 96% of innovations come from the actual performance of work.

At present, an education provider in Finland must have approximately 30-40 plans, constantly updated, to steer its operations.

Operational steering is being clarified, digitized, rationalized and, above all, accelerated. Operational steering is also being linked to the assessment of educational operations and learning. The Ministry of Education and Culture (MEC) criteria used at Point College is also constantly being developed, and the government sets guidelines for education provider reporting and assessment with consolidated charts of accounts, indicators and data systems, thus facilitating real-time monitoring and openness. Compatibility between different data systems will allow for sensible administration and reporting. Today, funding is set (per capita) based on a biannual accounting day. In the future, the aim is to begin continuous monitoring through real-time reporting.

2.2 Partnerships and resources

Cooperation with employers is increasing exponentially. Workplace instructor training and evaluator training require implementable models in order to succeed, particularly in SMEs. This must be resourced in an entirely new way, in order to ensure that the increasing entry of students into working life will be at all possible. Working life and places of employment must be given "workplace instructor resources", in which a vocational teacher serves in the field as a workplace mentor, helping to create learning support functions for the places in question.

Cooperation with comprehensive schools and, correspondingly, universities of applied sciences must be close, genuine and concrete. Working in close cooperation at different levels of the education system makes it possible to build bridges, paths and channels, which are used to support and promote a faster track to graduation, thus saving society money. To the same extent, cooperation with, for example, universities of applied sciences allows for the differentiation of one's own operations elsewhere, thus making it possible for a teacher in upper secondary vocational education to teach a smaller group and provide excellent support for them. The most important thing is that the network of educational institutions will be considered a unified and professional actor by employers. In this regard, it could be possible to even appoint joint personnel to coordinate regional on-the-job learning across actor, organizational and administrative boundaries. This would save money, but it would also introduce shared operating methods and models, which would be seen by employers as a "one-stop shop".

Where advancements in digitalization are concerned, ICT development is a challenge, in which pedagogical aspects are a question of teacher motivation and are related to different competence challenges than the administrative ICT solutions.

The continued pressure exerted by finances and funding to cut costs further forces vocational education to tailor, productize and set custom pricing for the education it provides. Whether to pay for walls and floors or for high-quality education are questions that are constantly found on the agenda. What constitutes the generation of vitality and competitiveness in each sector and what is well-being? What are the roles and missions of vocational education and how does the government steer regions and actors so as to avoid redundancies? Financial management and its attendant data systems, consolidated charts of accounts and reporting are evolving into real-time functions. Finances and operations are being integrated to form a more clearly-defined entity. In financial systems, greater emphasis is being placed on the possibility for simulation, which allows for quick responses to any fluctuations in cash flow in the new financing model.

3. Point College as a VET provider

3.1 Management and supervision

Changes in vocational education pose a challenge to management and supervision at every level, also at Point College. The modern concepts of learning, human beings and management must go hand in hand, so that engaging in sensible development work with organizations is, as a rule, even possible. People should be committed, motivated and even inspired, with even more time being devoted to this - even here at Point. In dealing with change, management should be on everyone's agenda, where the ability of management to tolerate uncertainty is also measured. The networking of managers on all levels becomes very valuable, as does the co-operation between in-house experts. New job descriptions and the continuous revision of operational guidelines are constantly on the agenda at Point. Communications should play a crucial role, even though it is already well accounted for at Point College.

Occupational well-being and coping on the job require an exceptional effort in management work. Supervisors must be able to cope as well as support their subordinates in coping with their own work. A constantly evolving working life, longer careers and, correspondingly, an increase in the specialized needs of students require a much greater effort than before. The participation of managers in specifying regional educational needs and decision-making together with other actors in the region should be of paramount importance.

3.2 Learning, instruction and core functions

All success in vocational education is based on the continuous development of core functions and pedagogy. It is founded on the idea that learning and instruction meet needs and expectations. The equivalence of qualifications with working life needs must be constantly updated. The mechanism for establishing new qualifications and eliminating old ones must be considerably faster.

The demarcation of vocational upper secondary qualifications, further vocational qualifications and specialist vocational qualifications must be examined in order to create a sort of "puzzle/module" approach, in which suitable pieces are combined to form new qualifications and the boundaries between youth and adult qualifications are blurred.

The development of pedagogy in the adoption of new learning concepts must be done decisively, so that the vocational education will not be a case of "the shoemaker's children going barefoot". New types of coaching, mentoring and gamification methods are coming to the forefront and motivating students is important. The range of teacher skills in using different methods and tools must be increased. The use of comprehensive projects and contracts is also increasing, achieving collaborative, long-term learning experiences. Co-teaching breaks down conventional barriers and the concept of time is upended in the face of competence-based approaches. Personal paths and the recognition of prior learning are moving instruction in a more guidance-oriented direction. There will be more combined studies, in which learning in a virtual environment and project-type collaborative productions are rotated. This creates entirely new kinds of job descriptions for teachers. There is a need for guidance counselors, tutors, mentors, school coaches, job coaches, job coordinators and other, interesting new positions. These job descriptions must be made carefully, in order to create a meaningful role for all actors in new operating approaches.

4. Three frameworks for managing an organization and a holistic view of quality

4.1 Quality management, risk analysis and strategy

Point College has made an effort to combine three different frameworks, so that administration can be developed. They are evaluation/self-assessment, risk analysis and strategy. All of these must be carried out in accordance with the principles of good governance and, for example, mandatory audits, and they must all create functions and procedures aimed at the future. However, it must be possible to consolidate and define them into a singular future. The two figures below illustrate this model.

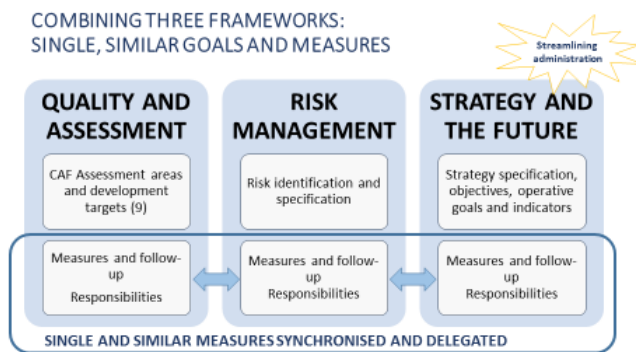


Figure 1 Combining three frameworks

The quality and assessment model has been set for Point College by combining MEC assessment criteria and the CAF. The CAF (Common Assessment Framework, which is a system for the public sector), is like a sub-framework of the EFQM (European Framework of Quality Management). Point College has already used these tools and frameworks, as well as their indicator ideas, four times in conducting its own self-assessment.

In EFQM/CAF models, the indicators involve the following results: customer results, people results, society results and business results. Indicators are always divided into performance indicators and satisfaction indicators. The self-assessment of operations and results has been geared toward common strategic focal points and measures. Personnel, students and employers have been involved in self-assessments. Personnel have been able to make comments on the final assessment with a method called gallerywalk.

Point College operations are described in the Quality Manual of Point College and operational processes. Operations are steered by an organizational model, process hierarchy, management system and operational guidelines, along with their job descriptions. There is also a large number of plans, guidelines and programs, which set the future course for Point College.

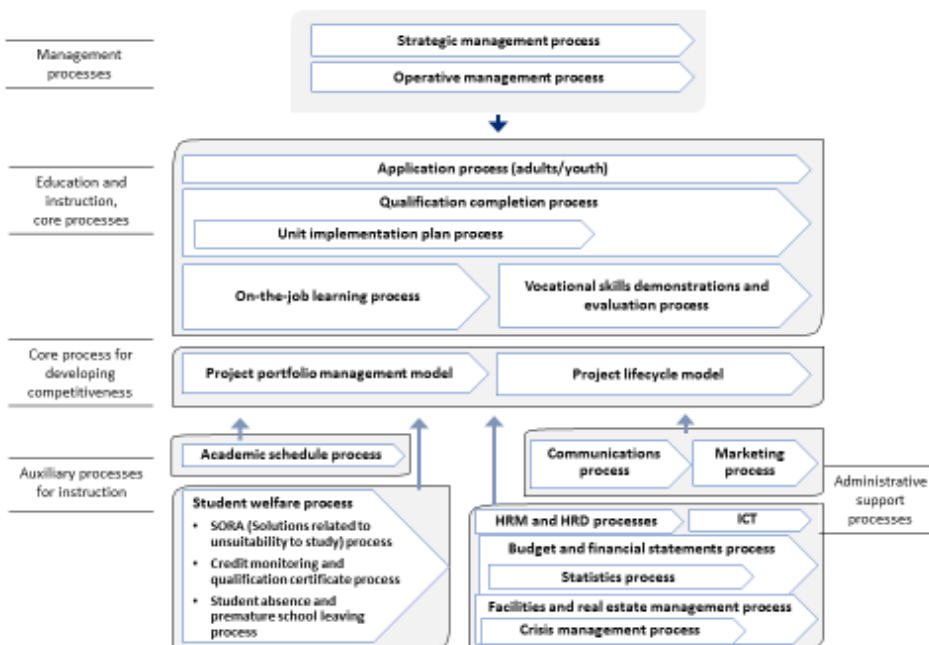


Figure 2 Point College - Process hierarchy

4.2 Some remarks to be considered when analyzing the results

Student results

Students begin their studies at different times and there are several admissions during the academic year. Graduation times vary widely. Students are more independent or, correspondingly, receive more targeted support for specialized needs. Half of each age group apply for vocational studies, with students eagerly earning new qualifications. Student satisfaction has increased, with the variety of study paths ensuring that fewer students will drop out of their study programs than do at present. Because the new models may include various combinations and switching of fields, seeking a study path is like putting a puzzle together. There are now very few marginalized youths - only those following or looking for their own paths. Students are now more international and international mobility is on the rise with the availability of excellent financial assistance.

People results

In the new solutions the number of personnel may be lower for permanent staff, while the network of experts will be more extensive on the working life side of things. The number of qualified teachers is growing because pedagogical challenges are growing. Coping on the job and occupational well-being must be ensured in the changes, so that the number of sick leaves and cases of fatigue will not increase as the aging workforce is renewed. It is possible that personnel satisfaction could be improved, but this would require a renewal of management.

Society results

The profile and brand of vocational education are made permanent through skilled communications and operations that must be carried out in much closer cooperation with working life and students. Messages concerning partnership and participation should also be aimed at several targets using quantitative indicators. This will serve to confirm the establishment of cooperation and partnership. One societal message might include emphasizing agreement and trust in the reform of vocational education as well as how trust capital is built.

Vocational education should be prominently mentioned when discussing the upper secondary level alongside general upper secondary schools. Vocational students should not be underestimated, nor should they be considered as somehow inferior to students in other forms of education. Moreover, it should not be assumed that they were forced to take the vocational education route because they did not make it into a general upper secondary school. Messages coming from the sphere of vocational education should emphasize success, competence and professional skills in core operations, not merely communications from an administrative and production organization standpoint. The skills function should actively taken advantage of in this respect.

Business results

The reform of vocational education has made it possible to get rid of unnecessary cost items. The vocational education generates employment and promotes further studies more effectively and precisely. On the other hand, “exchange training” and building new careers becomes easier and faster due to the new, but more clearly defined qualification structure and, in part, to units common to multiple qualifications. Elective studies have been optimized into a regional course offering that transcends educational structures.

Personnel qualifications and money invested in their development produce increasingly better results, and teachers are more at workplaces to support learning. Facilities and equipment in a school environment have been minimized and schedules have been used throughout the year and each day. The Finnish Government and EU have been able to meet the requirements for reform by

sensibly combining different forms of funding much more effectively and clearly than before. Forms of funding and the number of funding agencies have sharply fallen, so it has been possible to allocate funding appropriately to the reform of vocational education.

5. Human Resource Management (HRM)

5.1 Structure and emphases of the Personnel Program

The management of personnel processes is primarily assigned to upper management and immediate supervisors. Managing personnel processes is an integral part of the daily routine for supervisors and managers, not a discrete part.

The Personnel Program, or strategy, is a very important management tool, in which we have defined the most important principles and processes in management and leadership. The program also defines some rules of conduct.

The basis for the Personnel Program is specified in the organization's strategy (vision, mission, values, business idea and the strategic objectives). The basic elements of the Personnel Program are: descriptions of the whole management system and rules of procedure, structure of the staff, description how cooperation and occupational safety are carried out, our core processes of staff management (a more detailed presentation will follow) and finally, monitoring methods and operational assessment (a more detailed presentation will follow).

5.2 Core processes of staff management

In the following we will introduce the core processes of staff management and the tools we use for monitoring and assessment.

Our image as an employer and ensuring attractiveness

As our image as an employer is particularly affected by active communications, we have invested in our marketing and brand communications. Attractiveness is influenced by personnel and customer feedback, which is actively monitored and used.

Managing employment relationship lifecycles

This process includes everything from recruiting to the end of the employment relationship. Other key points are: Introduction program (to the workplace and one's own tasks), wages and benefits, job descriptions, working hours and individual resource planning, rewarding the staff, absence and attendance management and substituting, work-related travel, occupational health care and insurances.

Managing competence and performance

In the management of everyday performance and the long-term development of competence, we have defined the following areas as vital: assessment of the current status of competence and developmental needs; continuous maintenance and development of competence; motivation and encouragement; meeting and information procedures; development discussions and role of work groups. The needs are evaluated annually and the Employee Training Program is defined.

Required areas of professional competence are defined in the Point Competence Circle, which includes four themes: individual vocational competence, work community and network competence, strategy competence and self-management skills.

Managing occupational well-being and work ability

Occupational well-being, coping and maintaining work ability comprise a key area, which must be addressed in management. We use an existing and proven occupational framework:

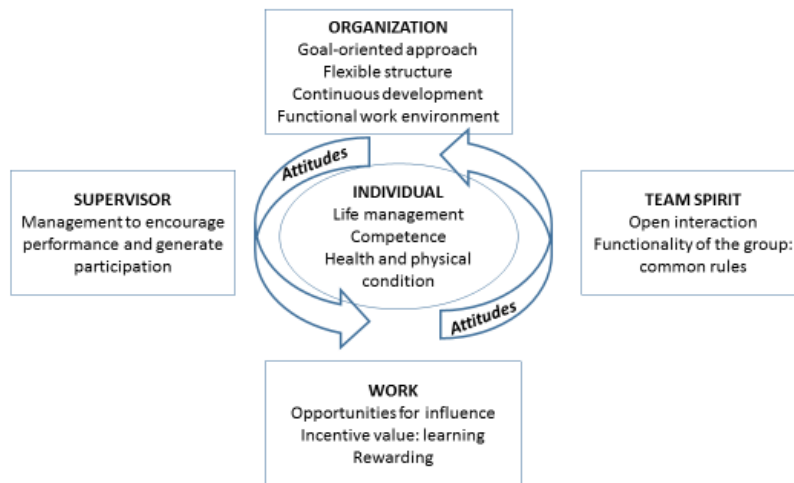


Figure 3 Framework for Occupational Well-being (Manka 1999, 2008)

The management of occupational well-being also includes the following five areas: Early intervention model – guidelines for dealing with inappropriate behavior; Work community communications and skills; Independent self-management and ensuring one's own well-being; Self-management; Recreation and shared events.

Confirming the personnel plan and ensuring organization resources

In operative management, the focus is on managing sub-entities and supervisory work in daily routines, which are used to ensure the planning, execution and monitoring of operational resources. *Anticipation – Planning – Implementation – Reporting – Assessment* is an on-going management process where supervisors must take into account the whole scale from strategic objectives to daily tasks of each member of the staff.

Follow-up and assessment

Tools used in the monitoring and assessment of personnel management are annual personnel surveys and an assessment of operational and performance quality. The indicators used in monitoring comply with EFQM/CAF indicators, whose dimensions are internal performance and personnel satisfaction. The conclusions drawn from assessment are included in the following year's operational plan, which also involves a revision of the personnel plan, if necessary.

5.3 From Professional Competence Requirements to Employee Training Program

Part of the Personnel Part is Employee Training Program. Each year, we define the key points on how to develop the competencies of the whole staff. The Employee Training Program is drafted and updated each year at the cooperation negotiations. The employer is under no obligation to provide training, but employees may demand that the employer provide an explanation as to why an individual or group has not received any training. We have specified that all personnel undergo minimum three days of training each year.

The training plan is based on the employer's operational needs and the long-term employment opportunities while in the service of the employer. When drafting the plan, attention should be given to anticipated changes occurring the enterprise's operations, which may have an impact on the number, structure or vocational competence of personnel.

As mentioned above, our organization will be undergoing several changes in the coming years. Due to the nature of the changes, ICT competence in particular assumes a special significance, even strategically, and an investment is made in it.

We have three focal points 2015-2016: 1) Support for implementation of the new curriculum, 2) ICT: pedagogical and tool-related workshops and 3) Specialist Qualification in Business Management & special needs teacher, guidance counselor and pedagogical studies.

6. ICT as a supportive function for education

First, we will present some points in our strategy that define the role of the ICT function. Then, we will introduce the most important new principles that should be implemented in education. These two things are linked with current trends in ICT and, based on these, we arrive at a plan for the management of pedagogical ICT function as well as a plan for future development goals.

6.1 How to define a pedagogical ICT strategy

In general, a strategy for the whole enterprise can already directly include the role of ICT. If this is not the case, then the ICT strategy is structured in such a way that it will support the main strategy, thus allowing it to be applied in the function of the enterprise.

In our strategy, there are several points that emphasize the use of ICT and require that the college provides digital learning tools to support its education and training function. Our strategy states that "We improve our ability to provide...high quality trilingual and international teaching." The current thinking is that we need information technology for high quality teaching because it significantly increases the possibilities for using different learning methods. It is therefore logical that we have expressed this idea--explicitly-- in our strategy: "We offer flexible models and modern technology to support different learning styles, individuality and development of expertise."

In addition to this, our strategy also includes a statement which obligates the institution to provide teachers with the support they need in their work. Our strategy states that "We support our personnel in times of change". The learning environment is currently undergoing change, moving from a traditional chalkboard-classroom to a modern, partly virtual learning environment which is facilitated by digital tools. As a result, in order to fulfill our strategy's obligation to support personnel, we have provided them with both technical and pedagogical ICT support. Pedagogical ICT support means that we have an ICT specialist, who teachers can contact when they want to try new methods or tools that they are not sure about. The teachers can also request instruction when they want to learn how to use new programs or educational services that are available online.

6.2 Some current trends in vocational education and learning in Finland

Next, we will discuss some current vocational education trends in Finland. The national core curriculum for vocational education was reformed in 2015, with a strong shift to using competence as a measurement instead of time. This means that, in all evaluation, it is important to recognize the competencies a student has achieved. Using a certain amount of time for training is not obligatory if it seems unnecessary.

Another key principle is that subjects are not taught separately, but rather should be integrated with each other in the same way they are linked in work processes. This allows students to naturally discover what the motivation is for studying, e.g. using the student's mother tongue in practical nurse education.

In general, pedagogy has long placed an emphasis on student learning, not teaching. Participation, a student-centeredness and cooperative learning are good examples of the recommended approaches that teachers are encouraged to apply in their work.

In addition, leaving the classroom for the "real world" is highly recommended in all education, particularly vocational education. In vocational education, this usually means that since we prepare the students for work, also much of the learning is supposed to take place in working life.

6.3 Current trends in ICT

Information technology is an area that is in a constant state of upheaval. Below, we will present some trends, which might not be the latest, but currently have something to offer in the field of education.

Visualization

The use of different kinds of visual materials (photographs and videos) is seeing a sharp increase. Visual materials are used both for demonstrating things to be learned and documenting learning that has taken place. Especially in vocational education, where the students are learning skills, it is very practical to demonstrate tasks using a video. In the same way, when the students want to document what they have done, photos and videos are an ideal way to prove that they have achieved the competencies.

Mobile devices

The use of personal mobile devices, such as mobile phones and tablets, is proliferating rapidly. This means that all our services must be scalable for different devices and accessible everywhere. When it comes to data processing that requires the full functionality of a personal computer, we prefer the use of laptop computers over desktop computers, thus allowing us to stay mobile.

Cloud computing

When using mobile devices, you must have your data stored so that you can access it anywhere on any device. This is especially important when the same person uses different devices, depending on the time and place. In addition to storing data, cloud computing also means that the applications you use are available in the cloud.

Gamification

In learning environments, one of the newest and the most inspiring trends is gamification. Games are used for motivating the students, thus making it more fun to do repetitive exercises. It is also very useful to have the students involved in the game design process, which engages them while teaching a great deal.

Social media

Even though social media is needed for communication, it can also be used in education for guiding and counseling students, such as when they are in working life. Closed user groups and the chat function can be used to reach students more quickly than dedicated school systems.

6.4 A well-defined plan for the development of ICT in education

When all of the above are combined, we get a rational, well-defined base for developing the pedagogical ICT-function at Point College. Below are the main points of our plan.

We set the following goals for this academic year:

New students must provide their own laptop computers. This means that we are required to provide an efficient wireless network on our premises and enough power outlets for charging devices.

We enhance use of the digital Learning Management System (LMS). Our goal is to make use of the LMS interactive, so that it is not only used for delivering material from teachers to students.

In certain courses, we stream lectures online and save them so that they can be watched later by students.

Teachers are encouraged to use video conferencing tools for counseling students during on-the-job-learning periods, instead of constantly visiting the students at their places of employment.

Video and photos are a widely accepted way to prove the skills the students have acquired. Students can also collect their learning documents in an electronic portfolio, which can later be shown to a future employer.

Of course, the skills of our own personnel are constantly evolving as we increase the use of information technology in education. However, the degree of use and variety of devices are also increasing, so we can assume that the need for support services will be the same.

Our school maintains operations at three different locations, so there is often a need for telecommuting. This means that we have to provide the necessary tools for it. The electronic calendar is recommended as a tool for the whole organization. Furthermore, various support services must be accessed online, not by a physical visit. Naturally, the answer to such requirements is cloud computing, but this means that we must invest a great deal in data security.

Risks

We have identified the following factors that may cause risks for the success of our plans above: The capacity of our WLAN, data security, teachers' skills and the economical problems the students may have when providing the laptop computers. We will especially follow different indicators of these risks in order to react early enough if some problems arise.

6.5 New development projects

We are involved in several development projects based on, among others, the following themes:

Mobile classroom

A mobile classroom makes it possible to hold classes outside the school. This is needed in such places of employment whose work tools do not support learning documentation.

Integration of work processes and learning documentation

Conversely, in some professions a great deal of the work is done with computers. What kind of documents are needed by students to present and prove their learning?

Models for producing web material

Online courses support individual and remote learning, and our goal is to ensure high pedagogical quality. In order to do so, we collect useful information and guidelines for the course planners as well as different types of structures that can be applied in production phase.

Chat function for counseling students online

For on-the-job-learning periods, we have plans to develop photo and video instructions, which combine the vocational skills requirements of the curriculum with work processes. These are compiled and stored on a platform, which allows students to mark their tasks "Done", much like in a game.

We believe that, although a great deal of work has been done in digitalizing education, there is still much left to do. And, as with all changes in culture, real change takes place slowly and there are always people who will resist it. In our own experience, providing lectures for teachers is not the most efficient way to increase their knowledge in ICT. Instead, we try to organize such activities that require new ICT skills. Not only students but also teachers learn best by doing!

7. Our experiences and positive results with the holistic use of these tools throughout the organization

The best result of the quality work was increasing the overall shared knowledge at Point College: where our strengths are and where improvements are needed. Self-assessments are always visualized and simplified into easy-to-read display boards, which are often presented at meetings. Point College also has an extensive Quality Handbook, which describes operating methods (operational descriptions) and processes, indicators, the entire operational steering system, preliminary data system architecture and archiving system.

In addition, the Ministry of Education and Culture rewards us for our performance, which provides us with financial benefits. In the performance category of Ministry of Education and Culture indicators, Point College has been the top of the class for three years running under "other multidisciplinary education providers" (2013-2015). There are 7 MEC indicators, with the most important being related to student graduation, employment, further study placement, employee qualifications and investment in development. This brings bonus money to the school; in 2016 the bonus we received amounted to 369,000 €. The performance percentage is 4% of the total funding. In the future this may rise to as much as 10%. Also seen from the opposite perspective, our early school-leaving rate is approx. 5%, which is equivalent to the rate in general upper secondary schools, but not typical of vocational education.

8. Discussion

The year 2016 is the real year of changes both locally, regionally and nationally. For VET it means that we have to be really clever to maintain the good profile and best parts of education and training which meets the needs of the working life. We need to sustain the equality and quality between vocational and general education. In Finland vocational education is chosen by about 50 % of the age group. This is exceptional in the European countries.

The regenerative capacity, competence and occupational well-being of personnel will be put to the test in the years to come. New structures, merged organizations, management systems and new content and qualifications in core operations will challenge personnel in a never-ending cycle of change. Stamina will be the key. Where change is concerned, personnel should be instilled with a positive drive for development. The desire and courage to support employees in the development of their own work requires the planning and promotion internal and development projects. In the upheaval brought about by change, a systematic approach will provide at least a slight sense of security and the vision to take small steps.

Especially the role of ICT is essential and crucial in the coming changes. Digitalization is emphasized in the Finnish Government Program and largely utilized in the Finnish workplace. We as an educational provider must prepare our students for the future needs and as well develop our own operations. Participating in the development projects is one way of carrying out this progress.

Audiovizualni nastavni materijali – jezik i kultura u poučavanju stranoga jezika

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Sažetak. Na početku članka naglašava se važnost ispreplitanja lingvistički i kulturološki relevantnih podataka u poučavanju i učenju stranoga jezika. Nastavna literatura kulturološku komponentu nerijetko stavlja u drugi plan; nepotpune činjenice ne uspijevaju razjasniti brojne kulturološke kontekste naroda čiji jezik se uči, a bez čijeg je poznavanja uspješna komunikacija s izvornim govornicima teško ostvariva. Mišljenja smo kako je u nastavni proces potrebno uvoditi autentične materijale koji uspijevaju udovoljiti suvremenim glotodidaktičkim stremljenjima. Skupinu audiovizualnih nastavnih materijala čini lepeza televizijskog i internetskog programa unutar koje posebno mjesto pripada televizijskome reklamnom spotu i televizijskoj seriji. Središnji dio članka razmatra didaktičku ulogu televizijske reklame u nastavi talijanskog jezika te televizijske serije u nastavi engleskog jezika. Jako je bitno naglasiti mogućnost identične i/ili slične primjene i drugih nastavnih materijala iz ove skupine te njihovu uporabivost i u nastavi drugih jezika. Nakon predstavljanja pojma televizijske reklame i Carosella nižu se brojne aktivnosti kojima se naglašava uloga reklamnog spotu u učvršćivanju leksičke, morfosintaktičke i kulturološke kompetencije učenika. U nastavku se iznosi primjer didaktičke obrade britanske serije “Fawlty Towers” u nastavi engleskog jezika. Nakon uvodnog pojašnjavanja značenja termina “Fawlty Towers” predstavlja se jedna od epizoda sugestivna naziva “Communication problems”. Humoristično obojeni dijalozi prava su jezična i kulturološka riznica. Okosnicu radnje tvore nesporazumi između nagluhe gospođe Richards i osoblja hotela. Glavno oruđe komike upravo je jezik; briljantne igre riječi i korištenje idioma odražavaju bogatstvo jezika, a načini rješavanja problema predstavljaju tipično engleske kulturološke obrasce ponašanja. Na kraju članka iznose se razlozi koji audiovizualne materijale čine valjanim i dobrodošlim nastavnim sredstvima.

Ključne riječi: jezik, kultura, materijal, kriteriji, obrada.

1. Uvod

Jezik je dio kulture jednog naroda i teško je zamisliti nastavu stranog jezika odvojenu od nastave kulture naroda kojemu je taj jezik materinski. Znanje jezika, naime, uključuje pravilno oblikovanje fraza i rečenica, ali i njihovu primjenu u skladu s kulturnim normama izvornih govornika (Navarro, 2010.). Kultura u užem smislu riječi predstavlja kolektivni identitet jednog naroda koji se odražava u oblicima ponašanja, običajima, stilu i načinu života toga naroda. Kultura u širem smislu predstavlja ukupnost materijalnih i duhovnih vrijednosti i dostignuća koje je narod tijekom svoga razvoja stvorio i postigao, dajući time svoj doprinos općem razvoju i napretku čovječanstva. U kontekstu poučavanja stranoga jezika pojam kulture izuzetno je složen; značenje mu je, naime, uvjetovano kontekstom situacije u okviru

koje se odvija komunikacija (Kramsch, 1993.). Različitosti u kontekstima komunikacije odraz su različitosti među ljudima. Pripadnost određenoj dobnoj/spolnoj/rasnoj skupini, društveni položaj, stupanj obrazovanja, obiteljsko podrijetlo i sl. neki su od čimbenika formiranja supkultura unutar društva. Uzimajući u obzir brojnost ovih čimbenika te složenost međuljudskih odnosa, razumljivo je da se pojam kulture ne može svesti na izdvojenu jezičnu vještinu. Rad na kulturološkoj komponenti jezika trebao bi uključivati osnovno znanje o kulturi, poznavanje kulturalnih vrijednosti, poznavanje karakterističnog načina ponašanja te razvoj kulturalnih vještina (Tomalin, 1995.). Literatura namijenjena učenju stranoga jezika uglavnom se temelji na gramatičkoj i/ili leksičkoj komponenti jezika dok onu kulturološku nerijetko stavlja u drugi plan: činjenice koje se iznose često su nepotpune, studentima nerazumljive i/ili nedovoljno aktualne da bi uspijevale razjasniti višeslojne kulturološke kontekste naroda čiji jezik se uči, a bez čijeg je poznavanja uspješna komunikacija s izvornim govornicima teško ostvariva. Jako je bitno, dakle, od samih početaka učenja stranoga jezika lingvističku komponentu jezika prožimati onom kulturološkom. Mišljenja smo kako je u nastavni proces potrebno uvoditi pažljivo birane, autentične nastavne materijale koji razvijaju pozitivan stav prema jezičnoj i kulturološkoj različitosti s ciljem postizanja opće jezične kompetencije.

U nastavi stranih jezika već se desetljećima rabe raznovrsna auditivna, vizualna i audiovizualna nastavna sredstva (Petrović, 1988.). Skupinu audiovizualnih nastavnih sredstava čini šarolika lepeza televizijskog i internetskog programa: stapanjem slike, zvuka, a nerijetko i pisma stvara se dojam potpuno prirodne situacije prepune verbalnih i neverbalnih reakcija sugovornika. Uspješnom sintezom lingvistički i kulturološki relevantnih podataka te izrazitom sugestivnošću i dopadljivošću u toj skupini važno mjesto pripada televizijskome reklamnom spotu te televizijskoj seriji. Članak razmatra didaktičku ulogu televizijske reklame u nastavi talijanskoga jezika te televizijske serije u nastavi engleskoga jezika, no jako je bitno naglasiti mogućnost slične i/ili identične nastavne primjene i drugih nastavnih materijala iz ove bogate skupine te njihovu uporabivost i u nastavi drugih jezika: film, serija, kviz, dokumentarna/zabavna/sportska emisija te brojni video isječci različite tematike i duljine trajanja.

2. Televizijski reklamni spot

Poruka usmjerena jasno definiranom odredištu (birano tržište, potencijalni potrošači) koja sistematično argumentira tezu o izvrsnosti određenoga proizvoda i/ili usluge te tako oblikuje potrošačeve stavove i odluke pri odabiru s krajnjim ciljem uvjeravanja u istinitost navedene teze neizostavni je dio plaćene tzv. reklamne komunikacije.

Televizijsku reklamu u klasičnome obliku predstavlja kratki film, spot ili grupa spotova (tzv. reklamni blok) s prosječnim trajanjem od 30 sekundi po spotu. Oglašivačka industrija uvelike vodi računa o položaju pojedinog spota unutar reklamnog bloka; uočeno je da se, kako neposrednim tako i odgođenim ispitivanjem pamćenja, najbolje pamte i dosjećaju sadržaji posljedni u nizu (još su uvijek u kratkoročnom pamćenju tzv. efekt novosti) te oni s početka niza (kodiranjem su prvi došli u dugoročno pamćenje i tu se zadržali tzv. efekt prvenstva). Učinkovita reklama izravna je posljedica predanoga rada stručnjaka iz raznovrsnih područja ljudske djelatnosti poput ekonomije, psihologije, antropologije, sociologije, modnog dizajna, likovne i glazbene umjetnosti itd.

Pojava reklama u današnjem smislu riječi usko je vezana uz pojavu novina. Prve reklame u Italiji, smještene na posljednjoj strani dnevnog tiska, datiraju od druge polovine 19. stoljeća. Krasila ih je jednostavnost i neposrednost izraza s učestalom uporabom imperativa (...prendete.../...bevete.../...al vostro farmacista chiedete...).

Prvi televizijski spot reklamiran je u Americi davne 1941. godine, dok su Talijani to iskustvo imali prilike doživjeti 3. veljače 1957. godine. Tog je dana, naime, svjetlo dana ugledala specifična televizijska forma zvučna imena Carosello. U terminu između 20:50 i 21:00 sati, ukupnog trajanja od 155 sekundi, svakodnevno i gotovo neprekinuto punih 20 godina uveseljavao je i zadržavao uz ekrane nacionalne televizije (današnji RAI UNO) gledatelje svih uzrasta. Njegovim utemeljiteljem smatra se priznati redatelj Luciano Emmer, no Luca Magni, Sergio Leone i mnogi drugi sudjelovali su u ostvarenju ovoga ambicioznog televizijskog projekta. Sastojao se od komičnih i/ili animiranih skečeva s obilježjima kazališne predstave u trajanju od 120 sekundi, dok je preostalih 35 sekundi pripadalo reklamnoj poruci.

Talijansko društvo 60-ih i 70-ih godina, zatvoreno i nepovjerljivo prema stranome tržištu, doživljava obiteljsku zajednicu isključivim središtem interesa i vrijednosti što je vidljivo i u reklamnome kodu toga vremena. Familijarni kontekst, humoristično obojani dijalozi, ponavljani slogani (...Ava, come lava .../...Omo lava più bianco ...) te jedinstveni likovi poput pilića Calimera i čelavog profesora Rocka Carosellu su dali pečat osobnosti i prepoznatljivosti. Promjene u talijanskome društvu koje postaje modernije, dinamičnije i zahtjevnije doprinijele su gašenju ove, prema stranome tržištu, zatvorene forme. No, zasluge Carosella velike su: obilježio je početak postojanja talijanske animacije i televizijske reklame, a fraze poput „E dopo Carosello tutti a nanna“ i „A letto dopo Carosello“ i danas odjekuju talijanskim govornim jezikom.

Važno je istaknuti ulogu neverbalne komponente jezika u spotu: izrazi lica, geste, položaj tijela, pogled, intonacija glasa, nazočnost pozadinske glazbe i drugih prirodnih i neprirodnih zvukova od neprocjenjive su važnosti za efektivnost i privlačnost reklamnoga televizijskog spota. Tu valja istaknuti glazbu koja je glavni kreativni sastojak u trećini od 500 novijih televizijskih reklama. Glazba, naime, reklamu čini perceptivno istaknutom u odnosu na drugi televizijski sadržaj što za posljedicu ima bolje pamćenje. Uvjerljivost iskaza postiže se polisemijom te neizostavnom uporabom stilskih izražajnih sredstava poput poredbe, personifikacije, metafore, metonimije, sinagoge i eufemizma. Katkada bivaju angažirane slavne osobe koje autoritetom i kompetencijom reklamu čine vjerodostojnijom (pr. igrač Juventusa u reklami za „Yogurt Danone“). Dodatnu slikovitost jamče sugestija, aluzija, analogija, humor, ironija te neposredan i jednostavan jezik sa zamjetnom uporabom idioma i lokacija. Uspješnost televizijskih reklama ovisi i o karakternim osobinama promatrača, njegovoj spremnosti za prihvaćanjem sugestija i uvjeravanja.

Osamdesete i devedesete godine 20. stoljeća svjedoče nevjerojatnom uspjehu komercijalne televizije te predstavljaju razdoblje svojevrsnog procvata reklamnog svijeta.

2.1 Kriteriji pri pravilnome odabiru televizijskog reklamnog spota u nastavi stranih jezika

Audiovizualni nastavni materijal u nastavi stranih jezika didaktički je opravdan samo ukoliko sadržajno potpuno odgovara jezičnoj kompetenciji, dobi i interesima onih kojima je namijenjen te ukoliko se njegovom primjenom ostvaruju planirani nastavni ciljevi. Tako će, primjerice, studentima elementarnoga jezičnog znanja biti primjerene reklame jednostavnih gramatičkih i leksičkih struktura dok će za bolje poznavatelje jezičnih zakonitosti nastavnik brižno potražiti nešto složenije narativne, opisne i/ili argumentativne reklamne sadržaje (sigurnost u prometu, prevencija bolesti i sl.). Učenicima tinejdžerske dobi znatiželju će pobuđivati najnoviji tipovi mobitela ili laptopa dok će najmlađe veseliti prizori omiljene im igračke ili slatkiša. Studentima Turizma poseban izazov predstavljat će reklamni spotovi za pojedina turistička odredišta, sadržaje ili agencije, a ljubitelji gastronomije dopadljivima će držati reklamne sadržaje s kulinarskim proizvodima.

Nastavnik koji odluči beskrajne didaktičke mogućnosti reklamnoga spota primijeniti u nastavi, mora imati jasno definirane ciljeve. Željene gramatičke elemente moguće je uvesti/učvrstiti onim

reklamnim spotovima koji njima obiluju („Hotel Cristallo“ - imperativ, „Amarena Fabbri“ – imperfekt ...). Reklamni dijalozi često su podatan materijal za uvježbavanje raznovrsnih, studentima vrlo bitnih, komunikacijskih funkcija jezika („San Pellegrino“ – fizički i karakterni opis, „Prosciutto di Parma“ – izražavanje emocija ...). Valja naglasiti kako se primjenom odgovarajućeg, znalački biranog reklamnog sadržaja jednako uspješno mogu uvježbavati i receptivne i produktivne jezične vještine. Iz svega navedenoga jasno je kako je pravilan odabir reklamnoga sadržaja u nastavne svrhe od neprocjenjiva značaja. Naime, nepravilan izbor bilo kojeg nastavnog sredstva u odnosu prema konkretnom zadatku nastave te njegova neusklađenost s jezičnim znanjem studenata može kod onih kojima je namijenjen izazvati nelagodu i odbojnost što u konačnici dovodi do usporavanja i/ili pogrešnog usmjeravanja procesa učenja.

Internetske stranice nude prilično bogat reklamni spektar, a sadržaj je znalački grupiran tematski i/ili po godini proizvodnje što uvelike olakšava postupak traženja i odabiranja željenoga materijala. Kako i same ponekad zavirimo u svijet šarenih televizijskih reklama u nastavku ćemo navesti neke od uistinu brojnih mogućnosti rada na reklamnome spotu.

2.2 Rad na odabranome reklamnom spotu

2.2.1 Rad na odabranome reklamnom spotu u uvodnome dijelu sata

Na samom početku nastavnog sata poželjno je studentima približiti željeni sadržaj jednoznačnim, sugestivnim, usmeno postavljenim pitanjima koja ih izravno uključuju u priču u koju se upravo upuštaju te u njima bude intelektualnu znatiželju. („Servizio Civile“ - *Imate li slobodnog vremena? Kako ga provodite? Sudjelujete li u volonterskom radu? Gdje?...*)

Zatim je uputno studente snabdjeti bitnim podacima o odabranome sadržaju; što spot reklamira, tko su protagonisti, gdje su smješteni i sl. (Lombardo, 2006.). Cilj ovoga uvodnog dijela sata jest studente zagrijati (*riscaldamento*) za nastavnu aktivnost koja slijedi te u njima umanjiti nelagodu stvorenu mišlju da će autentičnome sadržaju biti izloženi bez pismenoga predloška.

Reklamni spot, zahvaljujući kratkoći trajanja, moguće je prikazati onoliko puta koliko to nastavne aktivnosti zahtijevaju. Nakon kratkoga, smisleno koncipiranog uvodnog dijela u kojem se studenti globalno upoznaju s osnovnom tematikom reklamnoga sadržaja može ih se pozvati na prvo gledanje odabranoga spota. Prvo prikazivanje može biti parcijalno (prikaže se prvih ili posljednjih 10, 15 sekundi), a od njih se traži da usmeno iznesu svoje pretpostavke o tome što je upravo viđenoj radnji prethodilo odnosno što bi joj moglo slijediti. Ovdje se od studenata očekuje da se jezikom služe u nešto dužem monologu te je preporučljivo greške, inače česte u govornoj produkciji, bilježiti i naknadno objašnjavati. Naime, pažnja je u prvome redu usmjerena komunikacijskim ciljevima govornoga čina, a svako prekidanje remetilo bi koncentraciju studenata i tako utjecalo na tečnost i fluentnost njihova iskaza.

2.2.2 Rad na gramatičkim elementima jezika

Tekstovi preuzeti iz odabranih audiovizualnih nastavnih materijala pokazali su se didaktički opravdanim i za uvođenje i/ili uvježbavanje unaprijed planiranih gramatičkih elemenata jezika. U dijalogu spota AVIS (*Associazione Volontari Italiani Sangue*) uočljiva je česta uporaba neodređenih zamjenica *qualche, nessuno, ognuno ...* dok je tekst spota „Hotel Cristallo“ podatan za uvježbavanje imperativa *divertiti, riposatevi, abbronziamoci ...*

Gramatičke strukture uzete iz teksta, no ponešto prilagođene ciljevima vježbe, mogu postati predloškom pri izradi raznovrsnih vježbi zasnovanih na transformaciji, supstituciji, sintezi, nadopuni teksta, višestrukom izboru i sl. Na ovaj se način dobro poznati tipovi vježbi predstavljaju u drugačijem svjetlu i tako, unoseći dašak novoga i drugačijega, postaju plodnim tлом za učvršćivanje gramatičke kompetencije studenata. Učenje stranoga jezika, naime, nezamislivo je bez sistematskog učenja gramatike i niza dobro osmišljenih gramatičkih vježbi (Prebeg-Vilke, 1977.).

2.2.3 Rad na fonetsko-fonološkim elementima jezika

Prirodnost reklamnoga jezika najbolje dolazi do izražaja ukoliko se studentima predstavi samo zvučna komponenta spota. Namjernim izostavljanjem slike, u središte pozornosti stavlja se glas. Naime, osposobljenost za govornu komunikaciju na stranome jeziku podrazumijeva aktivno vladanje fonološkom komponentom jezika; njegovim izgovorom, ritmom i intonacijom (Desnica-Žerjavić, 1996.). Upravo radi toga preporučljivo je provoditi vježbe imitacije kojima se usvaja i učvršćuje fonetsko-fonološka sfera jezika. Radi se o djelotvornim, često zanemarivanim vježbama u kojima studenti nakon slušanja odabranog dijela teksta, a bez pisanoga predloška, strpljivo ponavljaju ritmičke grupe pojedinih rečenica koje jasno izgovara nastavnik. Poželjno je da tekst bude u obliku dijaloga, a jezik jasan, bez buke u akustičnome kanalu kako bi se izbjegle nepotrebne poteškoće s auditornom percepcijom. Čitanjem na glas studenti uočavaju vezu između pisanoga teksta i govora što za posljedicu ima učvršćivanje prozodijskih obilježja jezika i uvježbavanje pravila izgovora (Desnica-Žerjavić, 1996.). Jako je bitno kod studenata razviti sposobnost dedukcije značenja nepoznatih elemenata preko već poznatog kontekstualnog leksika.

2.2.4 Rad na leksičkim elementima jezika

Vođen osnovnom tematikom spota nastavnik može biti autorom dobro osmišljenih vježbi koje za cilj imaju leksičku i morfo-sintaktičku nadogradnju jezika. Tako, primjerice, radeći sa spotom „Mele Melinda“ nastavnik studente može upoznati s terminima raznovrsnih stabala i plodova voća ili im ukazati na pravilnu uporabu imenica *frutto / frutti / frutta*. Talijanski jezik bogat je izrazima s imenicama koje označavaju voće. Nastavnik od učenika može tražiti da pažljivo biranim izrazima (*Essere una mela marcia / farsi una pera / avere una pelle di pesca...*) pronađu ponuđene ekvivalente (*essere un elemento corrotto in un gruppo, drogarsi con una siringa, avere la pelle liscia...*) ili da iznesu svoje mišljenje o poslovice *Una mela al giorno leve il medico di turno*. Ovakvim i sličnim vježbama nenametljivo se uvode novi leksički elementi, a istodobno se intelektualna radoznalost drži stalno budnom što je nužan preduvjet za izgradnju pozitivnoga stava prema sadržaju učenja. Jako je važno ispreplitati individualni, tandemski (u paru) i skupni oblik rada, ne samo radi poticanja pasivnih studenata koji riječ rado prepuštaju glasnijima i ambicioznijima od sebe, već i radi postizanja što dinamičnije i lepršavije razredne atmosfere koja svakako pospješuje proces učenja.

Nadalje, u spotu „Salumi Beretta“ televizijska kamera smještena je u unutrašnjost hladnjaka; u kadru je protagonist zbunjena lica koji beznažno traži željeni proizvod. Ovom scenom studente je moguće pozvati na nizanje svih onih pridjeva kojima bi se opisala vanjština i/ili karakterne osobine glavnoga glumca. Raznolikost u uporabi pridjeva moguće je proširiti i na druge osobe, primjerice prijatelja, člana obitelji i sl. Fleksibilnost leksičkog sistema te veliki broj denotativnih i konotativnih značenja leksičkih jedinica posebno su naglašeni u onim reklamama s metaforičkim sloganima („Scotch Brite“ - *dare un colpo di spugna*, „Nicotinel“ - *fare un braccio di ferro* ...). U velikom broju spotova dominantna je verbalna metafora. Riječi su te koje argumentiraju izvrsnost proizvoda („Nescaffè“ - *momenti da assaporare*, „Yogurt Danone“ - *yogurt Danone per sentirti danone*, „Interruttori Serie Living Ticino“ - *spengono un'era e ne accendono un'altra* ...). Vrlo dopadljive su i vizualne metafore u kojima se pred očima promatrača jedna stvarnost pretvara u drugu („Pasta Divella“ - *la pasta Divella è una danza*; plesači se pretvaraju u tjesteninu, „Novo Esso Extra“ - *metti un tigre nel motore*; automobil se pretvara u tigra, „Pelati Cirio“ - *come natura crea, Cirio conserva*; rajčica postaje konzervom...). Poneke reklame mogu se podičiti maštovitom interakcijom obaju metaforičkih kodova („Abbracci Mulino Bianco Barilla Biscotti“ - *mama i kći se pretvaraju u leteće zagrljaje*, „Coccolino“ - *medvjedić miluje ručnike*). Učenici, služeći se jednojezičnim rječnikom, mogu pristupiti traženju drugih izraza i/ili kolokacija koje sadržavaju zadanu riječ (npr. *colpo* ili *ferro*). Ploveći stranicama rječnika učenici uče kako tražiti odgovarajući pojam,

ali i kako od svih značenja odabrati ono koje odgovara zadanome jezičnom kontekstu. Naime, nužno je naglašavati kako je upravo kontekst osnova za tumačenje značenja riječi, za njihovo potpuno razumijevanje i pasivno usvajanje (Skljarov, 1993.).

Osposobljavanje učenika za govornu kompetenciju danas se smatra prioritarnim zadatkom nastave stranih jezika (Skljarov, 1993.). Vizualna komponenta reklamnoga spota čini ga nastavnim materijalom prikladnim za provođenje raznovrsnih govornih aktivnosti. Namjernim izostavljanjem zvučne komponente učenike se može staviti pred kreativan izazov osmišljavanja prikladnoga teksta na temelju viđene slike. Ovu aktivnost preporučljivo je raditi u paru, uz nastavnikovu pomoć, koji postavljajući pitanja potiče na što veću raznolikost u pružanju odgovora. Nadalje, studente je moguće pozvati na dovršavanje započete, reklamnim spotom inspirirane misli (*per me, guidare la macchina significa.... per me essere belli significa...*) i/ili im svratiti pozornost na pojedinosti koje se žele komentirati (dob, odjeća protagonista, obilježja interijera/eksterijera ...).

Studente je moguće potaknuti na iznošenje misli bilo da se radi o kratkom komentaru, dugoj raspravi ili kritičkom osvrtu. („Città di Urbino“ - reklama prikladna za provirivanje u svijet talijanske umjetnosti, povijesti, regionalne stvarnosti i sl.). Sa studentima koji prilično dobro vladaju jezičnim zakonitostima moguće je upustiti se u raspravu o obilježjima samog spota; ulozi glazbe, specijalnim efektima, učinkovitosti slogana i sl. te zanimljivo postavljenim pitanjima u njima izazvati želju za usmenim izražavanjem (*Čini li vam se reklama uspješnom? Kome je namijenjena? Može li se usporediti s nekom iz naše zemlje?...*). Ovom govornom aktivnošću učenici znanje usmjeravaju prema određenom komunikacijskome cilju te uvježbavaju jako bitnu vještinu slobodnog iznošenja stava.

Imajući na umu razlike između govorne i pisane komunikacije, jako je bitno od samih početaka učenja stranoga jezika studente izlagati raznovrsnim, pažljivo pripremljenim pismenim vježbama. Studenti, individualno ili u paru, mogu pristupiti pismenom osmišljavanju potencijalnog dijaloga/razgovora među protagonistima iz spota. Kontekstualni leksik i/ili osnovne misli vezane uz reklamni spot mogu biti okosnicom manje ili više vođenoga pismenog sastava. Ovisno o jezičnoj kompetenciji studenata od njih se može tražiti pružanje jednostavnih odgovora na postavljena pitanja do prilično zahtjevnog iznošenja vlastitih teza i mišljenja. Pisanje slobodnih sastava na danu temu provodi se isključivo s onima čije izražajne mogućnosti jamče uspješnost u njihovoj provedbi.

S ciljem proširivanja postojećeg vokabulara poželjno je studente upoznati sa značenjima pojedinih sufiksa i prefiksa. Korisna vježba je pretvaranje jedne vrste riječi u drugu upravo pomoću sufiksa i/ili prefiksa. Vježbanje asocijacija riječi po srodnosti moguće je odabiranjem srodnih riječi po značenju ili uporabi iz veće grupe nepoznatih riječi, odabiranjem riječi iz višestrukog izbora u skladu s danim kontekstom, određivanjem riječi na temelju njihova opisa ili definicije i sl.

Sve ove vježbe, bilo da se provode usmeno ili pismeno, imaju jasno definiran cilj: ubrzati leksičku progresiju studenata te doprinijeti sistematskom proširivanju vokabulara.

2.2.5 Rad na kulturološkim elementima jezika

Jezično kompetentan govornik stranoga jezika pored lingvističkoga znanja mora ovladati i onim paralingvističkim, ekstralingvističkim te onim sociolingvističkim koje podrazumijeva promjene u ponašanju ovisno o kontekstu u kojemu se odvija govorni čin na takav način da ono bude u potpunosti prihvatljivo izvornim govornicima (Navarro, 2010.). Ljudska komunikacija satkana je od verbalnih i neverbalnih komunikacijskih znakova. Verbalnu komunikaciju pojedinac ostvaruje govorom, dok je neverbalna komunikacija ona koju čine neverbalni znakovi. Radi se o svim onim znakovima koji sudjeluju u govornome činu, a sami nisu govor (Navarro, 2010.). Neverbalni jezični znakovi dijele se na dvije skupine: prvoj

pripadaju paralingvistički znakovi (svi elementi vokalizacije koji nisu uključeni u fonološki opis govora; boja i ton glasa, brzina govora te ekspresivni načini izražavanja) dok onu drugu čine ekstralingvistički znakovi (proksemički i kinezički). Proksemički znakovi zasnivaju na prostornim odnosima sudionika u komunikaciji, njihovom međusobnom rasporedu te teritorijalnom ponašanju, dok kinezički znakovi uključuju pokrete lica (facijalna ekspresija i usmjeravanje pogleda), pokrete pojedinih dijelova tijela, držanje tijela u cjelini te geste kao sustave većeg broja raznih tjelesnih pokreta. Poznavanje neverbalne komponente jezika od iznimne je važnosti za stjecanje opće jezične kompetencije; semantička informacija, naime, čini tek 7 % poruke koju prenosimo/primamo dok je preostalih 93 % predstavljeno skupom komunikacijskih odrednica koje pripadaju upravo neverbalnoj komunikaciji (Navarro, 2010.). Najproučavaniji dio neverbalne komunikacije svakako su geste. Koriste se kao nadopuna izgovorenoj poruci i/ili kao potpuna/djelomična zamjena verbalnog iskaza. Na tlu susjednog nam poluotoka one predstavljaju vrlo bitno komunikacijsko sredstvo i smatraju se sastavnim dijelom njegova lingvističkog i kulturološkog nasljeđa. Talijani, naime, pribjegavajući gestama, izražavaju raznovrsne komunikacijske funkcije: osjećaje i osjećajna stanja, opise, radnje, mišljenja i mnoge druge. Autentični kinezički elementi, često nazočni u televizijskim spotovima, izvrsna su prilika za uranjanje u prostran svijet talijanske gestualnosti. Dakako, naša pažnja trebala bi biti usmjerena prema onim gestualnim oblicima koji su kulturološko snažno obojeni i kao takvi strancima nedovoljno razumljivi i/ili potpuno nepoznati („Parmiggiano Reggiano“ – izražavanje nezainteresiranosti/ravnodušnosti uzastopnim trljanjem prstiju dlana o vrat; *uopće/nimalo ni najmanje mi nije stalo/me nije briga*, „Servizio Civile“ – izražavanje vlastita lukavstva spuštanjem donje vjeđe kažiprstom; *ne vjerujem ti, lukav sam ja, ne možeš me nadmudriti ...*). Uočenu gestu studentima je moguće predstaviti kratkom definicijom, crtežom, ključnom riječju, ekspresivnim registrom i/ili pripadajućim verbalnim iskazom. Mnogo je načina na koji je moguće poigrati se gestualnim jezikom u nastavnim okvirima. Studente se tako može pozvati da, na temelju kontekstualnog leksika, zamijećenu gestu prepoznaju te ju definiraju na neki od gore navedenih načina. Ovakav tip vježbi potiče studente na samostalnost u iznošenju vlastitih pretpostavki čime se stvaraju uvjeti za razvoj jako bitnog kreativnog mišljenja. Nadalje, nastavnik može biti autorom kratkih, dobro osmišljenih dijaloga čiji tekst/dio teksta je moguće zamijeniti/popratiti odgovarajućom gestom. Bitno je da vokabular bude prilagođen općem i jezičnom znanju studenata. Na taj način umanjuje se potreba za dodatnim pojašnjenjima koja bi remetila kontinuitet rada. Jako je bitno da predstavljene geste budu konvencionalne, eksplicitne, aktualne te, barem na razini prepoznavanja, nazočne na cijelom teritoriju susjedne nam zemlje. Jednako tako, potrebno je voditi računa i o polisemiji pojedinih gesta.

Nepoznavanje značenja gesta u odnosu na komunikacijski kontekst u kojem se koristi može rezultirati nerazumijevanjem poruke ili pogrešnim razumijevanjem iste. Jednako tako, neselektivno pribjegavanje elementima vlastita jezika često rezultira slanjem neprimjerene/neshvatljive poruke. Talijan, usprkos dobrom poznavanju engleskoga jezika, korištenjem geste „*mano a borsa*“, postaje neobičan anglosaksonskoj kulturi koja gestu ne poznaje. Radi se o specifičnome pomicanju šake postavljene *u šišku* sa spojenim vrhovima prstiju. Ovom gestom pojačava se intenzitet izgovorenog upitnog iskaza te unose elementi čuđenja, ravnodušnosti i/ili ironije, a moguće ju je parafrazirati riječima *Ali što želiš/radiš/govoriš?*

Norme ponašanja vezane uz neverbalnu komunikaciju mogu se toliko razlikovati u pojedinim kulturama da isti pokreti, ne samo da imaju različito značenje, već bivaju nejednako vrednovani postojećim mjerilima pristojnosti. Naime, kao što je neophodno ukazivati na mogućnost gramatičke i leksičke interferencije materinskoga jezika potrebno je, od samih početaka učenja stranog jezika, brinuti o mogućnosti interferencije vlastite kulture na razumijevanje i savladavanje one strane. Posljedice nepoznavanja strane kulture mogu

uzrokovati neugodnosti i nesporazume. Usporedbe imaju za cilj osvijestiti značajke vlastite kulturološke i jezične stvarnosti i prihvatiti različitost one strane.

Reklame su katkada svjedocima neželjenih stereotipa i klišeja. Tako, primjerice, televizijsku obitelj iz reklame za proizvode „Mulina Bianca“ čine majka, otac i dvoje plavokose djece. Smještene u pastoralnom mjestu, lijepe i nasmijane, budi ih cvrkut ptica. Dobro raspoređeni, prilaze kuhinjskom stolu obasjanom jutarnjim zrakama sunca te započinju dan omiljenim im proizvodima „Mulina Bianca“ (*stelline, abbracci...*).

Nadalje, televizijski lik djevojke/žene/majke gotovo u pravilu je nasmijan, dotjeran i besprijekorna stasa bez obzira radilo se o deterdžentu, gelu za tuširanje ili novom modelu glačala koji reklamira. Naime, radi se o idealiziranju često potrebnome iz marketinških razloga. Gore spomenuta televizijska obitelj tako je daleka od tipične obitelji iz, primjerice, sivog predgrađa Milana dok je televizijski lik žene u nesuglasju sa stvarnom, od svakodnevnih briga umornom domaćicom iz Modene. Te je stereotipe potrebno uočiti i na njih studentima skrenuti pozornost kako bi se oslobodili pogrešnih predodžbi. Radeći s televizijskim spotom studentima se pruža mogućnost uočavanja razlika između dviju kultura što za posljedicu ima razvoj osjećaja tolerancije, uvažavanja i otvorenosti prema kulturi susjednog nam naroda. Radi se o pretpostavci koja rezultira jačanjem jako bitne kulturološke svijesti.

3. Televizijska serija

Televizijska serija predstavlja pravo vrelo izvornih kulturoloških podataka. Način i stil života, gastronomska obilježja, unutrašnji i vanjski izgled kuće, radne navike, provođenje slobodnoga vremena samo su neke od uistinu brojnih sličica iz svakodnevnoga života koje se jasno ocrtavaju u serijama te tako studentima pružaju uvid u mentalne koncepte stanovnika određenog područja. Mentalni koncepti nazočni su i u pripadajućim jezičnim konstrukcijama. Drugim riječima, televizijska serija kao izrazito autentičan materijal daje uvid u kulturološku pozadinu jezičnih tvorevina i na taj način pridonosi podizanju kulturološke osviještenosti kod studenata. Kao što je već navedeno, suvremena metodologija poučavanja stranoga jezika već neko vrijeme ističe nužnost razvijanja, upravo ove, kulturološke dimenzije učenja kao važnom i nazamjenjivom preduvjetu pri ostvarenju uspješne komunikacije.

S ciljem pojašnjavanja metodologije rada na podizanju kulturološke i lingvističke osviještenosti, autorice su se poslužile legendarnom britanskom humorističnom serijom *Fawlty Towers*.

3.1 Fawlty Towers

Fawlty Towers, ta izuzetna humoristična serija, nastala je sedamdesetih godina prošlog stoljeća. Osmislio ju je John Cleese, član cijenjene grupe *Python*, koja je urnebesnim i bizarnim humorom obilježila britansku humorističnu scenu dvadesetog stoljeća. Zanimljivo je da je u svega dvanaest epizoda serija uspjela steći kulturni status, a 2000. godine zauzela je prvo mjesto na ljestvici od stotinu najboljih britanskih televizijskih programa Britanskog filmskog instituta.

Inspiraciju za seriju John Cleese dobio je prilikom boravka u hotelu Gleneagles, u Torquayu, gradu na jugo-zapadu Engleske, gdje se imao prilike susresti s izuzetno drskim vlasnikom hotela. Nekulturni vlasnik poslužio je kao predložak za kreiranje glavnog lika serije, Basila Fawltyja. Samo prezime vlasnika, koje se očituje i u naslovu serije, daje naslutiti komiku s kojom će se susresti gledatelj; prezime je, naime, homonim s pridjevom *faulty*, što znači *loš, neispravan i faličan*. Sam je hotel takav jer bezobrazluk i snobizam vlasnika nikako ne mogu biti temelj za napredak.

Igra riječi, na engleskom *puns*, između ostalog proizašla iz upravo spomenute homonimije – *faulty – fawltly* - predstavlja glavno oruđe britanskog humora; komika, ponekad dovedena do ruba apsurdna, ostvaruje se kroz brojne kontekstne situacije kreirane od strane likova upravo kroz kulturološki specifično poigravanje jezikom.

Kako bi se dočarala kulturološka upečatljivost serije, odabrana je sedma epizoda pod nazivom *Communication Problems (Problemi u komunikaciji)*. Sama epizoda, naime, sadržava najmanje pythonskih bizarnih elemenata koji bi mogli zbuniti studente i odvratiti im pažnju od kulturoloških specifičnosti.

3.2 *Communication problems* (Problemi u komunikaciji)

Znakovitog naziva, ova epizoda pravi je primjer kako nepoznavanje kulture i jezika te pomanjkanje tolerancije mogu rezultirati ne baš malim problemima u komunikaciji.

Prvu prepreku u komunikaciji predstavlja konobar Manuel, simpatičan i bezazlen Španjolac, čije je nedovoljno poznavanje kako engleskog jezika tako i karakterističnih kulturoloških obrazaca, uzrokom neprekidnih nesporedazuma. Nesporedazumi se ogledaju u briljantnim igrama riječi iz kojih proizlazi i komika situacije. Katkada situacije poprimaju i tragikomičnu notu, koja se očituje u Fawltijevom stavu prema Manuelu. Njega, naime, Manuelovo loše vladanje jezikom izluđuje te, kako bi ublažio osjećaj bijesa, podsmjehuje mu se, konstantno ga nazivajući *nitwit*, što na hrvatskomu prijevodu znači *idiot, blesan*. I ne samo što ga naziva pogrdnim imenima, nego i njegovu zbunjenost, proizašlu iz gore spomenutog neznanja, drugima „opravdava“ pogrdnim odgovorom *He knows nothing. He's from Barcelona!*

U odnosu Fawltija prema Manuelu, a i prema drugim gostima hotela koji ne potječu iz Engleske, primjećuje se karakterističan obrazac engleskog humora sedamdesetih godina prošlog stoljeća; u podrugljivom stavu prema strancima mogu se nazrijeti umjereni oblici ksenofobije i rasizma.

Drugi izvor frustracije za Basila Fawltija jest lik gospođe Alice Richards, nagluhe i čangrizave usidjelice. Ona jest nagluha, no valja istaknuti da je njena naglušnost selektivna: ona uspijeva čuti ono što ju trenutno intrigira i što, zapravo, želi čuti. Sama njena pojava nipošto ne odgovara Basilu jer ona za njega jednostavno nije dovoljno otmjena, kao i većina gostiju hotela. On tako smatra da može biti drzak i neprofesionalan prema svima koji potječu iz nižih slojeva društva. Njegov beskrupulozni snobizam odražava još jedan obrazac britanskog humora iz sedamdesetih godina prošlog stoljeća, a to je profinjena i sarkastična kritika snobova, čije očajničko nastojanje da se umile osobama iz visokog društva i tako si osiguraju ulazak u njega, redovito završava apsurdnim i tragikomičnim situacijama.

3.3 Odabrani dijalozi

Cijela epizoda obiluje smiješnim te lingvistički i kulturološki intrigantnim situacijama, no kako bismo jasnije predočile igru riječi kao glavnu odliku komike, odlučile smo prikazati dvije situacije. Radi se o televizijskim ulomcima koji se, prema poznavateljima britanskog humora i ljubiteljima humorističnih serija uopće, smatraju legendarnima.

Prva situacija predstavljena je uvodnom scenom koja daje naslutiti komični smjer cijele epizode. Riječ je o dijalogu između gđe Richards i Manuela u kojem ona pokušava doznati u kojoj je sobi smještena te traži razgovor s upraviteljem hotela. Njezino nezadovoljstvo uzrokovano je po njenome mišljenju nedovoljno ljubaznom recepcionerkom. No, sve što je uspjela „doznati“ od Manuela jest da se upravitelj zove C.K. i da nešto s njim nije uredu te da ima četrdeset godina; informacije koje svakako nije tražila:

Mrs Richards: I'd like to talk to the manager.

Manuel: Que? (što na španjolskom)

Mrs Richards: K?

Manuel: Si! (da na španjolskom)

Mrs Richards: K.C. is the manager?!

Manuel: What? No, Fawlty the manager!

Mrs Richards: K.C. What aged forty! What are you talking about, you silly man!

Manuel: No, no ... Mr. Fawlty is the manager! Fawlty!

Mrs. Richards: What's wrong with him?

Druga situacija, ili bolje rečeno, nesporazum, nastao je prilikom prvog susreta gđe Richards s Basilom Fawltyjem.

Basil je već u početku iritiran samom činjenicom da se njena naglušost može riješiti, a ona uporno odbija uključiti slušni aparat jer troši baterije (*the battery runs down*). Svoju iritabilnost ne srami se pokazati pa tako kad gđa Richards podnese pritužbu da je tražila sobu s pogledom, ali je nije dobila, on spremno, jedva čujno, komentira: *Mad, deaf and blind*, i, potom, obrativši se gošći, nadodaje: *Madam, may I remind you that the sea is right there, between the land and the sky!*

Na uporno inzistiranje gđe Richards da pogled, kao takav, ne postoji – *the view is invisible!* – Fawlty, već u deliriju bijesa, uzvraća na karakterističan način: *Well, you are in Torquay, Madam! May I ask what you expect to see from the Torquay bedroom window? Sidney Opera House perhaps? Or, the hanging gardens of Babylon!? Heard of wilderbeast sweeping majestically ... I'm sorry Krakatoa isn't erupting at the moment!* I na koncu ovu briljantnu jezičnu bujicu zaključuje, na sebi svojstven crnohumorni način, sugestijom: *May I suggest moving to a hotel closer to the sea, or preferably in it!*

Njegova reakcija na iritantnu narav Alice Richards refleksija je tipično britanskog obrasca ponašanja, takozvanog *stiff-upper-lip philosophy*. Koliko god ljuti ili pak žalosni bili, njihovo je ponašanje uvijek, mogli bismo reći, stoičko; samokontrola je nazočna uvijek, nema psovki ni suviše vike u slučaju ljutnje, kao ni patetičnoga naricanja u slučaju tuge. Jedini pokazatelj stvarnog stanja emocija sofisticirano su konstruirane rečenice u kojima jedna riječ može biti uporabljena na više načina. Ta metaforička igra riječima je, dakle, jedini pokazatelj nijansi osjećaja koju osoba izvanjski vrlo uspješno skriva.

Izvorna televizijska serija, u svojoj šarolikosti, prikladna je za rad s jezičnim skupinama različitog predznanja. Međutim, važno je naglasiti da će se u radu sa skupinama nešto slabijeg predznanja nastavnik fokusirati na objašnjavanje lingvističke komponente dok će u radu s naprednijim grupama moći biti kreativniji i staviti naglasak na objašnjavanje kulturološke pozadine jezičnih tvorevina. Spektar aktivnosti s naprednijim grupama je širi, a može se sastojati od testa razumijevanja, pisanja eseja na obrađene teme, predstavljanja zadanih dijelova materijala na stranom jeziku od strane studenata i sl.

4. Zaključak

Audiovizualni materijali, odabrani prema gore navedenim kriterijima, ozbiljan su nastavni sadržaj. Autorice ih same, također, rado primjenjuju, a razloga koji ih čine didaktički opravdanim i poželjnim uistinu je mnogo:

- Autentični su materijali koji u pomalo artificijelnu razrednu atmosferu unose svježinu i dinamiku.
- Lako razumljivi scenariji čine ih uporabivim na svim stupnjevima znanja jezika.
- Izuzetno su praktična motivacijska sredstva jer se pripadajuće vježbe mogu unaprijed pripremiti i sačuvati za višekratnu uporabu.

- Ovisno o potrebama nastavnoga trenutka moguće ih je više puta i na različite načine prikazati (potpuno, djelomično, sa i bez zvuka/slike).
 - Kao sredstva priopćavanja neizravno prenose informacije iz različitih područja ljudskih djelatnosti: kulture, povijesti, politike, sporta.
 - Vedrim koloritom, pozadinskom glazbom, atraktivnim sloganima privlače pažnju te bude radoznalost. Znatiželja je, naime, bitna pretpostavka pri usvajanju novih sadržaja.
 - Vizualni i auditivni elementi predstavljaju nadopunu verbalnom izrazu te u kombinaciji s jezičnim znakovima pospješuju pamćenje podataka.
 - Studente izlažu različitim registrima jezika, jeziku po regijama i određenim interesnim područjima. Izloženost samo jednoj varijanti stranoga jezika, samo jednome idiolektu, ne može osposobiti učenika za razumijevanje govornoga jezika u svim njegovim varijantama na fonološkoj razini.
 - Prikladni su za uvježbavanje i rad na svima četirima jezičnim vještinama.
 - Jedinstvena su sredstva integriranja kulturoloških podataka kod studenata (struktura obitelji, uloga žene u društvu, moralne vrijednosti i sl.).
 - Unose potrebnu interakciju između nastavnika i studenata; radi se o stalno nazočnoj interakciji neophodnoj za uspješnu nastavu stranoga jezika.
 - Potiču na kritičko promišljanje i zauzimanje stava prema poruci koju prenose.
 - Senzibiliziraju s međukulturalnom dimenzijom lingvističkoga podučavanja.
- Osobno se uvjerivši u njihovu didaktičku opravdanost, autorice ih rado preporučuju nastavnicima stranih jezika.

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Audiovisual materials in foreign language teaching - cultural and linguistic aspects

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Summary. This paper underlines the importance of a frequent introduction of both cultural and culturally defined linguistic elements in the everyday language classroom. The authors believe that by exposing students to carefully selected authentic materials, such as television commercials and sitcoms, they will help them to understand the similarities and differences between cultures and, thus, pave the way for tolerance and effective communication. This, as well as the two major theories on culture and its influence on language itself, are discussed in the introductory part of the paper.

The main part of the paper revolves around the didactic role of both television commercials in the Italian language classroom and television series in the English language classroom.

After a brief insight into the notion of a television commercial and the so-called Carosello which is perceived as an extremely important segment of the Italian culture, the criteria for the selection of audiovisual materials are analysed. Then, the variety of related activities that may be used to foster the grammar and vocabulary acquisition are presented. Cultural elements are also discussed.

As an example of British cultural elements, the didactic analysis of one episode of the classic sitcom *Fawlty Towers* is provided further in the paper. The episode, *Communication Problems*, revolves around misunderstandings between selectively deaf Mrs. Richards and the hotel staff. These serve as a perfect example of culturally specific behavioural patterns, which are reflected in the fascinating use of language, such as idioms, puns and clever use of synonyms.

Key words: *language, culture, authentic materials, selection criteria, analysis.*

Using context clues – An inexhaustible treasury for vocabulary learning

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Abstract. Second language vocabulary acquisition is important for learners who frequently acquire impoverished lexicons despite years of formal study. This paper deals with the «guessing strategy», one of the most appreciated methods that helps students discover the meaning of an unfamiliar word they come across. The research reviews the values and efficiency of this approach, as well as its advantages in relation to other methods of vocabulary learning. The paper describes the significance of context clues and information they offer about the meaning of an unknown word. Different types of contextual clues have been described and examples are provided for each type. It was decided to include students to find out what type of context practice suits them best. They were provided with exercises containing similar vocabulary, but different context clues to discover which of these they were going to be the most successful at, and whether there the final results would differ. Some indicators confirm that the level of language competence plays an important role in guessing, and that insufficient vocabulary can prevent learners from discovering the meaning of unknown words. The reasons for some theorists' neglect of the positive effects of this method are also introduced. The conclusion states that the strategy of guessing gives positive results whenever it is available. Teachers must avoid unrestrained use of this particular method, because in certain cases, it may easily become the cause of frustration and demotivation, instead of enhancing general comprehension.

Key words: *vocabulary acquisition, guessing strategy, context clues, meaning, exercises*

1. Introduction

The understanding of words is vital to effectively communicate and understand the world around us. From the late 80s, vocabulary has been an area of special interest for the acquisition of the second language. Researchers realized that many of learners' difficulties result from an inadequate vocabulary. Even when they are at higher levels of language competence and performance, they still feel the need of learning vocabulary. Of all the vocabulary strategies commonly recognized today in both the first and second language, the most widely studied and encouraged is the guessing of the meaning of unknown words from context or the „guessing strategy“. It has been the subject of many research studies and the great majority of studies demonstrate its value and indicate that the strategy is effective. Furthermore, most EFL vocabulary learning guides and instructional methodologies advocate a „vocabulary in context“ approach, suggesting that vocabulary should never be taught in isolation as in word lists with their mother-tongue equivalents. Studies of context effects have established that words are recognized better in context than out of it. This strategy offers

many advantages over laborious, time-consuming methodical instruction in vocabulary. Providing students with the meanings of all new words or encouraging extensive use of dictionary may not be adequate enough to stimulate vocabulary acquisition. The reason is that „word lists“ or „word-translation“ pairs prevent students from applying more suitable strategies such as inferencing and guessing meaning of words in their natural contexts. Some even believe that dictionary usage interrupts the flow of reading (Brown 1997). Another fact in support of this strategy is that it involves skills of interpreting surrounding text while reading which enhance reading skills (Coady and Nation, 1988). However, there is also a growing number of studies that bring into question the value of encouraging the guessing strategy for EFL learners. There are positive outcomes from the use of context to help learners to receive target words, recognize the surrounding and contextual meanings, retrieve words, restore them in long-term memory and have an appropriate use of them in the four language skills. Not all contexts are helpful, though. Some contexts give little information about a word's meaning. This strategy has therefore some weaknesses. Although there is a belief that learners benefit from encountering vocabulary in native-like contexts, some authentic texts may be unsuitable for particular learners if there are too many unknown words and the control of unknown words seems to be important for the comprehension of texts.

2. What is context?

Context has been described as the words surrounding a particular word in question, within a sentence or phrase. Context is also taken to include the reader's expectations and purposes for reading; various aspects of the location and situation in which the person is reading; and even the person's culture and times - in short, the reader's entire background of knowledge and experience (e.g. Brown, 1997). These various factors operate simultaneously for proficient readers; they usually operate quite unconsciously; and they can affect the identification of single words as well as the reader's understanding of an entire text.

Among the four skills, reading has particularly received emphasis because of its importance for the learner and his learning of new words through incidental, indirect and subconscious learning. Many research studies have linked vocabulary learning with reading (Huckin, Haynes and Coady 1998). Such learning involves inferring meanings using contextual clues to guess meanings, which should lead learners to activate their knowledge and enhance further vocabulary retention.

Extensive reading is commonly proposed as a way for learners to expand their vocabulary. It involves intensive use of the guessing strategy and has been strongly recommended as the only reasonable means of building a suitable large vocabulary (Krashen, 1989).

3. Justification for the guessing strategy

The fact that the guessing strategy is often encouraged is not surprising considering the enormous amount of words in the English language and the number of words one needs to know to recognize a reasonably high percentage of words in the written text. More and more studies show that a key factor affecting students' ability to make use of context is vocabulary knowledge. Barnett (1988) made some interesting points about it in his discussion on the guessing strategy: All facts suggest a need for selective approach, by the learner and the teacher.

- Usable context varies and is affected by the proportion of unknown words
- Learners with larger active vocabularies use available context better than those with smaller vocabularies.
- Beginning students and advanced students have been shown to use guessing strategies more than middle level learners.

These findings have some important implications. They support the idea that context is created in proportion to preexisting knowledge and show that vocabulary is an important part of that knowledge. In fact it is another indication that the level of linguistic development plays an important part on guessing. On the other hand, insufficient vocabulary can prevent learners from constructing enough context to guess unknown words regardless of how much effort they make.

Beginning students and advanced readers have been shown to use the guessing strategy more than readers in the middle levels (Barnett, 1988). This is probably because beginners don't know much language and have to guess. Advanced readers are likely to guess for the opposite reason; they know enough vocabulary to successfully apply the strategy.

Guessing from context is a complex and often difficult strategy to carry out successfully. To guess successfully from context, learners need to know about 19 out of every 20 words, 95% of a text, which requires knowing the 3000 most common words (Liu & Nation, 1985; Nation, 1990). According to Kelly (1990), even if one knows these words there is little chance of guessing the correct meaning „unless the context is very constrained, which is a rare occurrence“ (p. 203). Although this strategy often may not result in gaining a full understanding of word meaning and form, guessing from context may still contribute to vocabulary learning.

A procedure for guessing from context begins with deciding whether the word is important, whether it is a part of an important idea or is repeated often. Once learners decide that a word is worth guessing, they might follow a five-step procedure as suggested by Nation and Coady (1988):

- determine the part of speech of the unknown word,
- look at the immediate context and simplify it if necessary,
- look at the wider context,
- guess the meaning of the unknown word,
- check that the guess is correct.

Haynes (1984) believes that teachers should encourage guessing if clues are in the immediate context, but they should also teach learners when not to guess. A learner must be aware that many words have several possible meanings. Only by being sensitive to the circumstances in which a word is used can the reader decide upon an appropriate definition to fit the context.

A reader should rely on context clues when an obvious clue to meaning is provided, or when only a general sense of the meaning is needed for the reader's purposes. Context clues should not be relied upon when a precise meaning is required, when clues suggest several possible definitions, when nearby words are unfamiliar, and when the unknown word is a common one that will be needed again; in these cases, a dictionary should be consulted.

4. Using context clues

Contextual analysis is a strategy that can create optimal growth and development of identifying and learning new vocabulary within a text. As pointed out earlier, authentic contexts can be well motivating for vocabulary acquisition. Such learning often involves using context clues to guess meanings, which teachers hope will lead learners to activate their knowledge for further vocabulary retention. Use of context clues is an effective approach to teaching students to use context to figure out the meaning of an unfamiliar word they come across in their reading. Context clues are hints about the meaning of an unknown word. We all know that even when you use the dictionary, it is often necessary to read several definitions of a word before you can find the one that fits the meaning of the sentence. So you will have to be alert to context clues even when you use the dictionary.

Using context clues as a strategy could help students to identify unknown words in sentences or longer texts. Context instruction should require students to have to make hypotheses about

what a word is based on, what they already know, and the context within which the word is found. Teaching students how to use context to derive word meaning is important. Students need guidance to learn new tactics and strategies that will help them increase their vocabulary and reading comprehension. They often guess unknown words without an effective strategy instruction. As educators, it is imperative to help the students learn how to solve a problem when they come to unknown or unfamiliar words within a text. If the learner does not have teacher assistance in this matter, the average learner will ignore the unknown word, skip over it, miss the meaning of the sentence, the meaning of the paragraph, and in many cases, the meaning of the entire text. When there are many new words, students are often discouraged. However, when the vocabulary of the text is more familiar, students are more likely to continue with the reading task.

There are several factors to consider when deciding on the use of context clues. In order for a reader to be successful in figuring out an unknown word, it depends on how many times the word is presented in the context, whether the context is oral or written, the ability of the reader to use context clues, and whether the context is sufficient. One way to implement context clues is by presenting students with single sentences first. It is more manageable and comprehensible for the student using a smaller chunk of a text (Buettner, 2002). Buettner suggested that students are able to focus on working on one sentence at a time. Clues may appear within the same sentence as the word to which it refers, or it may be in a preceding or subsequent sentence.

Most vocabulary is gained through reading and for that reason it is important that learners are able to recognize and take advantage of context clues. A writer may give the meaning of a difficult word in the passage itself. The explanation might follow a comma or a dash after the difficult word. This is especially used for place names, technical terms and other words that even native English speakers may not be familiar with.

For example:

When I was in Germany, I enjoyed *Schweinebraten*, which is a type of roast pork.

5. Types of context clues

There are several kinds of context clues that are quite common.

5.1. Definition

A definition gives the meaning of unfamiliar words. The author may use words, phrases or statements to define something. The writer will use key words or signal words to identify a definition, so we need to look for them.

Signal words:

is/are	means/mean
is/are called	what this means is
is/are known as	consist of
is/are defined as	refer to
is/are described as	may be seen as

e.g. **Inflation** is a rise in the general level of prices for things you buy.

an unfamiliar word = *inflation*

signal word = *is*

the definition = *a rise in the general level of prices for things you buy.*

5.2. Restatement

The author may use other words, phrases, or sentences to provide the meaning of difficult words. We call this example or restatement, the author describes it again or in a different way.

Signal words: or, that is to say, in other words, i.e. or that is

e.g. The surface of Africa consists mainly of **plateaus** or large flat areas.

an unfamiliar word = *plateaus*

signal word = *or*

the restatement = *large flat areas*

5.3. Synonym

The author uses another word or phrase to help the reader understand the meaning of a word. A synonym is a word that means the same or nearly the same as the unfamiliar word.

Signal words: also, as, like, similarly, or

e.g. After seeing the picture of the starving children, we all felt **compassion** or pity for their suffering.

an unfamiliar word = *compassion*

signal word = *or*

the synonym = *pity*

5.4. Cause and effect

The cause for or result of an unknown word enables the meaning of an unknown word to be inferred.

Signal words: because, since, as

e.g. The door was **ajar**, so the dog got out of the house.

an unfamiliar word: *ajar*

signal word: *so*

the cause: *the door was ajar*

the effect: *the dog got out of the house*

5.5. Examples

The author provides several words or ideas that are examples of an unfamiliar word.

Signal words: for example, for instance, such as, like

e.g. In science we are studying marine **mammals** such as whales and dolphins.

an unfamiliar word: *mammals*

signal word: *such as*

example: *whales and dolphins*

5.6. Contrast

You can guess the meaning of new words by using signal words of contrast. They will show the opposite meaning of the new words.

Signal words; but, even though, instead of, in contrast to, in spite of, although

e.g. My last flat was very small, but my new one is quite **spacious**.

an unfamiliar word: *spacious*

signal word; *but*

contrast: *small/spacious*

If students cannot find any signal words, as stated before, they may look around new words or unfamiliar words and try to guess them. Even when students are able to use context clues to infer the meanings of unfamiliar words, the words may not become part of students' speaking, listening or reading vocabularies. In fact, learning new words from context might well be only the first step learners employ and they should carry on to learn new words together with the context where it appears (e.g. remembering the word together with the surrounding context). Students must remember that they should not guess all the time. At some point they should use a dictionary for words that they feel are important enough to have a very clear and precise understanding.

6. Study

The aim of this study was to demonstrate effectiveness of different types of context clues. The questions guiding this research are: do context clue strategies support students when finding the meaning of an unknown word and what types of clues students find more effective or helpful for guessing the meaning of unknown words. This study therefore attempts to examine the comparative effect of types of context clues (synonyms, definitions, examples, contrast) on learners' prediction of the meaning of unknown vocabularies. Thus, the objectives of this study are:

- a) to investigate the effect of contextual clues on predicting meaning of unknown vocabularies which contributed to improve the reading comprehension of different texts,
- b) to examine the effectiveness of certain types of contextual clues which require the learners guess the meaning of unfamiliar vocabularies in the text quickly.
- c) to find the comparative effect of types of contextual clues on learners' prediction of the meaning of unknown vocabularies.

The research was carried out on a sample of 76 first-year students of Business Trade and Accounting and Finance. All of these students are at the intermediate level. The study that was carried out was based on context analysis and effects of context clues.

6.1. Introductory lessons

Types of context clues were presented to students in mini-lessons. Presentations were given on clues that can be found with definitions within text, antonyms or contrasting statements within text, synonyms within text, and examples within a sentence as we decided to focus on these four types of context clue strategies.

During the first mini lesson we introduced our students to context clues, and during the second one we started practicing different types of them.

When a student is trying to reveal the meaning of a new word, it's often useful to help them look at what comes before and after that word. The surrounding words can give helpful context clues about the meaning and structure of the new word, as well as how it is used. We have found it effective to model a self-questioning strategy (activity) to identify the different types of context clues. Students can ask questions that are designed to focus attention on the unknown word and the possible clues to its meaning, such as: What are the surrounding words? How do these offer me clues? What does this word mean in terms of the context? It is also helpful to provide students with frequent reminders and examples of the different types of context clues. We also posted the list of context clues (and some corresponding examples) on Moodle pages. While students are reading chosen texts in pairs, they can try different ways to identify context clues. They can highlight or underline the unknown words and/or the surrounding context. They can mark the clues that they believe will help them uncover a

word's meaning, share their thinking and discuss. It is important that they repeat the process for one or two more words.

During the other type of activity we divided them in groups of four. Students silently read the passages with new and unfamiliar words. After reading, they have to write down definitions for these unknown words, but there's a catch! They're not allowed to use dictionaries, glossaries, dictionary.com or any other reference. Even when we do have a dictionary, we know that a word may have many different meanings depending on the context. They're only allowed to help each other and concentrate on the literary work in which the word appears. They must use context clues. Each team compares definitions. The team with the highest point total at the end wins the game.

The third type of the activity gave them a chance to create a passage with an unknown word for a partner to figure out. Now they are allowed to use dictionaries or online dictionaries to find one word they believe is unknown to their partner and we instructed them to place it within the context of 2-3 sentences. Then students exchanged papers with a partner and tried to use context clues to figure out the meaning of the new word.

The learning outcomes of these and similar activities are that students will be able to figure out the meaning of new and unfamiliar words to enhance reading enjoyment. They will practice looking for new and unfamiliar words in prepared sentences and use context to determine meanings of words. After reading a newspaper or magazine article, they will be able to choose new and unfamiliar words and will use context to determine the meaning of these words. Students can even use dictionaries to check to see if their meanings are correct and to continue development of dictionary skills.

6.2. Pretest and Test

During the next class, students had to do a pretest. As a pretest, they were given the words that were going to be used in tests and had to define them as best as they could.

The test followed and students were given 4 sets of multiple choice exercises, each one containing ten sentences with the same target words, but in each exercise these words were presented in sentences containing a different type of context clue. The test required the learners to read the sentences and choose the correct word for each target word. Four answers were offered for each sentence. The task that was required from the students included the following steps:

- a) read the sentence containing the target word,
- b) identify the context clues,
- c) guess the meaning of the unknown word with the context clues,
- d) choose the best answer from the choices.

6.2.1 The first exercise contained sentences with examples within a sentence as context clues:

Segregation based on race, ethnicity, or sex is discriminatory and should be outlawed.

- a) the best
- b) separation
- c) a coming together
- d) jargon

6.2.2 The second exercise used a context clue strategy including definitions within sentences:

Segregation is the institutional exclusion of an ethnic, racial, religious or other minority

group from the dominant majority.

- a) a coming together
- b) the best
- c) jargon
- d) separation

6.2.3 The third context clue strategy were contrasting statements:

They fought to end the **segregation** of black population and today they are integrated into our society.

- a) jargon
- b) separation
- c) a coming together
- d) the best

6.2.4 In the fourth exercise students had to identify synonyms as context clues:

The high degree of black **segregation**, racial discrimination, is explained largely by the persistence of racial prejudices.

- a) a coming together
- b) jargon
- c) separation
- d) the best

During the tests we noticed that students re-read the given sentences multiple times, used the strategies by locating clues in context, and took the time to think about the meaning. Students used skills and strategies that were practiced in previous classes. The process of acquiring the guessing strategy as well as the activities that were used for this purpose are shown in Table 1

Table 1 Guessing strategy procedure

Explanation	Explain the different types of context clues.
	Demonstrate how to identify context clues with excerpts from an authentic text.
	After you explain and demonstrate using a variety of materials, have students explain the use of context clues in their own words and show how they would apply the strategy in their own way.
Practice	Model a self-questioning strategy, using the list of context clue types, with questions such as these: What are the surrounding words? Do they offer me clues? What does this mean in terms of the context?
	Have students work in pairs to read unfamiliar text on the computer, highlight unknown words, find context clues to hypothesize the meaning, write definitions for unknown words, create a passage with an unknown word for a partner to figure out and then check the meaning using a dictionary
Testing	Pretest: Let students analyze the words that are going to be used in tests. Their task is to define them as best as they can.

	Test: Have students read the sentences and choose the correct word for each target word.

7. Analysis of the findings

The data analysis began by analyzing the results. The mean score of the test result was calculated. The analysis of data revealed that the previous knowledge and use of context clues has a significant impact on guessing the meaning of unknown vocabulary. Moreover, the research examined the comparative effect of types of context clue on learners' guessing of the meaning of unknown vocabulary. The findings revealed that definitions exercise has the most effect, it was followed by synonyms and examples although there wasn't much difference between the results of these three. The strategy of antonyms or contrasting statements proved to be the most difficult one. (Figure 2). The findings of the study reveal that different types of context clues are significantly effective for better comprehension and understanding of unknown vocabularies. Moreover, the learners were able to predict the meaning of unknown vocabularies better if context clues were alternatively synonyms, definitions, examples and antonyms.



Figure 1 The mean score of each exercise

8. Conclusion

This study has explored the effects of word guessing strategy training in the EFL classroom. Looking at the results of the tests, it is evident that the students were able to use the context clues to help them define the meanings of the unknown words. They had a difficult time

describing the words in their pretest because the words they got correct were very minimal. However, when the students were given the words in a sentence, a great number of them were able to use the clues in the sentences to help them. We can conclude that context clue strategies impact the ability of inferring meaning of words. Using context to infer lexical meaning is complex and can be difficult for numerous reasons, such as the learners' lack of vocabulary, their failure to identify or elaborately process unknown vocabulary, a lack of clues or the presence of deceptively transparent clues. Nevertheless, inferring vocabulary meaning from context is an essential strategy for developing reading comprehension and promoting lexical acquisition. Lexical development is a major concern of EFL learners, but unfortunately it is frequently undervalued by course designers and some instructors. To continue reading without interruption, guessing meanings of words from context is a useful skill. The word guessing strategy training as an approach to reading instruction has some beneficial effects on learner's reading ability and can enhance their word guessing ability significantly. The findings suggest that we should use word guessing strategy training in the daily English lessons more actively. We will therefore keep using context clues strategies in the classroom as these are strategies that students will carry with them throughout life because making inferences of meaning of words in context is something that happens naturally in our everyday lives.

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Developing teaching material for a Business English class

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Abstract. Although there is a wealth of published materials available, the business English teaching community stills faces a need to develop its own course materials to suit the particular needs of students. In addition, in a fast-changing environment it is of paramount importance that the material used in the classroom is authentic and up-to-date. It maximizes students' exposure to a rich variety of language use and enables them to develop communicative competence. It is also important that students are engaged affectively and cognitively in the language experience. The material used in a Business English classroom should be driven not only by teaching but also by learning principles. Business English teachers at Higher Education Institutions in Croatia often develop their own materials in addition to using off-the-shelf coursebooks. This paper will show how much Business English is taught at Universities in Croatia and whether - and who for - Business English teachers write their own materials.

Key words: *material development, business English, tertiary level.*

1. Introduction

Teaching materials have a great impact on what and how a teacher teaches and how a learner learns. Effective teaching / learning materials are shaped by taking into consideration various factors such as teacher, learner, and the teaching context. When a new course book, a course book series or any teaching material is being planned, all three elements must be taken into consideration. Course book developers try to target the book at a specific audience, i.e. learners and to tailor the tasks and activities to meet the needs of that particular audience.

The same applies for materials developed for a Business English class. Business English (BE), being part of a broader ESP field, has its own particular demands which shape the teaching material. In addition, the learners taught Business English have their own characteristics which have to be respected and language demands which have to be met. Although on the market there is a myriad of Business English teaching materials (i.e. course books, workbooks, etc.) for students at different levels of the Common European Framework of Reference for Languages (CEFR), it is debatable whether they can meet the specific requirements of students at Higher Education institutions (HEI) as it is a very specific teaching context.

2. What is Business English and who are its learners?

English for Specific Purposes (ESP) is a learner-centered approach to teaching English as a foreign language. It is a term often used to describe language that is inaccessible to people who are not members of a particular language community (Frendo, 2005:6). It meets the needs of learners who need to learn English for use in their specific professional fields such as business. At its core, ESP has been "a practitioners' movement, devoted to establishing . . .the

needs and relevant discourse features for a targeted group of students” (Johns in Paltridge&Starfield, Eds. 2013:6).

2.1 Business English

Business English falls within the scope of ESP (Hutchinson & Waters, 1987) and should be analysed as such. It shares the common features of ESP, such as needs analysis, syllabus and course design, and materials selection. However, it is different from other ESPs as it is a mix of a specific content (related to the particular industry or job area) and general content (related to the ability to communicate in various situations that arise within the business context, such as small talk at a product launch, the ability to negotiate, etc.). In other words, BE draws on general English for some of the content and adds other elements specific to business as is shown on figure 1.

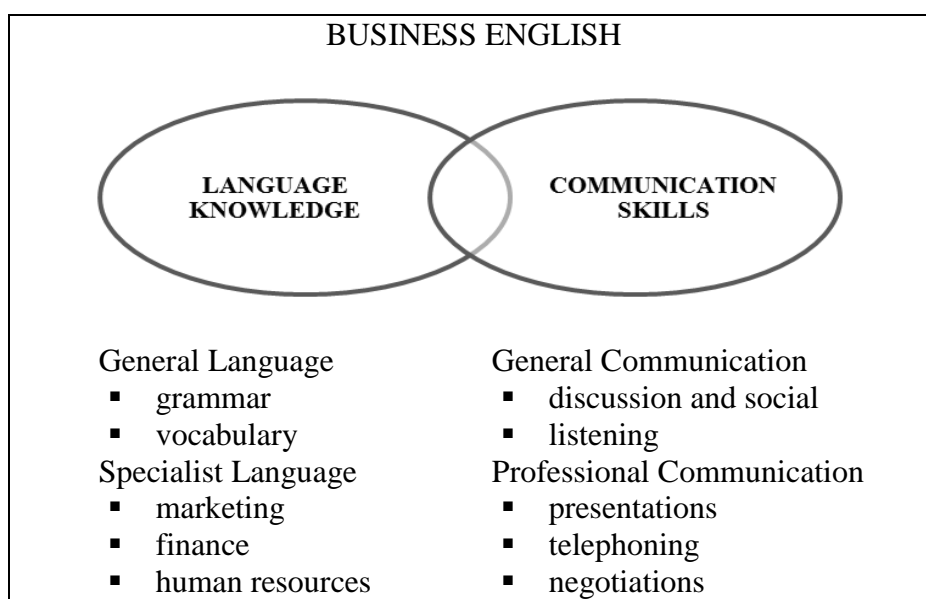


Figure 1 The scope of Business English (from Brieger, 1997:6)

Figure 1 shows that the scope of Business English includes not only language knowledge and communication skills, but also professional content. The teaching of Business English thus brings together three areas: teaching, English and business. Teaching refers to teaching both language, i.e. grammar and vocabulary, and communication skills needed in the professional world, e.g. presentation skills, report and e-mail writing, etc. English refers to the language being taught, and business is the professional content taught, which includes a range of themes related to the professional context such as marketing or finance. To be more precise, the professional context refers to the settings in which relevant language knowledge must be acquired and communication skills developed.

2.2 Business English learners

The content of a BE course and the methodology used always reflect the diverse needs of varied learner groups. Although it might be claimed that a language teacher’s primary role is to teach language and not the content it is not the case with pre-experience learners within the HEI context. Donna (2000:2) states that teaching Business English involves teaching English to adults working in businesses of one kind or another, or preparing to work in the field of business. Frendo (2005:1-2) groups learners according to their experience, level in the organisations’ hierarchy, national culture, needs, and language level. Brieger (1997:3) distinguishes between pre-service students and in-service professionals. A similar distinction is found at Ellis and Johnson (2003:5-6), who say that Business English learners can be

divided into pre-experience learners (or low-experience learners) and job-experienced learners.

Pre-experience learners or pre-service students are learners in educational institutions such as colleges and universities who take Business English courses to prepare for their future career, i.e. because they intend to follow a business career. They usually lack practical knowledge. They are often unaware of their future language needs in terms of communicating within the business context and very often study to pass an examination, be awarded a number of ECTS (European Credit Transfer and Accumulation System) credits, and eventually get a degree. Most students at the University of Split, Faculty of Economics (EFST) are pre-experience learners who, because of their lack of experience, will often need the teacher to “provide a window on the business world”. (Frendo, 2005:1).

On the other hand, job-experienced learners or in-service professionals, are learners who are already employed and have business experience. They need to learn English for a new job or a new situation which they lack the necessary experience for, e.g. establishing joint ventures in another country or being selected for a new project. They do not need their teacher to explain them the world of business but to help them develop the four language skills. Thus, their courses have different objectives and course content, and different methodology might be applied than when teaching pre-experience learners.

3. Business English and its teachers

Business English teacher can work in several contexts: education institute, private language school, in-company or 1-to-1 (Frendo, 2005:2-5). As Higher Education institutions (HEIs) fall within the education institute category, only teachers working in this context are the subject of this section.

Since the field of ESP is extremely varied, Dudley Evans and St. John (1998:14) refer to ESP teachers as ESP practitioners to emphasize the several roles they play. The five key roles of the ESP practitioner are: teacher, course designer and materials provider, collaborator (who works with subject teachers), researcher (who not only gathers materials but also understands those materials), and evaluator (who continuously evaluates the syllabus, materials used and tests learners). For the purpose of this paper, we shall concentrate only on the first two roles, i.e. teacher, and course designer and materials provider. It does not mean that other roles are ignored as all five roles are closely connected and interrelated.

3.1 Business English practitioners as teachers

ESP practitioner's role of a teacher is primarily the role of a language teacher. However, his/her role largely depends on whether the learners are pre-experience or job-experienced ones. Job-experienced learners are the primary knowers of the content and the teacher's role is to create real communication in class on the grounds of learners' knowledge (Sierocka, 2008:35). In-service students, who are a type of job-experienced learners, who are for example taking an in-house course in English have the content knowledge but lack, to a greater or lesser degree, language knowledge. The relationship between learners and teachers in this setting might be more of a partnership where learners contribute to the course with their content knowledge and teachers with their language knowledge. Scrivener (2005:310) says that “you (the teacher) know about English; they (the students) know about the topic”. Harding states that you don't need to be an expert, but you need to have some understanding of the subject area (Harding, 2007:8). Frendo (2005:5) claims that in most other fields of teaching the teacher knows more about the subject than the learner, but in Business English the relationship can be more symbiotic: the teacher knows about language and communication, but the learner often knows more about the job and its content. Although the stated might apply to job-experienced learners, it is not necessarily applicable to pre-service

learners as they also usually lack content knowledge, especially in their undergraduate studies, so the line between the role of a language teacher and content teacher becomes often blurred at HEI. This puts forward a challenge to ESP practitioner as a teacher if he/she needs to be more of an expert in the professional area that their students are studying than it is the case when teaching job-experienced learners. His/her role is not only to teach language but also through that language familiarise students with the professional content. The role of ESP practitioner at a HEI is closely connected to the role of a course designer and materials provider.

3.2 Business English practitioners as course designers and materials providers

Although there is a very wide selection of published textbooks that can be used in a Business English class and the teacher can select materials which match learners' demands and needs, it is uncommon to use only a particular textbook without supplementary material as evidenced by the analysed obligatory literature at the faculties of economics and business in Croatia. It is very difficult for ESP teachers to find on the market one catch-all course book or course book series which would target the very specific professional learners' needs. This is particularly true at HEIs because the needs of the learners' at undergraduate level are very broad and they must cover a wide range of topics since when they take obligatory Business English courses they have not chosen their field of specialization yet. A course book is very important for the teacher as it is often the structure of the course syllabus because it provides a framework for a course, forming in essence a syllabus (Robinson, 1991:57). If such literature is not available, the teacher must provide the material for the course, either by adapting the existing one or developing completely new. The ESP teachers at HEIs are also very often materials providers (Lekaj Lubina et al., 2015) because they must meet very specific and very diverse needs of various ESPs taught at different HEIs. The teaching material must be effective and the ESP practitioner must assess the effectiveness of the materials used, whether it is published or self-produced. Business English teachers embark on the adventure of developing their own materials because appropriate and qualified materials have, on the one hand, a positive effect on the learners' learning styles and learning result and, on the other hand, they have a great influence on what and how the teacher teaches and, to some extent, even the teacher's classroom management is determined by the materials.

4. Teaching materials in foreign language teaching

Business English falls within the scope of ESP (Hutchinson & Waters, 1987) and shares the common features of ESP as was previously explained and the teaching material chosen should meet the specific learners' needs. When selecting the material, it is important to know who the Business English learners are, i.e. whether they are pre-experience or job-experienced learners, so as to cater for their needs appropriately. As there are several types of learners, there should be different types of materials.

Brieger claims (1997:4) that the history of English Language Teaching can be roughly divided into two periods: the pre-communicative era (pre-1975) when most ELT was aimed at learning grammar and vocabulary and the post-communicative era (post-1975) when the main objective became developing fluency and communicative competence as learners needed to learn how to use the language in real-life situations. The way teachers and course book developers look at Business English has changed over the years. In the late 1960s and early 1970s it was believed that specialist vocabulary was what distinguished Business English from General English. This meant that earlier textbooks reflected this approach and all the tasks were aimed at acquiring specific vocabulary and no consideration was given as to how a student would apply the vocabulary in practice, e.g. how they would write a letter or communicate at a meeting. In the mid-1970s and 1980s, more emphasis was being put on

functional areas such as giving opinion, making recommendations, showing agreement (Ellis and Johnson, 2003:3-5). Since then, the emphasis has shifted on understanding the role of lexis and its relationship with grammar as the distinction between the two is becoming more blurred and the approach known as communicative language teaching (CLT) is being developed which aims to develop learners' ability to use language to communicate (Frendo, 2005:12). Business English textbooks have followed the same path.

In recent decades, due to the expansion of international trade and business, there has been a strong growth of published materials in Business English (Dudley-Evans & St John, 1998:2). However, although Business English is a major field in terms of textbooks, many ESP practitioners also must develop their own materials because the very specific learners and teaching contexts demand very specific materials they use in their class in addition or not to a coursebook. Arguments have been presented both for and against using coursebooks (Ur, 2009). The advantages of a course book are obvious: they save teachers a lot of work as they provide a framework to work with. Course content, i.e. all the texts and tasks have been prepared, and the methodology has already been made. It is a convenient and the cheapest way of providing content to learners. The course book also provides a syllabus. The books look good and professional, and are usually a part of the package which includes teacher's book, practice file/workbook, test files, audio and video resources, self-study materials, etc. The disadvantages are that a course book cannot necessarily fully meet the learners' needs and it must be either adapted or supplemented by additional materials. In addition, they can date quickly, the topics may not be of interest to the learners. They are limiting for teachers' creativity and lead to learners' lack of motivation and boredom. Anthony (1997) had a very negative view of teaching from ESP course books believing that teachers were often 'slaves' to the book or worse taught from textbooks which were unsuitable.

5. Business English courses and respective teaching materials at Croatian universities

According to the data of the Ministry of Science, Education and Sports, in Croatia there are 7 universities, 13 public polytechnics, 3 public schools of professional higher education, 3 private polytechnics and 25 private schools of professional higher education. The research presented in this paper focuses on seven universities and undergraduate and graduate programmes of Business and Economics delivered at those institutions.

Business English courses are taught at all state Universities in Croatia, namely at: the Faculty of Economics Rijeka (EFRI), Faculty of Economics and Tourism "Dr.Mijo Mirković" Pula (EFPU), Faculty of Economics Osijek (EFOS), Faculty of Organisation and Informatics (FOI), Faculty of Economics and Business Zagreb (EFZG), Faculty of Economics Split (EFST), University of Dubrovnik (UniDU) and University of Zadar (UniZD). The faculties' websites were analysed to obtain information on what BE courses they offered, when during the course of studies they are offered and how many ECTS were accredited which was a starting point for the analysis on the literature for the courses.

Table 1 Business English (BE) Courses at undergraduate studies at universities in Croatia

Faculty	Undergraduate studies						Graduate	
	1 st	2 nd	3 rd	4 th	5 th	6 th	1 st year	2 nd year
EFRI								
EFPU								
EFOS								
EFZG								
EFST								

FOI							
UNIZD							
UNIDU							

Key: Dark grey stands for obligatory and light grey for elective courses.

Table 1 shows that Business English courses are taught slightly more during the first two years of undergraduate studies, although there are differences in whether they are obligatory or elective courses. EFOS, EFZG and EFST are the only three faculties where BE is offered at the graduate level. Bearing in mind that undergraduate students are pre-experienced learners, their knowledge of the subject matter they are studying to get a degree in, i.e. business or economics, is very limited.

In order to analyse what materials are used, the respective faculties' website were also analysed to find out the literature for the courses. As not only faculties provide all relevant information, the Croatian Scientific Bibliography (CROSBI) was analysed as it provides information on the published coursebooks, workbooks, readers and the like by teachers working at Universities in Croatia. Websites of the University of Zadar, University of Dubrovnik and Faculty of Economics in Rijeka provide no information on the literature, nor was any information available through CROSBI, so these three institutions were excluded from further analysis. At most faculties, a part of the obligatory literature are coursebooks by prominent publishers, e.g. *Market Leader: Accounting and Finance*, *Market Leader* (various levels), *New Insight into Business* all by Longman, *English for Business Studies* and *Business Vocabulary in Use*, *Business Reports in English* all by CUP, *Business Basics*, *A Handbook of Commercial Correspondence* both by OUP and *In Company*, *Case studies* both by Macmillan. However, at all the faculties, ESP practitioners are also material developers which suggests that that they were not able to find a single course material on the market which would target their learners. Table 2 shows what books (coursebooks, readers, workbooks, additional material) were written by ESP practitioners at analysed Croatian faculties and are being currently used in class.

Table 2 Business English books by authors at universities in Croatia

Faculty	Authors	Title	Audience and/or details about the materials
EFPU	Dujmović & Kostić-Bobanović	<i>A Handbook of English Grammar</i>	first and second year undergraduate students
	Kostić-Bobanović & Dujmović	<i>Business English in use</i>	advanced students
EFOS	Sedlan König & Radoš	<i>On the line: a practical training in telephoning skills</i>	a collection of exercises useful in teaching English for telephone purposes
	König	<i>Hold the line, Business telephoning in practice</i>	
	König	<i>The Art of Presenting: a course in delivering presentations in English</i>	covers all major aspects of preparation and delivery of presentations
	Sedlan König, Knežević & Vujčić	<i>College writing skills for busy students</i>	book for everyone who needs to write for academic or business purposes
	Radoš & Meler	<i>English-Croatian Dictionary of Marketing Terms</i>	undergraduate and graduate Marketing students
	Radoš & Kirin	<i>Earn your points – English for</i>	coursebook designed for first-

		<i>First-Year Students of Economics</i>	year students of Economics
FOI	No author(s) were stated	<i>A selection of professional articles with exercises from publications in English</i>	materials used in lectures, consisting of texts and methodologically prepared exercises.
EZFG	Department of Business Foreign Languages	<i>Business English 1, Resource Bank</i>	first year of undergraduate studies
		<i>Business English 2, Resource Bank</i>	second year of undergraduate studies
EFST	Pašalić	<i>Business English 1 for Students of Economics and Business Economics</i>	first-semester undergraduate students of Economics and Business
	Duplančić Rogošić	<i>English for Business and Economics 2</i>	second-semester undergraduate students of Economics and Business
	Radmilo Derado	<i>Business English 3 Reader</i>	third-semester undergraduate students of Economics and Business
	Marinov, Duplančić Rogošić, Pašalić & Radmilo Derado	<i>Return on Investment</i>	a supplementary material for various Business English courses

It can be concluded from information available through CROSBİ and faculties' websites that Business English teachers in Croatia are also materials developers. Most materials are written for students at the institution where the teachers work as can be concluded from the available descriptions of the materials (e.g. third-semester undergraduate students of Economics and Business). However, this does not mean that the materials cannot be used with students at other HEI offering similar programmes (e.g. a supplementary material for various Business English courses).

6. Teaching practice at EFST

Ideally, before any material is developed a needs analysis is conducted. It is almost an essential starting point for ESP teaching and "we can't really address a student's specific needs unless we are absolutely clear about what they are" (Scrivener, 2011:310). Needs analysis enables us to focus on areas that are more relevant to the learner. The aim of a needs analysis is to collect information about the current situation and the target situation and understand the difference between the two, i.e. the training gap (Frendo, 2005:15). The stated gap leads to the design of the course, syllabus, methods, etc. Finding out about and analysing learners' needs is vital in ESP teaching. However, when the teaching practice changes very suddenly or a new course is being introduced practically overnight, there is no time for needs analysis. Teachers then rely on the coursebook that provides the syllabus.

Prior to the academic year 2007/2008, teaching Business English courses at the Faculty of Economics Split was done in a three-lesson block where one lesson was delivered in the form of lectures, which was used to introduce the topic, discuss it and clarify some difficult and/or unknown vocabulary that would be an integral part of exercises in the other two regular foreign language (FL) classes. Each group had around 60 students. The lecture was not a classical ex-cathedra lecture but was rather a combination of introductory tasks and discussion with students during which the teacher would teach using a two-way communication. Since the teaching practice was changed in 2007, students have been put into one to three groups for

ex-cathedra lectures with 250 students on average per group and several smaller groups of around 60 students per group for the regular FL classes. This teaching practice followed all the other courses taught at EFST and the typical type of instruction in the university setting in Croatia where lectures are used to communicate the contents of the subject matter to students. BE teachers had to adapt to the newly emerged situation. Since then, the primary purpose of lecture has been to introduce key concept and relevant vocabulary of the topic all interwoven into a story-telling lecture type. The teachers have also been explaining language structures through various examples. The students have been putting into practice the taught content during FL classes, sometimes even two or three days after the lectures. Thus, the students have been faced a dual challenge; the first one is that they are not familiar with the content and the other is that the content is being taught in a foreign language. The teachers have been challenged by the need to become more of experts in the field that is usually necessary when teaching Business English, or any other ESP.

From the explained teaching practice emerged a need to develop additional materials that would meet the needs of pre-experienced learners not familiar with the content being taught.

7. Materials used at EFST

On the market, there is a wide range of off-the-shelf teaching publications available. At EFST, a commercially available coursebook series (*Market Leader* published by Longman) has been used for classes as the core book as it is a multi-level Business English course for students of Business English. The course enables students to develop the communication skills needed to succeed in business and enlarge their knowledge of the business world (Cotton et al., 2012:4).

	DISCUSSION	TEXTS	LANGUAGE WORK	SKILLS	CASE STUDY
UNIT 1 CAREERS → page 6	Talk about your career plan	Listening: An interview with the Finance Director of a TV company Reading: Facebook profile 'could damage job prospects' – <i>Telegraph</i>	Career moves Modals 1: ability, requests and offers	Telephoning: making contact	YouJuice: Decide on the successful candidate for a job Writing: e-mail
UNIT 2 COMPANIES → page 14	Talk about companies	Reading: India: Tata's search for a new CEO – <i>Financial Times</i> Is John Lewis the best company in Britain to work for? – <i>Guardian</i> Listening: An interview with the CEO of a food company	Describing companies Present simple and present continuous	Presenting your company	Dino Conti Ice Cream: Decide on the best way to invest in a company's future Writing: proposal
UNIT 3 SELLING → page 22	Talk about shopping habits	Listening: An interview with the Director of Marketing of a TV shopping channel Reading: Women on top in new sales industry survey – web article	Making sales Modals 2: <i>must, need to, have to, should</i>	Negotiating: reaching agreement	A partnership agreement: Work on a proposed partnership between a jet charter company and a hotel group Writing: letter
WORKING ACROSS CULTURES: 1 SAYING 'NO' POLITELY					→ page 30

Figure 2 Screenshot of the Content page of the *Market Leader, Pre-intermediate, 3rd edition, Course Book* (Cotton et al, 2012:2)

As illustrated by figure 2, *Market Leader* is a very general Business English course book series which covers a very wide range of business topics. General Business English courses are justified at the undergraduate level at EFST, because Business English courses have to meet students' delayed needs, i.e. students are pre-experience and will be working on the specialism sometime in the future which we, the teachers, do not know what will be. *Market Leader* series has proved as a good basis for different Business English courses, from BE1 to BE6, as it has extensive supplementary material and is regularly updated. It covers a wide

range of general Business English topics and could be used to develop a good syllabus. No needs analysis has ever been conducted because the possible range of jobs future graduate students could have is too wide. Therefore, a general Business English course is ideal for them. In spite of this, the course book has always been supplemented by different authentic materials and activities bearing in mind the specific requirements of the teaching context. The additional materials would change every year so as to fill the gaps students had.

Most materials, whether they be written for a global market, for an institution or even for a class, aim to satisfy the needs and wants of an idealized group of target learners who share similar needs and levels of proficiency No matter how good the materials are, they will not by themselves manage to cater to the different needs, wants, learning styles, attitudes, cultural norms and experiences of individual learners. (Tomlinson, quoted in Mc Donough et al., 2013:64)

Market Leader series had been chosen for the previously explained reasons. However, almost any major off-the-shelf series could be used to teach in a regular Business English class. However, when the teaching practice was changed and one 45-minute ex-cathedra lecture for very large groups of students was introduced at EFST, it became evident that the chosen coursebook, or any other coursebook for that matter, could not meet the newly emerged needs. *Market Leader* course book, practice file and practice exercises on the DVD continued to be used for the FL classes, but it was up to the teacher(s) to devise new additional materials in order to be well prepared to lecture about a business / economics topic for 45 minutes every week. The teachers had to become more of content experts than was previously required so as to be able to deliver lectures in English on a professional topic. They had to write their own materials not only for students but also for themselves.

To compensate for both students' and their own lack of specialist knowledge, teachers had to become researchers, which is also one of the roles of ESP practitioners. Teachers were not provided with any time for needs analysis and very limited time for materials research and materials development. A close cooperation with subject specialist was also required but was not possible because of time constraints during the initial development of the materials. The following year some help and direction was received from subject experts. It was somewhat limited although their experience and knowledge would have lessened the FL teachers' workload. The teachers at EFST thus gathered different, authentic and up-to-date texts from various sources such as business journals, books and relevant websites that they adapted language-wise so the students could understand the language being used to present the unknown content. This is of paramount importance as there appears to be a minimum proficiency level that is required for students to participate in predominately content-related activities (Yogman and Kaylani (1996, quoted in Gatehouse, 2007). Research has shown that students who are struggling to catch up with general language proficiency simply find the content activities to be overwhelming (Gatehouse, 2007). The students should not have to learn both the language and the content at the same time. In addition, although it would be expected that the groups at EFST are fairly homogenous as they must meet the same entry requirements to enrol, i.e. pass lower level at the state Matura exam, that is not the case and groups are heterogeneous with different levels of knowledge.

Having adapted the texts, a wide range of exercises, such as fill in the gaps, matching task, corpus-based tasks, collocation tasks, etc., was written to help students learn and revise the vocabulary necessary for dealing with business topics covered in FL classes. Many tasks also aimed at developing students' communication skills needed in the business context. Some of the materials, e.g. *English for Business and Economics 2*, also provide a key to exercises which makes materials suitable for self-study and revision. Additional materials offered more

opportunity and additional context to students to practice the repertoire acquired in content lectures and language acquired in the FL class.

8. Conclusion and recommendations

The aim of this research was to explore how the teachers at Faculty of Economics Split dealt with changed teaching practice in terms of the materials used. Based on the results of the analysis of faculties' websites and Croatian Scientific Bibliography, it was found that Business English teachers at EFST do not rely only on the course books available on the market but develop their own materials, which is in line with other Business English teachers at Croatian faculties of business and economics. It is also in line with foreign language practices as teachers often develop their own materials as the available off-the-shelf materials cannot meet the specific needs and demand of students at Higher Education Institutions. It should be stressed that the right choice of materials is important as it motivates learners and builds an ideal teaching/learning effect.

Based on the findings of this research, several guidelines for future research can be recommended. First, a questionnaire should be designed to research the teachers' motives for developing the material, what sources they use, what challenges they face, whether they conduct a needs analysis prior to developing the materials and whether they obtain help from content experts. The questionnaire should be administered to all Business English teachers at Croatian Universities. Second, a future research could include all HEIs where Business English courses are taught to see whether there is any difference in material development between institutions offering undergraduate degrees and undergraduate professional degrees. Third, another research could focus on various ESPs taught at different faculties. Although Business English is a big field in English Language Teaching, teachers still develop additional materials. It would be interesting to see how teachers who have no or very limited choice of materials for teaching their ESP cope with this problem.

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Pregovarački postupak bez prethodne objave

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Sažetak. Direktive i uredbe EU o javnoj nabavi, kao skup propisa, primarno uređuju učinkovito i racionalno trošenje proračunskih sredstava država članica EU-a, a Zakon o javnoj nabavi Republike Hrvatske uređen na načelima Ugovora EU-a i načelima javne nabave, sukladan direktivama i uredbama EU o javnoj nabavi, osigurava učinkovito i racionalno trošenje proračunskih sredstava RH. Cjelokupni sustav javne nabave utemeljen je na transparentnosti, zabrani diskriminacije i jednakom tretmanu gospodarskih subjekata što omogućuje slobodu kretanja robe i usluga, a rezultira intenziviranjem tržišnog natjecanja te u konačnici dovodi do gospodarskog rasta i razvoja. Prilikom provedbe pregovaračkog postupka bez prethodne objave naručitelj se obraća gospodarskim subjektima po vlastitom izboru i pregovara o uvjetima ugovora s jednim ili više gospodarskih subjekata te nije obavezan dosljedno primjenjivati načela javne nabave, osobito načela tržišnog natjecanja i transparentnosti. Europski sud pravde je kroz svoju praksu utvrdio dva osnovna pravila za primjenu ovog postupka:

- zakonske pretpostavke moraju se strogo tumačiti, postupak treba provoditi iznimno, kad su zakonske pretpostavke za njegovu provedbu zaista ispunjene
- teret dokaza da okolnosti konkretnog slučaja opravdavaju primjenu ovog postupka je na naručitelju.

Pregovarački postupak bez prethodne objave najmanje je konkurentan i transparentan postupak od svih postupaka javne nabave. Pregovarački postupak bez prethodne objave je drugi primjenjivani postupak kod sklapanja ugovora o javnoj nabavi u Republici Hrvatskoj. Prema statističkom izvješću¹ o javnoj nabavi u Republici Hrvatskoj za 2014. godinu ukupna vrijednost javne nabave bila je 32.875.972.157,00 kuna. Naručitelji su se najčešće koristili otvorenim postupkom i to u 78,54 % slučajeva, a pregovaračkim postupkom bez prethodne objave u 10,78 % slučajeva.

Ključne riječi: *javna nabava, pregovarački postupak bez prethodne objave*

1. Uvod

Javna nabava uređen je postupovan sustav nabave roba, radova i usluga u kojemu se javni i privatni sektor susreću u financijskom smislu. Visina financijskih transakcija u javnoj nabavi, u godišnjoj ukupnosti svih provedenih postupaka, predstavlja važan dio u gospodarstvu svake države članice EU-a. Stoga su jasno određeni glavni zadatci kao što su: osiguranje pravne sigurnosti, učinkovito i racionalno trošenje sredstava iz proračuna, sprječavanje korupcije i kriminala, poticanje gospodarskog razvoja, zapošljavanje i tržišno natjecanje te unaprjeđenje upravljanja javnim financijama.

Republika Hrvatska suočena sa stalnim proračunskim manjkom i kontinuiranim rastom javne potrošnje usmjerila je posebnu pozornost na javnu nabavu. Sustav javne nabave značajnije se

¹ www.javnanabava.hr – 23. veljače 2016. - Službeno izvješće Uprave za sustav javne nabave

počinje primjenjivati procesom pridruživanja europskim integracijama, čime je Hrvatska preuzela obvezu prilagoditi svoje pravne propise zakonodavstvu Europske unije. S obzirom na to da javna nabava ima značajan utjecaj na fiskalni sustav zemlje, unaprjeđenje sustava javne nabave direktno utječe na ekonomičnost, efikasnost, zakonitost i transparentno trošenje novca iz državnog proračuna. Pravna uređenost javne nabave uvjetovala je na kakav način možemo sklopiti ugovor o javnoj nabavi, bilo da se radi o nabavi roba, radova ili usluga. Postupci nabave moraju se temeljiti na transparentnosti, neometanoj tržišnoj konkurenciji i antikorupcijskim mjerama. Temeljem tih načela gradi se čitav sustav javne nabave, a njihovo razumijevanje i pravilna primjena znači pravilno tumačenje direktiva i uredbi EU-a o javnoj nabavi i Zakona o javnoj nabavi.

2. Pregovarački postupak javne nabave bez prethodne objave

Sukladno Zakonu o javnoj nabavi naručitelji mogu provoditi pregovarački postupak javne nabave s prethodnom objavom poziva na nadmetanje i pregovarački postupak javne nabave bez prethodne objave poziva na nadmetanje.

Pregovarački postupak javne nabave bez prethodne objave poziva na nadmetanje Zakon o javnoj nabavi² definira u čl. 2. točki 20. kao postupak u „kojem se naručitelj obraća gospodarskim subjektima po vlastitom izboru i pregovara o uvjetima ugovora s jednim ili više gospodarskih subjekata“. U provedbi ovog postupka naručitelj nije obavezan dosljedno primijeniti načela javne nabave kao što su načelo transparentnosti i načelo tržišnog natjecanja te je iz tog razloga za primjenu ovog postupka javne nabave Europski sud pravde utvrdio dva značajna pravila. Prvo pravilo određuje da se ovaj postupak može provoditi iznimno, kada su za njegovu primjenu ispunjene zakonske pretpostavke, a zakonske pretpostavke moraju se strogo tumačiti. Drugo pravilo određuje da je na naručitelju teret dokazivanja opravdanosti primjene ovog postupka za konkretan slučaj. Naručitelj je obavezan u prethodnoj obavijesti o namjeri sklapanja ugovora navesti obrazloženje posebnih slučajeva i okolnosti koje opravdavaju primjenu ovog postupka. Zakon donosi ista postupovna pravila za javne i za sektorske naručitelje.

Sukladno europskim izvorima prava, i to mišljenja Europskog suda pravde i direktivama EU-a koje uređuju javnu nabavu, u Zakonu o javnoj nabavi RH-a definirani su posebni slučajevi i okolnosti za primjenu pregovaračkog postupka bez prethodne objave i to u: članku 26. st. 2. za javne radove, članku 27. st. 2. za robe, članku 28. st. 2. za javne usluge i čl. 117.

Ugovor o javnim radovima smije se sklapati u pregovaračkom postupku javne nabave bez prethodne objave:

1. Kada nije dostavljena nijedna ponuda ili nijedna prikladna ponuda ili nije dostavljen nijedan zahtjev za sudjelovanje u provedenom otvorenom ili ograničenom postupku javne nabave, pod uvjetom da se početni uvjeti ugovora bitno ne mijenjaju i da je Europskoj komisiji poslan zapisnik iz članka 37. stavka 8. Zakona, ako ga zatraži.³

Neprikladna ponuda je ona ponuda koja u cijelosti ne odgovara potrebama naručitelja određenim u opisu predmeta nabave i tehničkim specifikacijama kojima se nude roba, radovi i usluge koji očito ne zadovoljavaju potrebe naručitelja u odnosu na traženi predmet nabave.

² Zakon o javnoj nabavi (NN 90/11, 83/2013, 143/2013) i Odluka Ustavnog suda Republike Hrvatske broj: U-I-1678/2013 od 19. prosinca 2013. (NN 13/2014)

³ Članak 26. stavak 2. Zakona o javnoj nabavi (NN 90/11, 83/2013, 143/2013) i Odluka Ustavnog suda Republike Hrvatske broj: U-I-1678/2013 od 19. prosinca 2013. (NN 13/2014)

2. Kada zbog tehničkih ili umjetničkih razloga ili razloga povezanih sa zaštitom isključivih prava ugovor može izvršiti samo određeni gospodarski subjekt.
Posebno ili isključivo pravo je pravo koje nadležno tijelo dodjeljuje na temelju zakona, drugih propisa ili upravnog akta, a koje obavljanje određene djelatnosti ograničava na jednog ili više gospodarskih subjekata te ima znatan utjecaj na mogućnost drugih subjekata da obavljaju tu djelatnost.
3. Kada je to nužno potrebno ako se zbog razloga iznimne žurnosti izazvane događajima koje javni naručitelj nije mogao predvidjeti, rokovi u otvorenom, ograničenom ili pregovaračkom postupku javne nabave s prethodnom objavom ne mogu primijeniti.
Okolnosti na koje se poziva za opravdanje iznimne žurnosti ne smiju ni u kojem slučaju biti uzrokovane postupanjem javnog naručitelja. Pod ovim slučajevima podrazumijevamo vanjski događaj koji se nije mogao izbjeći ili otkloniti kao tipičan primjer isključenja protupravnosti radnje te je razlog oslobođenja odgovornosti za štetu. Razlozi nastanka iznimne žurnosti moraju biti dokazivi, moraju potjecati od vanjskih uzroka i ne smiju ni u kojem slučaju biti uzrokovani postupanjem naručitelja. Viša sila (lat. *vis maior*) vanjski je događaj koji se nije mogao izbjeći, predvidjeti ili otkloniti, npr. klizanje tla, elementarne nepogode, ali i ratovi, štrajk.
Primjer: KOMUNIKACIJA EUROPSKE KOMISIJE – iznimna žurnost
Komunikacija u vezi s trenutnom azilantskom krizom, COM (2015)454 final⁴
Cilj komunikacije objasniti je razne mogućnosti zadovoljenja hitnih potreba na temelju primjenjivih propisa Europske unije u području javne nabave, za brzo osiguranje infrastrukture (smještaja), kao i najnužnijih potrepština (npr. šatori, kreveti, odjeća ...) i usluga (npr. usluge čišćenja, sigurnosti ...). Ugovorna tijela morat će za svaki pojedinačni slučaj ocijeniti koji će postupak odabrati za sklapanje ugovora čiji je cilj zadovoljenje najhitnijih potreba tražitelja azila (smještaj, potrepštine ili usluge).
4. Za dodatne radove čija ukupna vrijednost ne smije prijeći 25 % vrijednosti osnovnog ugovora, koji nisu bili uključeni u početni projekt niti u osnovni ugovor, ali su zbog nepredviđenih okolnosti postali nužni za izvođenje radova opisanih u njima, pod uvjetom da se ugovor sklopi s gospodarskim subjektom koji izvršava osnovni ugovor:
 - a) kada takve dodatne radove nije moguće tehnički ili ekonomski odvojiti od osnovnog ugovora bez znatnih poteškoća za javnog naručitelja ili
 - b) kada su takvi radovi, iako odvojivi od izvršenja osnovnog ugovora, nužno potrebni za njegov dovršetak.
5. Za nove radove koji se sastoje u ponavljanju sličnih radova koji se dodjeljuju gospodarskom subjektu s kojim je isti javni naručitelj već sklopio osnovni ugovor, pod uvjetom da:
 - a) su takvi radovi u skladu s osnovnim projektom za koji je bio sklopljen osnovni ugovor
 - b) je osnovni ugovor sklopljen u otvorenom ili ograničenom postupku javne nabave
 - c) je već u prvom pozivu na nadmetanje bila predviđena mogućnost primjene ovoga postupka
 - d) je javni naručitelj pri određivanju procijenjene vrijednosti nabave uzeo u obzir ukupnu procjenu troškova novih radova koji će se ponavljati
 - e) se ovaj postupak odvija unutar tri godine nakon sklapanja osnovnog ugovora.⁵

⁴ <http://www.javnanabava.hr/default.aspx?id=4047> – službena objava Sustava za javnu nabavu

⁵ Zakon o javnoj nabavi (NN 90/11, 83/2013, 143/2013) i Odluka Ustavnog suda Republike Hrvatske broj: U-I-1678/2013 od 19. prosinca 2013. (NN 13/2014)

Ugovor o javnoj nabavi robe smije se sklapati u pregovaračkom postupku javne nabave bez prethodne objave:

- Kada se predmetni proizvodi izrađuju isključivo u svrhu istraživanja, eksperimentiranja, proučavanja ili razvoja. Ova odredba ne obuhvaća proizvodnju kojom bi se ostvarila tržišna isplativost ili pokriće troškova istraživanja i razvoja.
- Za dodatne isporuke od dobavljača iz osnovnog ugovora koje su namijenjene ili kao djelomična zamjena uobičajene robe ili instalacija ili kao proširenje postojeće robe ili instalacija, ako bi promjena dobavljača obvezala javnog naručitelja da nabavi robu koja ima drugačije tehničke značajke što bi rezultiralo nesukladnošću ili nerazmjernim tehničkim poteškoćama u radu i održavanju. Trajanje takvih ugovora, kao i ugovora koji se ponavljaju, ne smije biti duže od tri godine.
- Za robu koja kotira i nabavlja se na burzi robe.
- Za kupnju robe po posebno povoljnim uvjetima od dobavljača koji je trajno obustavio poslovne djelatnosti, ili od stečajnog povjerenika ili likvidatora, ili u okviru nagodbe s vjerovnicima ili drugog sličnog postupka prema nacionalnim propisima zemlje sjedišta gospodarskog subjekta.⁶

Ugovor o javnim uslugama smije se sklapati u pregovaračkom postupku javne nabave bez prethodne objave:

- Kada se predmetni ugovor o javnim uslugama sklapa nakon provedenog natječaja te se, u skladu s odgovarajućim pravilima, mora sklopiti s pobjednikom ili jednim od pobjednika toga natječaja. U potonjem slučaju svi se pobjednici natječaja pozivaju na pregovaranje.
- Za prigodnu kupnju kada je robu moguće nabaviti koristeći posebno povoljnu mogućnost koja je dostupna samo u kratkom razdoblju po cijeni znatno nižoj od cijena uobičajenih na tržištu (samo za sektorske naručitelje).

Pregovarački postupak javne nabave bez prethodne objave započinje danom slanja poziva na pregovaranje. Ovaj poziv naručitelj ne objavljuje u Elektronskom oglasniku javne nabave. Poziv se u pisanom obliku upućuje izravno gospodarskom subjektu, odnosno gospodarskim subjektima s kojima naručitelj namjerava pregovarati. U pravilu se vodi s jednim gospodarskim subjektom, a ako naručitelj pregovaranje vodi s više gospodarskih subjekata, poziv im se upućuje istodobno, ali tako da nemaju uvid u podatke o ostalim gospodarskim subjektima.

Poziv na pregovaranje mora sadržavati:

1. datum do kojeg se mora dostaviti inicijalna ponuda
2. adresu na koju se ponuda dostavlja
3. podatak o jeziku na kojem se ponuda dostavlja
4. ostale podatke koje javni naručitelj smatra potrebnima
5. dokumentaciju za nadmetanje i ostalu moguću dodatnu dokumentaciju.

Sadržaj dokumentacije propisan je u članku 3. Uredbe o načinu izrade i postupanju s dokumentacijom za nadmetanje i ponudama. Dokumentacija za nadmetanje mora biti izrađena na način da sadrži sve potrebne podatke koji su gospodarskom subjektu potrebni za izradu kvalitetne ponude. Dokumentacija se sastoji od više dijelova, a to su: opći podatci, podatci o predmetu nabave, razlozi isključenja, odredbe o sposobnosti, podatci o ponudi i ostali podatci.

⁶ Zakon o javnoj nabavi (NN 90/11, 83/2013, 143/2013) i Odluka Ustavnog suda Republike Hrvatske broj: U-I-1678/2013 od 19. prosinca 2013. (NN 13/2014)

Naručitelj je dužan i u ovom postupku nabave odrediti obvezne razloge isključenja ponuditelja, kao i ostale razloge isključenja ponuditelja. Naručitelj je obavezan sukladno članku 67. i članku 68. Zakona o javnoj nabavi navesti koji razlog ili razloge će koristiti za isključenje natjecatelja ili ponuditelja. Osim razloga za isključenje, u dokumentaciji za nadmetanje, naručitelj je obavezan sukladno članku 69. - 72. Zakona o javnoj nabavi navesti uvjete pravne i poslovne sposobnosti koje ponuditelji moraju ispunjavati, a može financijske, tehničke i stručne sposobnosti.

Gospodarski subjekt pozvan od strane javnog naručitelja dostavlja cjelovitu ponudu u primjerenom roku, koji je naručitelj naveo u pozivu na pregovaranje i u dokumentaciji za nadmetanje. Rok za dostavu inicijalne ponude nije naveden u Zakonu, nego ga određuje naručitelj u svakom konkretnom slučaju ovisno o okolnostima vezanim za složenost predmeta nabave i vrijeme koje je potrebno za izradu i dostavu ponuda te ovisno o žurnosti potrebe za radovima, robama ili uslugama.

Ponuda je pisana obvezujuća izjava volje ponuditelja da izvede radove, obavi uslugu i/ili isporuči robu sukladno uvjetima i zahtjevima naručitelja navedenim u dokumentaciji za nadmetanje, a sadržaj propisan je člankom 10. Uredbe o načinu izrade i postupanju s dokumentacijom za nadmetanje i ponudama. Isti članak Uredbe uređuje i sadržaj ponudbenog lista.

Otvaranje ponuda kod pregovaračkog postupka bez prethodne objave nije javno prema zakonskoj odredbi. Pristigle inicijalne ponude javni naručitelj otvara i prvo provjerava postoje li razlozi isključenja te ocjenjuje sposobnost ponuditelja prema uvjetima navedenim u dokumentaciji za nadmetanje. U slučaju da je kod ponuditelja stečen razlog za isključenje, a on je jedini koji zbog tehničkih ili umjetničkih razloga, povezanih sa zaštitom isključivih prava, može izvršiti ugovor, naručitelj iznimno smije odustati od isključenja.

Kada ne postoje posebni uvjeti, a naručitelj ustanovi da kod ponuditelja ne postoje razlozi za isključenje i da ispunjava uvjete koji se odnose na njegovu sposobnost, tada pristupa pregledu i ocjeni inicijalnih ponuda. Inicijalna ponuda može biti i konačna ako ispunjava sve potrebe i zahtjeve naručitelja. Ako inicijalna ponuda nije i konačna, odnosno ne zadovoljava potrebe i zahtjeve naručitelja u potpunosti, nakon pregleda inicijalnih ponuda naručitelj dostavlja ponuditeljima poziv na izmjenu i/ili nadopunu inicijalne ponude ili na dostavu konačne ponude. Naručitelj prilikom otvaranja inicijalnih i/ili konačnih ponuda sastavlja Zapisnik o pregledu i ocjeni inicijalnih i/ili konačnih ponuda u pregovaračkom postupku bez prethodne objave prema članku 25. Uredbe o načinu i postupanju s dokumentacijom za nadmetanje i ponudama.

Na osnovu rezultata pregleda i ocjene konačnih ponuda naručitelj odabire najpovoljniju ponudu sukladno kriteriju za odabir ponude te donosi odluku o odabiru. Nakon donošenja odluke o odabiru naručitelj je obavezan u Elektroničkom oglasniku javne nabave Narodnih novina objaviti prethodnu obavijest o namjeri sklapanja ugovora ako je ovaj postupak proveden iz sljedećih razloga:

- ako nije dostavljena ni jedna ponuda, ni jedna ponuda nije bila prikladna ili nije dostavljen ni jedan zahtjev za sudjelovanje u otvorenom ili ograničenom postupku javne nabave, ali pod uvjetom da se početni uvjeti ugovora bitno ne mijenjaju
- ako zbog tehničkih, umjetničkih ili razloga povezanih sa zaštitom isključivih prava, ugovor može izvršiti samo određeni gospodarski subjekt
- ako se proizvodi izrađuju isključivo u svrhu istraživanja, eksperimentiranja, proučavanja ili razvoja
- za dodatne isporuke robe od dobavljača iz osnovnog ugovora
- za nove radove ili usluge koji se sastoje od ponavljanja sličnih radova ili usluga koje se dodjeljuju gospodarskom subjektu s kojim je isti javni naručitelj već sklopio osnovni ugovor

- ako se ugovor o javnim uslugama sklapa nakon provedenog natječaja te se, u skladu s odgovarajućim pravilima, mora sklopiti s pobjednikom ili jednim od pobjednika.

U sljedećim slučajevima naručitelj nije obavezan objaviti prethodnu obavijest o namjeri sklapanja ugovora:

- ako je iznimna žurnost razlog provedbe pregovaračkog postupka bez prethodne objave
- ako je predmet ugovora dodatni radovi i/ili dodatne usluge
- ako je predmet ugovora roba koja kotira i nabavlja se na burzi roba
- ako je predmet ugovora kupnja robe po posebno povoljnim uvjetima koji je trajno obustavio poslovne djelatnosti ili od stečajnog povjerenika ili likvidatora ili u okviru nagodbe s vjerovnicima.

U Prethodnoj obavijesti o namjeri sklapanja ugovora naručitelj obvezno mora navesti činjenice i okolnosti temeljem kojih je započeo i proveo pregovarački postupak javne nabave bez prethodne objave. Objava Prethodne obavijesti o sklapanju ugovora u Elektroničkom oglasniku javne nabave Narodnih novina ima učinak dostave odluke o odabiru. U slučajevima kada nije obvezna objava prethodne obavijesti o sklapanju ugovora, naručitelj nakon donošenja odluke o odabiru tu odluku dostavlja ponuditeljima na dokaziv način, a uobičajeno je kao poštanska pošiljka s povratnicom. U oba navedena slučaja odluka nije izvršna, nego je potrebno primijeniti rok mirovanja koji je za nabavu velike vrijednosti petnaest dana, a za nabavu male vrijednosti deset dana, s time da rok mirovanja počinje teći od prvog sljedećeg dana nakon objave Prethodne obavijesti o namjeri sklapanja ugovora, odnosno dostave odluke o odabiru.⁷ Protekom roka mirovanja odluka o odabiru postaje izvršna i nastaje ugovor o javnoj nabavi. Ako je u pregovaračkom postupku bez prethodne objave sudjelovao samo jedan ponuditelj tada odluka o odabiru postaje izvršna danom objave Prethodne obavijesti o namjeri sklapanja ugovora, tj. danom dostave odluke ponuditelju na dokaziv način.⁸ Javni naručitelj obavezan je za svaki sklopljeni ugovor o javnoj nabavi poslati na objavljivanje obavijest o sklopljenom ugovoru najkasnije 48 dana od dana sklapanja ugovora o javnoj nabavi, a sektorski najkasnije dva mjeseca od dana sklapanja ugovora o javnoj nabavi.

U obavijesti o sklopljenom ugovoru naručitelj mora naznačiti relevantne odredbe Zakona o javnoj nabavi na temelju kojih je sklopio ugovor te obrazloženje „posebnih slučajeva i okolnosti“ koji opravdavaju primjenu ovog postupka. Zakon o javnoj nabavi propisuje prekršaj naručitelja i odgovorne osobe naručitelja ako navedenu obavijest ne pošalje na objavljivanje u Elektronički oglasnik javne nabave Narodnih novina.

Primjena ovog postupka u sebi nosi i određene rizike. Postoji mogućnost plaćanja više cijene za nižu kvalitetu. Naime, ponuditelj nije prisiljen snižavati cijenu i jamčiti kvalitetu jer nema konkurencije te se samom provedbom ovog postupka sužava tržište.

Temeljem pregovaračkog postupka bez prethodne objave ne smije se sklopiti okvirni sporazum.

3. Pravna zaštita i nadzor nad provedbom zakona u javnoj nabavi

Pravni okvir sustava javne nabave sastoji se od: Zakona o javnoj nabavi, Zakona o koncesijama, Zakona o javno-privatnom partnerstvu i Zakona o Državnoj komisiji za kontrolu postupaka javne nabave. Osim što uređuju područje primjene, Zakoni imaju za cilj povećati transparentnost i nediskriminiranost cijelog sustava javne nabave.

⁷ Zakon o javnoj nabavi (NN 90/11, 83/2013, 143/2013) i Odluka Ustavnog suda Republike Hrvatske broj: U-I-1678/2013 od 19. prosinca 2013. (NN 13/2014), članak 59.,98.

⁸ Zakon o javnoj nabavi (NN 90/11, 83/2013, 143/2013) i Odluka Ustavnog suda Republike Hrvatske broj: U-I-1678/2013 od 19. prosinca 2013. (NN 13/2014), članak 59.,98.

Nadzor nad primjenom Zakona i podzakonskih propisa u području javne nabave ima za cilj sprječavanje i otklanjanje nepravilnosti koje su nastale ili bi mogle nastati. Kontrolu postupka javne nabave provodi Državna komisija za kontrolu postupka javne nabave koja je samostalno i neovisno državno tijelo nadležno za rješavanje žalbi u vezi s postupcima sklapanja ugovora o javnoj nabavi, okvirnih sporazuma i natječaja na koje se primjenjuje Zakon o javnoj nabavi. Za razliku od kontrole postupka koju provodi Državna komisija, predstavku za nadzor nad primjenom svih zakona koji reguliraju područje javne nabave može podnijeti građanin, pravna ili fizička osoba, anonimna ili službena osoba koja ne mora imati nikakav interes.

Žalbeni postupak, kao najčešći oblik pravne zaštite, temelji se, osim na načelima slobode kretanja roba, slobode poslovnog nastana, slobode pružanja usluga i načelima koja iz toga proizlaze, također i na načelima zakonitosti, učinkovitosti, ekonomičnosti i kontradiktornosti postupka. Pravo na žalbu ima, odnosno žalitelj može biti: fizička osoba, pravna osoba, zajednica fizičkih i pravnih osoba koja ima ili je imala pravni interes za dobivanje određenog ugovora ili okvirnog sporazuma o javnoj nabavi i koja je pretrpjela ili bi mogla pretrpjeti štetu od navodnog kršenja subjektivnih prava, središnje tijelo državne uprave nadležno za sustav javne nabave i nadležno državno odvjetništvo. Ovdje je naglasak stavljen na pravni interes koji fizička, pravna ili zajednica fizičkih i pravnih osoba ima ili je imala za dobivanje ugovora ili okvirnog sporazuma te na štetu koja je pretrpljena ili koju bi mogli pretrpjeti. Ako navedeni uvjeti nisu ispunjeni, Državna komisija odbacit će žalbu zbog nedostatka pravnog interesa.

Zakon o javnoj nabavi, ovisno o vrsti postupka, različito propisuje rokove za izjavljivanje žalbe tako da su obuhvaćene sve situacije i kad je naručitelj proveo postupak javne nabave i kada ga nije proveo. Ako je gospodarski subjekt propustio rok za izjavljivanje žalbe u određenoj fazi postupka, nema pravo na žalbu u kasnijoj fazi postupka za prethodnu fazu. Žalba može biti izjavljena na slučajeve i okolnosti za odabir postupka, dokumentaciju za nadmetanje i moguću dodatnu dokumentaciju, postupak pregleda, ocjene i odabir ponuda, odnosno na razloge poništenja.

Kada govorimo o pravnoj zaštiti u pregovaračkom postupku bez prethodne objave prvenstveno moramo napraviti distinkciju između:

- žalbe protiv prethodne obavijesti i
- žalbe kada prethodna obavijest nije objavljena.

Kod žalbe protiv prethodne obavijesti rok za izjavljivanje žalbe u postupku nabave velike vrijednosti je deset dana, odnosno u postupku nabave male vrijednosti pet dana i to od dana objave prethodne obavijesti o namjeri sklapanja ugovora u odnosu na slučajeve i okolnosti za odabir postupka, dokumentaciju za nadmetanje i moguću dodatnu dokumentaciju, postupak pregleda, ocjena i odabira ponuda. Žalba izjavljena protiv prethodne obavijesti ima suspenzivni učinak te sprječava nastanak ugovora o javnoj nabavi.

U slučaju kada prethodna obavijest nije objavljena žalbu je moguće izjaviti kada naručitelj nije objavio prethodnu obavijest i to u roku od pet odnosno deset dana od dana primitka odluke o odabiru ili odluke o poništenju ugovora u odnosu na slučajeve i okolnosti za odabir postupka, dokumentaciju za nadmetanje i moguću dodatnu dokumentaciju, postupak pregleda, ocjena i odabira ponuda odnosno na razloge poništenja. Žalitelj koji je propustio izjaviti tako navedenu žalbu nema pravo na žalbu nakon objave obavijesti o sklopljenom ugovoru.

Osim prethodno spomenutih situacija ostali slučajevi u kojima je moguće izjaviti žalbu su:

- Ako naručitelj nije objavio prethodnu obavijest o namjeri sklapanja ugovora, žalba se izjavljuje u roku od 30 dana od dana objave obavijesti o sklopljenom ugovoru u odnosu na slučajeve i okolnosti za odabir postupka.
- Kada naručitelj nije objavio prethodnu obavijest te propusti objaviti obavijest o sklopljenom ugovoru, žalba se još može izjaviti sukladno članku 151. Zakona o javnoj

nabavi u roku od 30 dana od dana saznanja za ugovor sklopljen bez prethodno provedenog postupka, odnosno unutar roka od šest mjeseci od dana sklapanja takvog ugovora.

Naručitelj je obvezan odmah, a najkasnije u roku od pet dana od dana primitka žalbe dostaviti Državnoj komisiji za kontrolu postupaka javne nabave žalbu zajedno s podatkom i dokazom o načinu i vremenu zaprimanja, odgovor na žalbu s očitovanjem o žalbenom navodu i žalbenom zahtjevu, dokumentaciju koja se odnosi na postupak javne nabave s popisom priloga, podatak o objavi informacije ili dokaz o obavještanju odabranih natjecatelja, druge dokaze na okolnosti postojanja pretpostavki za donošenje zakonite odluke, radnji, postupaka ili propuštanja. Nadalje, naručitelj je obvezan na istim internetskim stranicama na kojima je objavio osnovnu dokumentaciju objaviti i informaciju da je izjavljena žalba i da se postupak javne nabave zaustavlja.

4. Zaključak

Pregovarački postupak javne nabave s prethodnom objavom jedan je od postupaka koje Zakon o javnoj nabavi definira kao postupak uz uvjetovanu primjenu i to isključivo kad nastupe okolnosti i slučajevi koje je Zakon taksativno naveo.

Praksa je pokazala i neminovnost ovog postupka i životnost njegove primjene. Stoga ne čudi da se primjenjuje, u prosjeku zadnje tri godine, oko 10 % u odnosu na sve ostale postupke javne nabave. Praksa je, također, pokazala i dodatne okolnosti koje bi novim zakonom o javnoj nabavi trebalo taksativno navesti i omogućiti širu primjenu ovog postupka. Svjesni njegovog djelovanja na smanjenje primjene načela javne nabave, prvenstveno transparentnosti i jednakog tretmana što uvjetuje ograničavanje tržišnog natjecanja, ipak provođenje dužeg i formalnijeg postupka, u određenim slučajevima dovodi do veće štete od selektivnog ograničenja tržišnog natjecanja. Prvenstveno u slučajevima zaštite zdravlja ljudi i životinja te očuvanja okoliša, kao i za neke usluge iz dodatka II b za koje se predviđa sličan postupak. Cilj izjednačavanja postupka za nabavu usluga iz dodatka II b i pregovaračkog postupka bez prethodne objave pojednostavljenje je složene i zahtjevne procedure javne nabave.

S obzirom na to da je javna nabava područje koje se intenzivno mijenja zbog prilagodbe društvenim i gospodarskim promjenama te razvoja i praćenja elektroničkog poslovanja, neminovne su promjene i pregovaračkog postupka bez prethodne objave i to njegove veće učinkovitosti i ekonomičnosti.

Reference:

Kolar, T., Loboja, A., Vuić Z.: Primjena novoga Zakona o javnoj nabavi i novih podzakonskih propisa Nove uredbe Vlade RH i novi pravilnici za provedbu novog Zakona o javnoj nabavi, Zagreb, Inženjerski biro, 2012.

Zakon o javnoj nabavi (Narodne novine br. 90/2011)

Zakon o izmjenama i dopunama Zakona o javnoj nabavi (Narodne novine br. 83/2013)

Zakon o izmjenama i dopunama Zakona o javnoj nabavi (Narodne novine br. 143/2013)

Odluka Ustavnog suda Republike Hrvatske broj: U-I-1678/2013 od 19. prosinca 2013. (Narodne novine br. 13/2014)

Zakon o Državnoj komisiji za kontrolu postupaka javne nabave (Narodne novine br. 18/2013)

Zakon o izmjenama i dopunama Zakona o Državnoj komisiji za kontrolu postupaka javne nabave (Narodne novine br. 127/2013)

Zakon o izmjenama Zakona o Državnoj komisiji za kontrolu postupaka javne nabave (Narodne novine br. 74/2014)

Uredba o načinu izrade i postupanju s dokumentacijom za nadmetanje i ponudama (NN 10/2012)

Uredba o objavama javne nabave (NN 10/2012)

Uredba o nadzoru nad provedbom Zakona o javnoj nabavi (NN 10/2012)

Portal javne nabave: <http://www.javnabava.hr> - službena internetska stranica Ministarstva gospodarstva, Uprave za sustav javne nabave RH

<http://www.dkom.hr> – službena internetska stranica Državne komisije za kontrolu postupaka javne nabave RH

Negotiated procedure without prior publication

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Abstract. EU directives and regulations of public procurement, as a set of regulations, primarily determine the effective and rational use of budgetary resources of EU member states, and the public procurement law in Republic of Croatia, arranged on the principles of the EU Treaty and the principles of public procurement, provides efficient and rational use of budgetary funds in Croatia. This paper describes the negotiated procedure without prior publication, its normative solutions, the practice of the State Commission for supervision of public procurement procedures and a practical example. Contracting authorities used mostly open procedure in 78.54% of the cases, and negotiated procedure without prior publication in 10.78% of cases in 2014. In the implementation of the negotiated procedure without prior publication, contracting authorities consult the economic operators of their own choice and negotiate the terms of the contract with one or more economic operators. The authorities are not obliged to consistently apply the principles of public procurement (in particular the principles of competition and transparency). Through its practice, the European Court of Justice has established two basic rules for implementing this procedure:

- the legal requirements must be strictly interpreted, the procedure should be carried out in exceptional cases, when the legal preconditions for its implementation are actually filled;
- the burden of proof that the circumstances of this case justify its application is on the contacting authority.

The procedure negotiated without prior publication is the least competitive and transparent procedure of all other public procurement procedures.

Key words: *public procurement, negotiated procedure without prior publication*

Prilog: [Call for initial offer Injector](#)



KLASA:

URBROJ:

Split, _____

Pursuant to Article 27, paragraph 2, point 1 of the Public Procurement Act (Official Gazette 90/11, 83/13, 143/13 and 13/14-decision of the Constitutional Court), we
deliver

INVITATION

**for the negotiated procedure without prior publication
for the procurement of injectors
CPV 38340000-0**

the economic operator

**SCIENCE PRODUCTS GMBH
Hofheimer Str. 63
65719 Hofheim
GERMANY**

The initial offer shall be submitted: _____

Address submitting initial bids: Sveučilište u Splitu
Split, Livanjska 5/I

Language of the initial written offer: Croatian

The authorized representatives of the client
Smiljana Bezić, certified representative
Prof. dr. sc. Ante Bilušić
Ivan Golub

TENDER DOCUMENTS

in public procurement

the negotiated procedure without prior publication

for the procurement of injectors

CPV 38340000-0

I. GENERAL INFORMATION

1.1. CLIENT

Name: **SVEUČILIŠTE U SPLITU**
Headquarters: **Split, Livanjska 5**
OIB (tax number): **29845096215**
Tel. / fax: **021/348900 021/339369**
Internet adress: www.unist.hr
E-mail address: sbezic@oss.unist.hr

1.2. PERSON IN CHARGE OF CONTACT

Smiljana Bezić, dipl. iur.
sbezic@oss.unist.hr

1.3. PROCUREMENT NUMBER

PP2 1-15

1.4. LIST OF ECONOMIC OPERATORS THAT THE CLIENT IN CONFLICT OF INTEREST::

- Ave d.o.o., Split, Mihanovićeve 27, OIB 39999401629
- Spiritus Maris d.o.o., Split, R.Boškovića 16, OIB 23788400959
- Stabilnost d.o.o., Split, Kroz Smrdečac 41, OIB 20957579034
- Poliklinika Dr. Ljutić d.o.o., Split, Spinčičeva 2c, OIB 89617509231
- Nefron, obrt za posl.usluge i turizam, Podstrana, Grljevačka 2b, OIB 86556834883
- Centar za medicinsko vještačenje d.o.o., Split, Šime Ljubića 33a, OIB 93222342278
- B.T.Projekt d.o.o. za graditeljstvo i usluge, Solin, K.Zvonimira 73, OIB 93375161353
- Theatrum Somnii d.o.o., Split, Vrlička 31, OIB 84582483117

1.5. TYPE OF PROCEDURE OF PUBLIC PROCUREMENT

Negotiated procedure without prior publication

1.6. ESTIMATE THE VALUE PUBLIC PROCUREMENT

230.400,00 HRK

1.7. TYPE OF CONTRACT PROCUREME

Supply Contract

1.8. THE ELECTRONIC AUCTION

Not intended implementation of an electronic auction

II. INFORMATION ABOUT SUBJECT OF PROCUREMENT

2.1. DESCRIPTION OF THE SUBJECT OF PROCUREMENT

injector

CPV 38340000-0

2.2. DIVISION OF THE PROCUREMENT

It is not permitted to offer groups..

2.3. QUANTITY OF THE SUBJECT OF PROCUREMENT

According to the specifications

2.4. PLACE OF DELIVERY OF GOODS

Kopilica 5, Split, Croatia

2.5. DELIVERY

90 days of signing the contract

SPECIFICATIONS

Naziv	Tehničke specifikacije	Ponudeni model	Jed. mjere	Količina	jed. cijena u €	Ukupno u €
Injector Ubrizgavač	<p>Engleski/English:</p> <ul style="list-style-type: none"> • minimum ejection volume: 500 picoliters or less, • injection type: pressure pulses, • adjustable pressure range within the range from 0 mbar to at least 5 bar, • pulse initiation: front panel (included), remote (either included or option), • adjustable pulse duration, minimal pulse interval of at least 10 milliseconds, • one injection channel, optional second channel, • certified according to CE or equivalent requirements, • warranty period: at least one year. <p>Hrvatski/Croatian:</p> <ul style="list-style-type: none"> • najmanji volumen ubrizgavanja: 500 pikolitara ili manji, • način ubrizgavanja: postizanjem pulseva tlaka, • mogućnost promjene tlaka u rasponu od 0 do najmanje 5 bara, • okidanje tlačnog pulsa: na upravljačkoj ploči ubrizgavača (uključeno), daljinski (uključeno ili opcija), • mogućnost promjene trajanja pulsa, minimalno trajanje pulsa barem 10 milisekundi, • jedan kanal ubrizgavanja, mogućnost dodavanja dodatnog, • sustav treba biti sukladan sa CE ili jednakovrijednim zahtjevima, • jamstveni rok: najmanje jedna godina. 	Model offered	kom.	1	Price in EUR	Total price
TOTAL IN EUR						

1.1.1.1 III. MANDATORY REASONS FOR EXCLUSION

3.1. Impunity

The contracting authority shall exclude the tenderer from public procurement procedure if the economic entity or person authorized by law to represent the legal entity convicted of any of the following crimes or for relevant offenses under the regulations of the host state of the undertaking or the state whose citizen the person authorized by law to represent the legal entity:

a) fraud (Article 236), fraud in business activities (Article 247), accepting a bribe in business activities (Article 252), bribery in business transactions (Article 253), abuse in the public procurement procedure (Article 254th), tax evasion and customs duties (Article 256), subsidy fraud (Article 258), money laundering (article 265), abuse of office and powers (Article 291), unlawful preferential treatment (Article 292), bribery (Article 293), bribery (Article 294), trading in influence (Article 295), bribery of trading in influence (Article 296), criminal association (Article 328) and committing a crime within the criminal association (Article 329th) of the Criminal Code,

b) fraud (Section 224), money laundering (article 279), fraud in business activities (Article 293), bribery in business transactions (Article 294a), bribery in business transactions (Article 294b), conspiracy to commit criminal acts (Article 333), abuse of office and powers (Article 337), abuse of public office (Article 338), illegal mediation (article 343), bribery (Article 347) and giving bribery (Article 348) of the Criminal Code ("Official Gazette", no. 110/97., 27/98., 50/00., 129/00., 51/01., 111/03., 190/03 ., 105/04., 84/05., 71/06., 110/07., 152/08., 57/11., 77/11. and 143/12.)

For the purposes of determining the circumstances mentioned under a) and b) the economic operator to offer to submit a declaration. A statement by a person legally authorized to represent the legal entity. The statement may not be older than three months following the commencement of the public procurement.

The contracting authority may, during the procurement procedure for checking the above circumstances of the body in charge of keeping criminal records and the exchange of such data with other states for any bidder or a person authorized by law to represent the legal entity apply for confirmation of the facts on which that authority keeps official records.

If the client is unable to obtain a certificate from the competent authority to verify the above circumstances the client may request the tenderer to that in due time deliver a valid:

The first document of the body responsible for keeping criminal records of the host state company or a state whose citizen the person authorized by law to represent the legal entity, or
2. an equivalent document issued by a competent judicial or administrative authority in the country where the economic operator or the country of his nationality a person authorized by law to represent the legal entity, if it does not issue the document from the criminal record, or
3. A statement under oath or a corresponding statement of the person who is legally authorized to represent the legal entity before a competent judicial or administrative authority or a notary or a competent professional or trade body in the country where the economic operator or the country of which the person is a citizen or with a certified statement signed by a notary, if in

the country where the economic operator or the country of which the person is a citizen do not issue the documents referred to in items 1 and 2, or they do not include all of these crimes.

Pay-one due tax liabilities and obligations for pension and health insurance

The contracting authority shall exclude the tenderer from the procurement procedure if you did not fulfill the obligation to pay outstanding tax liabilities and liabilities for pension and health insurance, unless a special law to pay these liabilities is not permitted or is granted a delay of payment (for example in the process of the pre-settlement).

For the purposes of determining the above circumstances the economic operator to offer submitted:

1. Confirmation of the Tax Administration on the debt, which must not be older than 30 days from the start of the procurement procedure, or
2. Current equivalent document of the competent authority of the host state of the undertaking, if it does not issue certificates in point 1, or
3. A statement under oath or a corresponding statement of the person who is legally authorized to represent the legal entity before a competent judicial or administrative authority or a notary or a competent professional or trade body in the country where the economic operator or a statement certified by a notary, which must not be older 30 days after the start of the procurement procedure, when in the country where the economic operator does not issue the certificate referred to in item 1 or equivalent document referred to in point 2.

False data

The contracting authority shall exclude the tenderer from the procurement procedure if submitted false information in the delivery of documents that are part of the offer in this tender.

1.1.1.2 IV. CONDITIONS AND LEGAL CAPACITY

Any candidate or tenderer entering the court, working, professional or other appropriate register of the host state of the undertaking must show that it is registered for performing activities related to the subject procurement.

Register for membership proves the appropriate copy, and if they are not issued in the country where the economic operator, the economic operator may submit a declaration to validate the signatures by the competent authority.

A copy or statement referred to in paragraph 2 of this Article shall not be older than three months from the date of the public procurement procedure.

V. INFORMATION ABOUT THE OFFER

5.1. INTRODUCTION

1. supply list
2. documents which the bidder proves that there are mandatory reasons is off of the
3. evidence of ability
4. filled tio Colonel.

5.2. MAKING OFFERS

1. offer must be made in the form of one f indicated w ith this documentation
2. offer must contain all attachments f Observe certain one f the documentation signed and certified by the bidder
3. offer must be printed or written in indelible ink
4. offer must be bound into a book on the F and to prevent ht and subsequently your ving or insertion of pages or parts supply
5. website offers are checked off alas number on the d and that the visible page number and total number of pages.
6. providers plaintiff not entitled to change, correct, amend, or delete or in any other way h and of the original text which gave the plaintiff ordering F in the tender documents, otherwise his bid not'll take into consideration
7. the offer must be fully completed and attached to EN original tio Colonel who is part of this Documentation
8. Corrections in the offer must be made on the one f h and that are visible. Corrections shall state the dates of the correction to be confirmed '1 one signed by the bidder.
9. offer must contain evidence of the tenderer f Observe that the conditions and requirements of the tender documents, the documents which the bidder proves that there are no mandatory or other reasons is off of the evidence of the tenderer for the execution of the contract w ponuda mora sadržavati dokaze ponuditelja o ispunjavanju uvjeta i zahtjeva iz dokumentacije za nadmetanje, dokumente kojima ponuditelj dokazuje da ne postoje obvezni i ostali razlozi isključenja i dokaze o sposobnosti ponuditelja za izvršenje ugovora

5.3. METHOD OF SUBMISSION OFFERS

- The bidder shall submit its bid on its own tio home without making compensation claims $\frac{1}{4}$ of Naru h teacher of any kind
- offer power train will be delivered after that or directly to the address ordering teachers h in a sealed envelope.
- On the envelope, and should specify the address

SVEUČILIŠTE U SPLITU
Projekt MEMSplit

Livanjska 5
21000 SPLIT

and in the lower right corner of the envelope should be an indication

« PONUDA ZA NADMETANJE »

PP2 _____

- the envelope must be given a complete name and address of the bidder.

5.4. ELECTRONIC SUBMISSION OF TENDERS

Not allowed

5.5. METHOD OF PRICING OFFERS

The bidder is required:

- specify only h no price for each item bid tio Lieutenant Colonel
- specify only h does not cost fittings exclusively for the type and quality of the materials mentioned in the descriptive part tio Lieutenant Colonel
- bid price expressed in tender list
- bid price expressed in euros figures
- offer price excluding VAT must contain f should include all costs incurred W and discounts

5.6. CURRENCY

in EUR

5.7. SHELF LIFE OFFERS

minimum 60 days from the day the offer.

VI. OTHER PROVISIONS

6.1. The deadline the decision on selection or cancellation

The selection decision shall be issued within 15 days.

6.2. The deadline, manner and terms of payment

All payments will be made on client business account of the successful tenderer within 15 days of receipt of the invoice.

6.3. Legal remedies

An aggrieved party can complaint to seek protection of their rights before the State Commission for Supervision of Public Procurement. An appeal to the State Commission, and submitted to the client in writing or by registered mail within 5 days in accordance with the provisions of the Public Procurement Act

The appellant shall deliver a copy of the appeal in the same way to the State Commission for Supervision of Public Procurement, Koturaška road 43 / IV, 10000 Zagreb.

The authorized representatives of the client

Smiljana Bezić, certified representative

Prof. Ph. D.. Ante Bilusic

Ivan Golub

Podučavanje održivosti kroz matematičke kolegije

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Sažetak. Glavna ideja ovog rada ukazati je na načine kako uključiti održivost u kurikulum matematičkih kolegija. Problematika održivosti je u svojoj biti interdisciplinarno područje. Postoji mnoštvo prilika za uvođenje primjera održivosti u matematičke kolegije, počevši od algebre i geometrije sve do analize i statistike. Poučavanje o održivosti prirodnih resursa ima najveći utjecaj upravo na velikim dodiplomskim matematičkim kolegijima poput onih koji se izvode na Sveučilišnom odjelu stručnih studija. Preporučamo načine na koji sveučilišni nastavnici matematike mogu pružiti kvalitetnu i autentičnu poduku svojim studentima baziranu na stvarnim podacima, koja uključuje ideje o održivosti unutar matematičkog konteksta, a bez ugrožavanja obveznih matematičkih sadržaja. Kao dodatni ishod učenja možemo očekivati osvještavanje važnosti problematike brige o okolišu i podizanje ekološke svijesti studenata.

Ključne riječi: *podučavanje, matematika, održivost*

1. Uvod

Tema održivosti (eng. *sustainability*) tema je koja zadnjih desetljeća zadire u sve sfere ljudskog života i djelovanja pa tako i u obrazovanje. Svjesni smo činjenice da je ubrzani industrijski i tehnološki razvoj čovječanstva s jedne strane donio kvalitetu života u razvijenim zemljama, a s druge strane doveo u pitanje održivost života na našoj planeti budućim generacijama. Neracionalni pristup eksploataciji prirodnih resursa i nedostatak promišljanja vladajućih elita doveo nas je do trenutka kada je nužno potreban preokret u razmišljanju o sadašnjosti kako bi negativne trendove u budućnosti okrenuli u održive. Pojam održivosti se različito definira: kao neprekidno održavanje raznolikog i produktivnog okoliša o kojem sav život ovisi; odgovorno korištenje resursa na neodređeno vrijeme; zadovoljavanje potreba sadašnjosti bez ugrožavanja mogućnosti budućih generacija da zadovolje svoje potrebe. Zato održiva budućnost prvenstveno ovisi o spremnosti društva da educira stručnjake koji će znati voditi radne procese, stvoriti infrastrukturu potrebnu da se optimizira upravljanje resursima. Obrazovanje, bilo formalno ili neformalno ključ je razvoja znanja, tehnologija i vještina potrebnih za održivu budućnost. Svjesni globalnog problema i upitne budućnosti Ujedinjeni narodi su proteklo desetljeće (2005. – 2014.) proglasili desetljećem obrazovanja za održivi razvoj. Nizom lokalnih i globalnih aktivnosti promicali su obrazovanje i podizanje razine svjesnosti za održivi razvoj od pojedinca do šire društvene zajednice. Brojne su inicijative zaživjele u raznim obrazovnim sferama poglavito u matematičkom obrazovanju i srodnim prirodnim i tehničkim disciplinama. Matematika planeta Zemlje 2013. (MPE 2013) je inicijativa matematičkih znanstvenih organizacija u svijetu s ciljem pronalaženja načina na

koji matematičke discipline mogu biti korisne u rješavanju globalnog svjetskog problema. Ova inicijativa rezultirala je nizom tematskih događanja u 2013. godini, uključujući i više od 10 dugoročnih programa na institutima širom svijeta, više od 50 radionica, gostovanjima pozvanih predavača, brojnim javnim predavanjima, razvojem obrazovnih materijala, tematskim umjetničkim izložbama i međunarodnim nagradnim natječajem za razvoj inovativnih obrazovnih modula prikladnih za širu diseminaciju.

2. Matematika i održivost

Trend integriranja koncepta održivosti u matematičke kolegije i obrnuto sve je prominentniji na svim razinama obrazovanja. Razlog leži u njihovoj prirodnoj vezi. Doslovno sva pitanja u održivom razvoju zahtijevaju matematičke vještine: mjerenja, procjene, pretvorbe jedinica, skaliranja u jednodimenzionalnom, dvodimenzionalnom, trodimenzionalnom, a čak i četverodimenzionalnom prostoru, matematičkog modeliranja rasta ili pada, korištenja numeričkih podataka u različitim analizama i razumijevanju ograničenja [3]. Analize održivosti počivaju na tablicama, grafovima i matematičkim jednadžbama. Međutim, da bi ideja održivosti zaživjela u svojoj punini nije dovoljno da se integrira samo u postojeće STEM discipline, već je nužno da održivost postane nova obrazovna paradigma. Kao takva mogla bi transformirati ne samo suhoparne akademske discipline nego bi promijenila način na koji razmišljamo o svemu što nas okružuje. Analiziranje realnih problema iz područja održivosti donosi dodanu vrijednost nastavi matematike. Studenti dobivaju širu sliku, postaju svjesni ograničenja koje nam priroda postavlja, a i uviđaju važnost matematike na putu rješavanja gorućih problema. Održivost je autentični, zanimljivi i motivirajući kontekst u kojem matematika ima svoju nezamjenjivu ulogu.

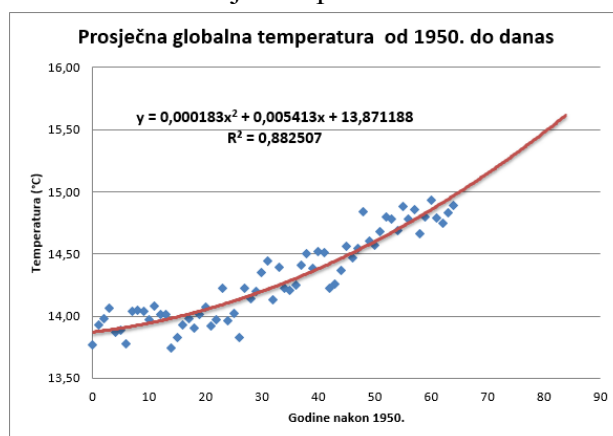
3. Primjeri integriranih sadržaja

U ovom ćemo poglavlju kroz više primjera sugerirati kako integrirati teme iz održivosti u nastavu matematike u visokom školstvu, ponajprije u području matematičke analize i statistike [2]. Za obradu realnih podataka koristit ćemo se MS Excelom 2007, standardnim i pristupačnim alatom koji je većina studenata u mogućnosti koristiti.

3.1 Prosječna globalna temperatura

Za potrebe ovog primjera potrebno je dohvatiti podatke o prosječnoj globalnoj temperaturi [9]. U radnom listu MS Excela kreira se točkasti dijagram. Uz pomoć opcije *Trendline* izabere se odgovarajuća funkcija koja najbolje modelira podatke. Kriterij odabira je iznos koeficijenta determinacije R^2 .

Tako za dohvaćene podatke dobivamo sljedeći prikaz:



Slika 1 Kretanje prosječne globalne temperature od 1950. do 2014. godine

Od studenata možemo očekivati da nađu rješenja sljedećih problema [4]:

- Odredite matematički model koji dobro opisuje kretanje prosječne globalne temperature kao funkcije vremena.

Dane podatke sa zadovoljavajućim iznosom koeficijenta determinacije R^2 modelira kvadratna funkcija

$$f(x) = 0,000183 \cdot x^2 + 0,005413 \cdot x + 13,871188.$$

- Upotrebom dobivenog modela prognozirajte globalnu prosječnu temperaturu za navedeni niz godina, kao i porast temperature u odnosu na 2014. godinu (t_1).

Tablica 1

Godina	Prognozirana temperatura t_2	$\Delta t = t_2 - t_1$
2020.	15,15	0,26
2040.	15,84	0,95
2100.	18,80	3,91

- Odredite godišnju stopu promjene prosječne globalne temperature u 2014. godini. Kada se stopa promjene ne bi mijenjala, tj. kada bi ostala na nivou one u 2014. godini izvršite predviđanja iz gornje tablice.

Odgovarajuće rješenje nalazi se određivanjem nagiba tangente na krivulju u danoj točki. Stoga je potrebno odrediti prvu derivaciju dobivene funkcije i njenu vrijednost za 2014. godinu ($x = 64$).

$$f'(x) = 0,000366 \cdot x + 0,005413$$

$$f'(64) = 0,0288$$

Možemo reći da je 2014. prosječna globalna temperatura bila 14,89°C uz stopu godišnjeg rasta 0,0288°C.

Tablica 2

Godina	Prognozirana temperatura t_2	$\Delta t = t_2 - t_1$
2020.	15,06	0,17
2040.	15,64	0,75
2100.	17,37	2,48

- Prema danom modelu odredite koje bi godine očekivana prosječna globalna temperatura iznosila 20°C.

$$y = 20^\circ\text{C}$$

Rješavanjem kvadratne jednadžbe dolazimo do rješenja $x = 168,81$ (2119. godina).

Obradi ovakvog sadržaja može slijediti kraća rasprava o uzrocima globalnog zatopljenja, posljedicama na okoliš i život na zemlji, mogući scenariji, osobnoj odgovornosti pojedinca za moguće promjene. Zainteresirane studente može se uputiti na daljnje proučavanje problematike [10].

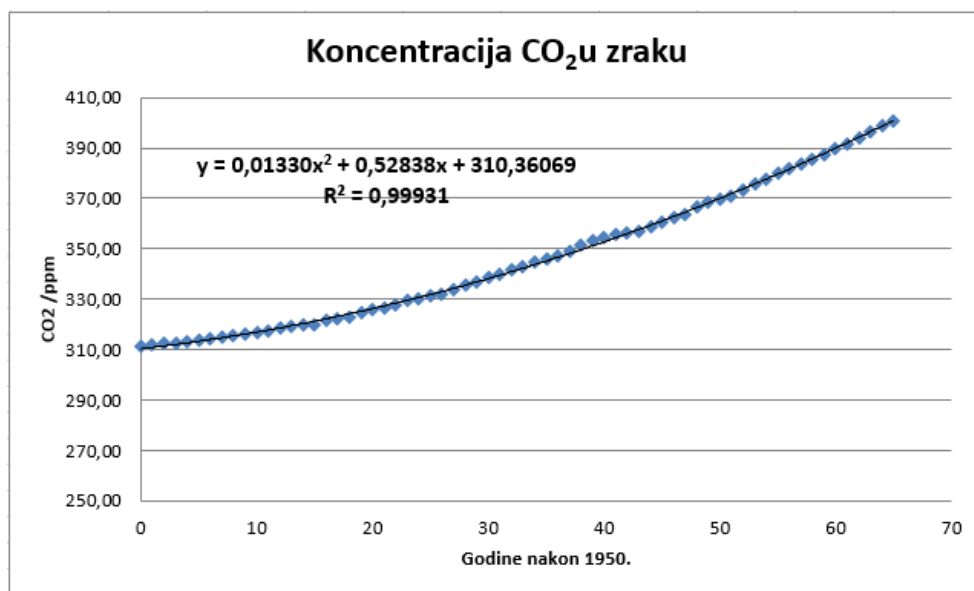
3.2 Koncentracija CO₂ u zraku

Za potrebe ovog primjera potrebno je dohvatiti podatke o koncentraciji CO₂ u zraku. Podaci su mjereni u atmosferskom opservatoriju na Havajima Mauna Loa i dohvaćeni s web stranice [11] za razdoblje od 1959. do 2015., a od 1950. do 1958. povijesni podaci sa [13] (godišnje prosječne vrijednosti CO₂). Podaci su:

	A	B	C	D	E	F	G	H	I
1	Godina	Godine nakon1950.	CO2 ppm	Godina	Godine nakon1950.	CO2 ppm	Godina	Godine nakon1950.	CO2 ppm
2	1950	0	311,26	1973	23	329,68	1996	46	362,59
3	1951	1	311,74	1974	24	330,17	1997	47	363,71
4	1952	2	312,22	1975	25	331,08	1998	48	366,65
5	1953	3	312,70	1976	26	332,05	1999	49	368,33
6	1954	4	313,22	1977	27	333,78	2000	50	369,52
7	1955	5	313,73	1978	28	335,41	2001	51	371,13
8	1956	6	314,25	1979	29	336,78	2002	52	373,22
9	1957	7	314,77	1980	30	338,68	2003	53	375,77
10	1958	8	315,28	1981	31	340,10	2004	54	377,49
11	1959	9	315,98	1982	32	341,44	2005	55	379,80
12	1960	10	316,91	1983	33	343,03	2006	56	381,90
13	1961	11	317,64	1984	34	344,58	2007	57	383,76
14	1962	12	318,45	1985	35	346,04	2008	58	385,59
15	1963	13	318,99	1986	36	347,39	2009	59	387,37
16	1964	14	319,62	1987	37	349,16	2010	60	389,85
17	1965	15	320,04	1988	38	351,56	2011	61	391,63
18	1966	16	321,38	1989	39	353,07	2012	62	393,82
19	1967	17	322,16	1990	40	354,35	2013	63	396,48
20	1968	18	323,04	1991	41	355,57	2014	64	398,61
21	1969	19	324,62	1992	42	356,38	2015	65	400,83
22	1970	20	325,68	1993	43	357,07			
23	1971	21	326,32	1994	44	358,82			
24	1972	22	327,45	1995	45	360,80			

Slika 2 Koncentracija CO₂ u zraku, od 1950. do 2015. godine

U radnom listu MS Excela kreira se točkasti dijagram. Uz pomoć opcije *Trendline* izabere se odgovarajuća funkcija koja najbolje modelira podatke. Kriterij odabira je iznos koeficijenta determinacije R^2 . Tako za dohvaćene podatke dobivamo sljedeći prikaz:



Slika 3 Koncentracija CO₂ u zraku, od 1950. do 2015. godine podaci modelirani kvadratnom funkcijom

Od studenata možemo očekivati da odgovore na sljedeća pitanja:

- Odredite matematički model koji dobro opisuje kretanje koncentracije CO₂ kao funkcije vremena.

Dane podatke sa zadovoljavajućim iznosom koeficijenta determinacije R^2 modelira kvadratna funkcija:

$$f(x) = 0,01330 \cdot x^2 + 0,52838 \cdot x + 310,36069$$

- Upotrebom dobivenog modela prognozirajte kolika bi bila očekivana vrijednost koncentracije CO₂ 2050. godine?

$$f(100) = 496,20 \text{ ppm}$$

- Odredite godišnju stopu promjene koncentracije CO₂ u 2015. godini. Kada se stopa promjene ne bi mijenjala, tj. kada bi ostala na nivou one u 2015. godini izvršite predviđanja očekivane vrijednosti koncentracije CO₂ 2050. godine.

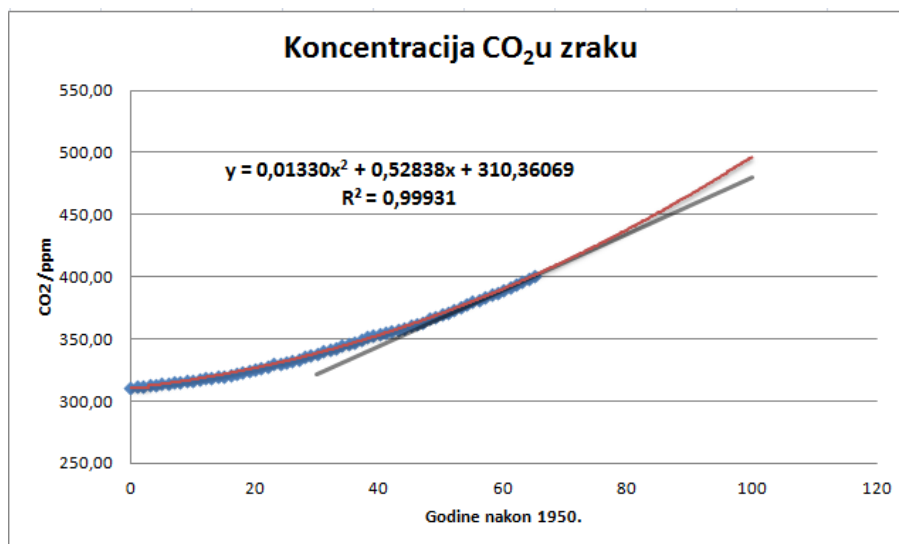
$$f'(x) = 0,0266 \cdot x + 0,52838$$

$$f'(65) = 2,25738$$

Predviđanje za 2050. godinu na bazi stope rasta iz 2015. dobit ćemo uvrštavanjem dobivenih podataka u jednadžbu tangente.

$$y = f'(x_0) \cdot (x - x_0) + y_0$$

gdje je $f'(x_0)$ stopa promjene (nagib tangente) u $x_0 = 65$ (2015. godina), $y_0 = 400,83 \text{ ppm}$ koncentracija CO₂ u 2015. godini, a $x = 100$ (2050. godina), y tražena koncentracija u 2050. godini. Tako bi, uz istu stopu promjene iz 2015., koncentracija CO₂ 2050. iznosila 479,84 ppm.



Slika 4 Koncentracija CO₂ u zraku, od 1950. do 2015. godine modelirana kvadratnom funkcijom; tangenta na krivulju u $x = 65$

- Prema [7] pri koncentraciji CO₂ od 450 ppm vjerojatnost globalnog zatopljenja od 2°C iznosi 50 %. Procijenite koje bi se godine mogla doseći ta vrijednost i prema dobivenom modelu, kao i prema kontinuiranom rastu stopom iz 2015. godine.

$$y = 450 \text{ ppm}$$

Rješenje ćemo dobiti rješavanjem jednadžbe. U prvom slučaju kvadratne, a u drugom slučaju linearne. Možemo zatražiti od studenata da napišu kratki tekst u kojem objašnjavaju dobivene vrijednosti.

Ako trend porasta koncentracije CO₂ nastavi slijediti dobiveni model s 50 % sa sigurnošću se tijekom 2035. godine može očekivati globalno zatopljenje od 2°C, a ako pak nastavi rast s konstantnom stopom iz 2015. Godine, taj porast može se očekivati u 2037. godini. Objasnite odakle razlika?

Prema [1] porast temperature od 1°C na današnju vrijednost globalne prosječne temperature značio bi daljnje zakiseljavanje oceana, slom prirodnih ekosustava, a značio bi i novih 18 – 60 milijuna gladnih u nerazvijenim zemljama. Porast od 1,5°C mogao bi dovesti do smanjenja ledenog pokrivača na Grenlandu i podizanja razine

mora za 7 m te posljedičnog poplavljanja obalnog pojasa. Porast od 2°C doveo bi do smanjenja poljoprivrednog prinosa u bogatim zemljama kao i ugroženost nedostatkom pitke vode za 1 – 3 milijardu stanovništva. Porast od 3°C značio bi propast ekološkog sustava Amazonske prašume. Porast od 4°C značio bi potpuni gubitak poljoprivredne proizvodnje za čitavu Afriku i Australiju.

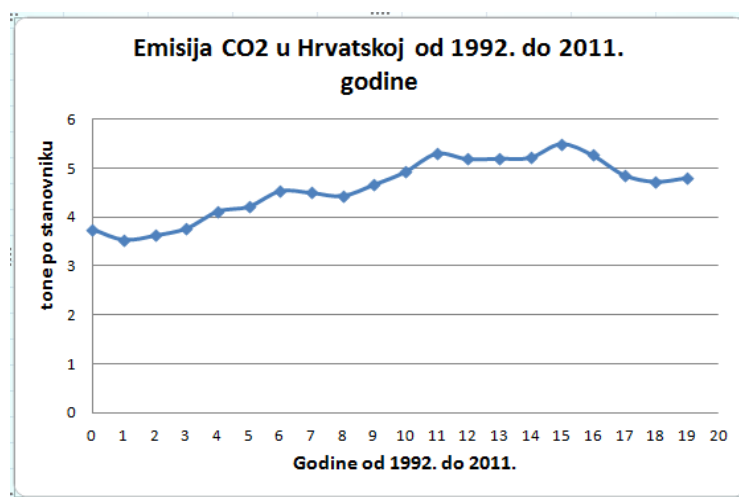
Kakav bi trebao biti trend promjene koncentracije CO₂ da bi izbjegli ovakav scenarij?

3.3 Emisija CO₂ u atmosferu (podaci za Hrvatsku)

Za potrebe ovog primjera potrebno je dohvatiti podatke o emisiji CO₂ u atmosferu. Kako bi se studenti lakše identificirali s problemom dobro je preuzeti podatke za Hrvatsku. Podaci su dohvaćeni s web stranice [6]. Obuhvaćena je emisija CO₂ koja nastaje zbog sagorijevanja fosilnih goriva i proizvodnje cementa. Ona uključuje i ugljični dioksid proizveden tijekom potrošnje krutog, tekućeg i plinovitog goriva.

Godina	Xt	CO2 emisija tona/stanovniku
1992	0	3,752
1993	1	3,541
1994	2	3,629
1995	3	3,772
1996	4	4,121
1997	5	4,220
1998	6	4,536
1999	7	4,500
2000	8	4,438
2001	9	4,666
2002	10	4,927
2003	11	5,302
2004	12	5,192
2005	13	5,202
2006	14	5,220
2007	15	5,501
2008	16	5,269
2009	17	4,867
2010	18	4,729
2011	19	4,802

Slika 5 Emisija CO₂ u RH



Slika 6 Emisija CO₂ u RH u tonama po stanovniku

Moguća pitanja koja se mogu postaviti studentima su:

- Koje je godine (od početka mjerenja) zabilježena maksimalna emisija CO₂ i koliko je ona iznosila? U usporedbi s 1992. godinom koliki je porast zabilježen?

Vidljivo je i iz tablice kao i grafa da je dosadašnji maksimum dosegnut 2007. godine i iznosi 5,501 tona/stanovniku. U odnosu na 1993. zabilježen je porast emisije od 1,049 tona/stanovniku

- Izračunajte postotnu promjenu emisije u svim godinama promatranog perioda u odnosu na početnu 1992. godinu. Interpretirajte stope promjene za 1994. i 2008. godinu!

1994. godine zabilježeno je smanjenje emisije CO₂ za 3,28 % u odnosu na 1992. godinu, a 2008. godine zabilježen je porast emisije CO₂ u odnosu na 1992. godinu za 40,42 %.

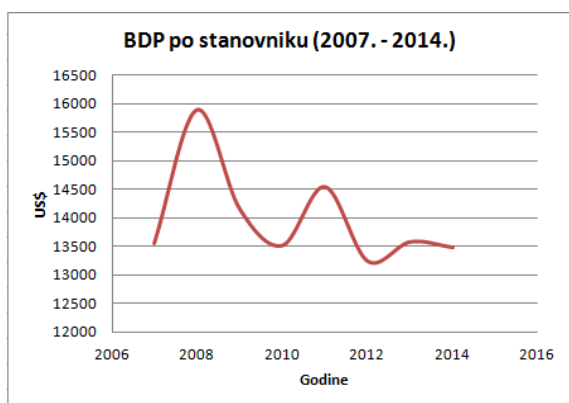
- Izračunajte postotnu promjenu emisije u nizu uzastopnih godina (lančane indekse) i pronađite te interpretirajte one indekse koji ukazuju na najveće smanjenje, odnosno povećanje emisije u promatranom vremenskom periodu.

Najveći pad emisije zabilježen je 2009. godine kada je, u odnosu na 2008., emisija smanjena za 7,64 %. Najveći se pak skok u emisiji dogodio 1996. godine kada je zabilježen porast emisije za 9,24 % u odnosu na 1995. godinu.

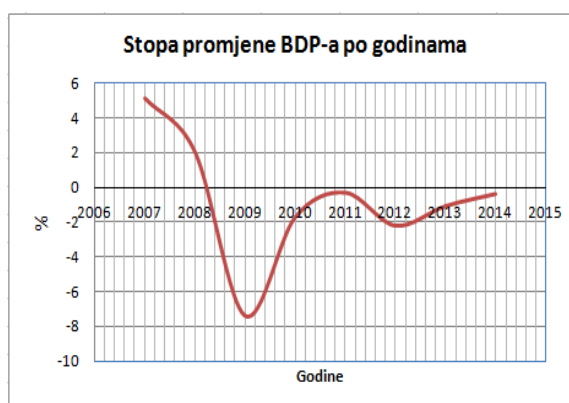
Godina	t	CO2 emisija tona/stanovniku	I(t) 1992.=100	S(t)	V(t)	S*(t)
1992	0	3,752	100,00	0,00	-	-
1993	1	3,541	94,36	-5,64	94,36	-5,64
1994	2	3,629	96,72	-3,28	102,50	2,50
1995	3	3,772	100,53	0,53	103,94	3,94
1996	4	4,121	109,82	9,82	109,24	9,24
1997	5	4,220	112,47	12,47	102,42	2,42
1998	6	4,536	120,89	20,89	107,48	7,48
1999	7	4,500	119,92	19,92	99,19	-0,81
2000	8	4,438	118,28	18,28	98,64	-1,36
2001	9	4,666	124,34	24,34	105,12	5,12
2002	10	4,927	131,31	31,31	105,61	5,61
2003	11	5,302	141,31	41,31	107,61	7,61
2004	12	5,192	138,37	38,37	97,92	-2,08
2005	13	5,202	138,63	38,63	100,19	0,19
2006	14	5,220	139,11	39,11	100,35	0,35
2007	15	5,501	146,59	46,59	105,38	5,38
2008	16	5,269	140,42	40,42	95,79	-4,21
2009	17	4,867	129,70	29,70	92,36	-7,64
2010	18	4,729	126,02	26,02	97,17	-2,83
2011	19	4,802	127,96	27,96	101,54	1,54

Slika 7 Emisija CO_2 u RH u tonama po stanovniku od 1992. do 2011, bazni indeksi na nivou 1992. godine i lančani indeksi te pripadne stope promjene

Daljnja rasprava može ići u smjeru pronalaženja razloga za najveći pad emisije 2009. godine u odnosu na 2008., pogotovo sa studentima ekonomskih usmjerenja. Kako bi se usmjerilo studente mogu im se podastrijeti podaci o kretanju BDP-a u tom promatranom razdoblju [6]. Evidentno je naime da je u tom periodu u RH došlo do pada gospodarske aktivnosti, a posljedično i smanjenja rasta emisije CO_2 .



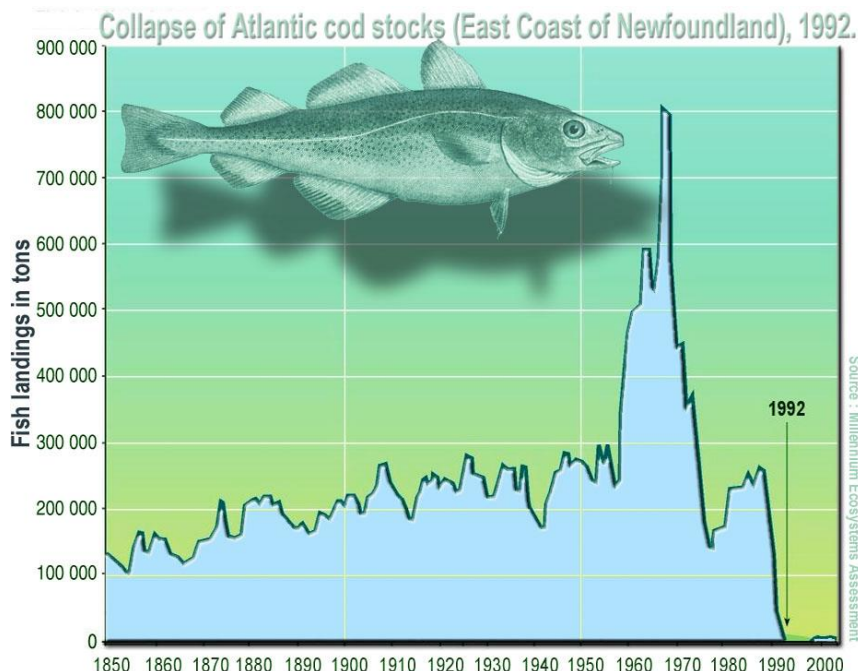
Slika 8 BDP per capita (US\$) za RH 2007. - 2014.



Slika 9 Stopa promjene BDP-a od 2007. do 2014.

3.4 Održivo ribarstvo

Recentna povijest zabilježila je više slučajeva kolapsa ribljeg fonda nekih vrsta, primjerice norveške haringe, bakalara, peruanskih incuna, pogotovo u razdoblju od 1960. do kraja prošlog stoljeća.



Slika 10 Kolaps ribljeg fonda atlantskog bakalara [12]

Tako je izlov atlantskog bakalara s održivog nivoa oko 250 000 tona godišnje narastao na visokih 800 000 tona godišnje što je dovelo do potpunog kolapsa u 1992. godini. Ovakve su pojave posljedica pretjeranog izlova, ali i klimatskih promjena, promjene temperature svjetskih mora te nedovoljne brige o akvakulturi. No, moguće je imati održivo ribarstvo pravilnim gospodarenjem i striktnim provođenjem lovnih kvota. Danas postoje institucije čija je to primarna zadaća. Jedan od načina da se postigne kvalitetno i promišljeno planiranje je modeliranje ulaznih varijabli (dostupnost hrane, stopa uzgoja, temperatura vode, onečišćenja) i izlaza (prirodna smrt, komercijalni ribolov). Takvo modeliranje moguće je pomoću diferencijalnih jednačbi [5].

3.4.1 Model kretanja količine ribe u ograničenom prirodnom okolišu

Ponudit ćemo posve pojednostavljen model količine ribljeg fonda u nekom geografski ograničenom području (npr. uvala).

$$\frac{dx}{dt} = x \cdot \left(1 - \frac{x}{12}\right)$$

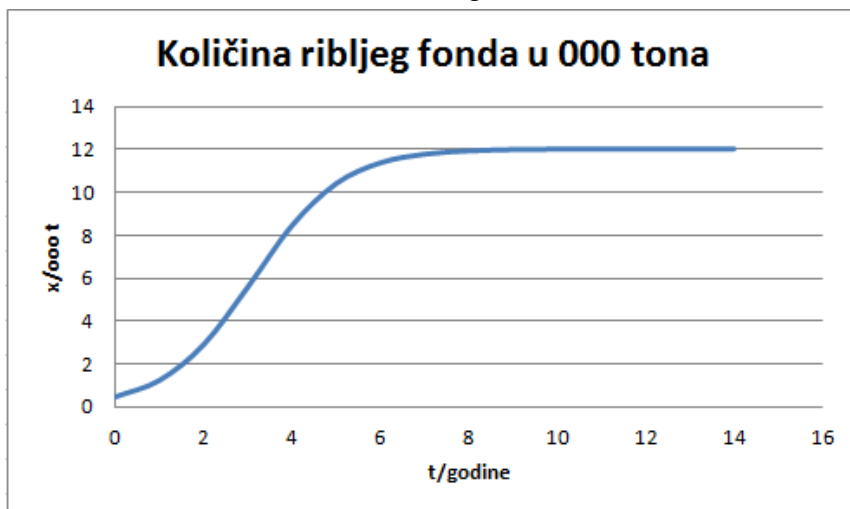
U ovom modelu x predstavlja količinu ribe (masu u tisućama tona), t vrijeme (u godinama). Faktor x s desne strane modela predstavlja rast ribljeg fonda, a izraz u zagradama smanjenje zbog ograničavajućih utjecaja. Broj 12 predstavlja stabilni (održivi) nivo ribljeg fonda.

Postavimo početni uvjet. Neka je početna količina ribe 500 t. Pišemo onda $x(0) = 0,5$.

Studenti kojima se ovo gradivo izlaže trebali bi biti u stanju riješiti diferencijalnu jednačbu uz zadani početni uvjet. Ovo je diferencijalna jednačba sa separiranim varijablama. Njeno rješenje uz zadani početni uvjet je:

$$x(t) = \frac{12}{1 + 23 \cdot e^{-t}}$$

Dobiveni model u MS Excelovom radnom listu izgleda:



Slika 11 Model kretanja ribljeg fonda u geografski ograničenom području (uvala)

- Kako se mijenja količina ribe u prve četiri godine? Koja funkcija opisuje takvo ponašanje?
- Kako se mijenja količina ribe za $t > 6$? Oko koje vrijednosti se stabilizira?
- Odredite točku infleksije za dani model?
- Dodatno istražite kakva je to logistička funkcija i koje se pojave njom modeliraju?

3.4.2 Model održivog ribarenja

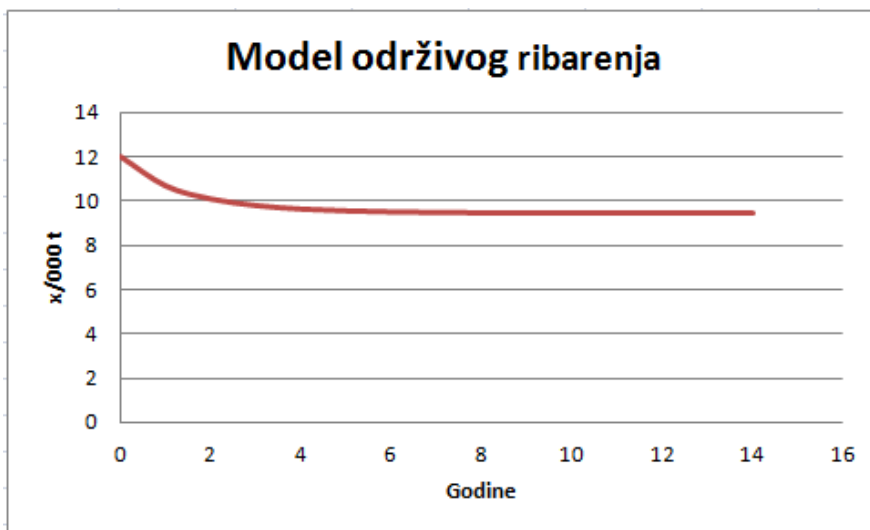
Pretpostavimo dalje da u naš morski zaljevski ekosustav dođe ribarski brod koji lovi 2000 t ribe godišnje. Tada model u diferencijalnom obliku izgleda:

$$\frac{dx}{dt} = x \cdot \left(1 - \frac{x}{12}\right) - 2$$

Neka je početna vrijednost održivi iznos u tom sustavu 12 000 tona.

$$x(0) = 12$$

Uz zadani početni uvjet dobivamo model koji u MS Excelu izgleda:



Slika 12 Model održivog ribarenja u geografski ograničenom području (uvala)

Uočimo da je riblji fond smanjen u odnosu na prvotnu količinu (za nešto više od 2000 tona godišnjeg ulova), ali je riblji fond i dalje stabilan (stacionaran).

3.4.3 Model neodrživog ribarenja

Pretpostavimo sada da u naš morski zaljevski ekosustav dođe ribarski brod koji lovi 6000 t ribe godišnje. Tada model u diferencijalnom obliku izgleda:

$$\frac{dx}{dt} = x \cdot \left(1 - \frac{x}{12}\right) - 6$$

Neka je početna vrijednost ovog puta 20 000 tona.

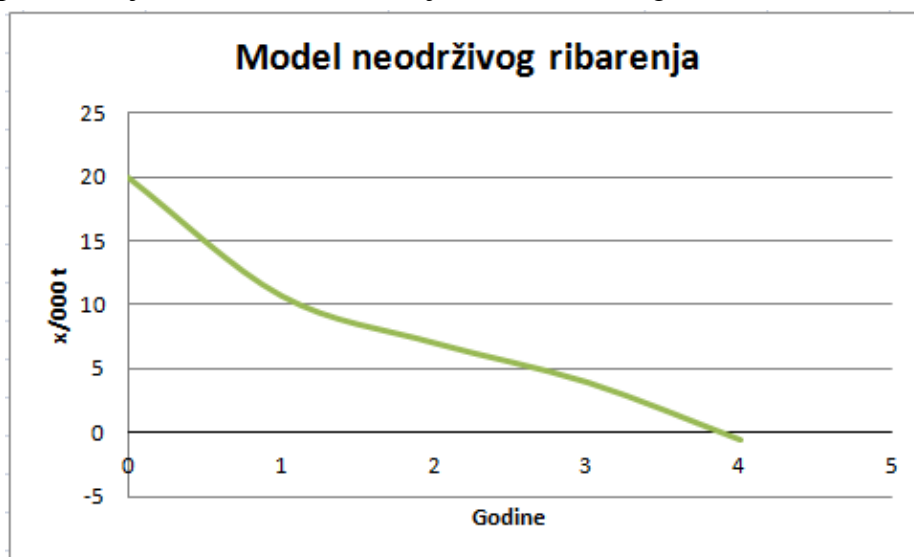
$$x(0) = 20$$

Rješenje ove diferencijalne jednačbe s danim početnim uvjetom je:

$$x(t) = 20 - \frac{116}{7 + 3 \cdot \operatorname{ctg}\left(\frac{t}{2}\right)}$$

Ukoliko rješavanje ovakvog problema izlazi van okvira kolegija moguće je koristiti neki od računalnih “solvera” diferencijalnih jednačbi.

Uz zadani početni uvjet dobivamo model koji u MS Excelu izgleda:



Slika 13 Model neodrživog ribarenja u geografski ograničenom području (uvala)

- Kada će doći do potpunog kolapsa ribljeg fonda?
- Koji je uzrok tome?

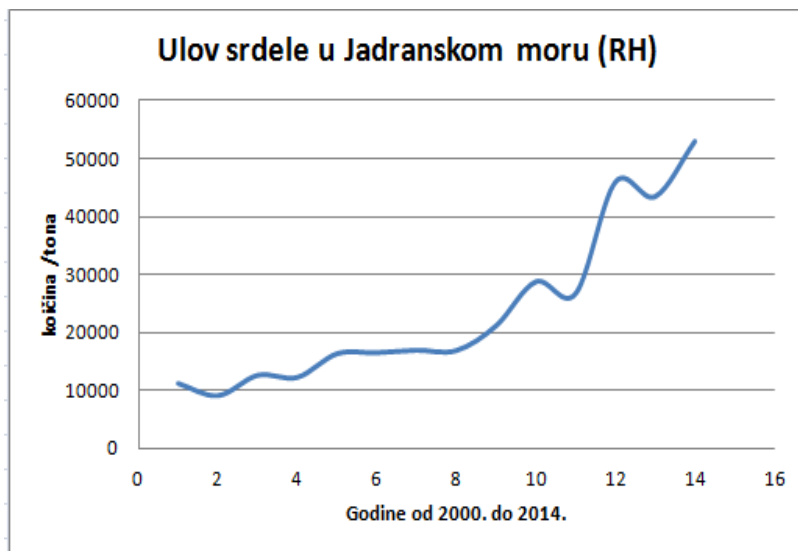
Na ovaj način studentima približavamo ovu problematiku i neophodnost matematičkog modeliranja i kao posljedicu toga razumno gospodarenje ribljim fondom, uvođenje kvota, kao i perioda dopuštenog ribolova.

Daljnja rasprava može ići prikazom podataka o izlovu sardine iz Jadranskog mora [8].

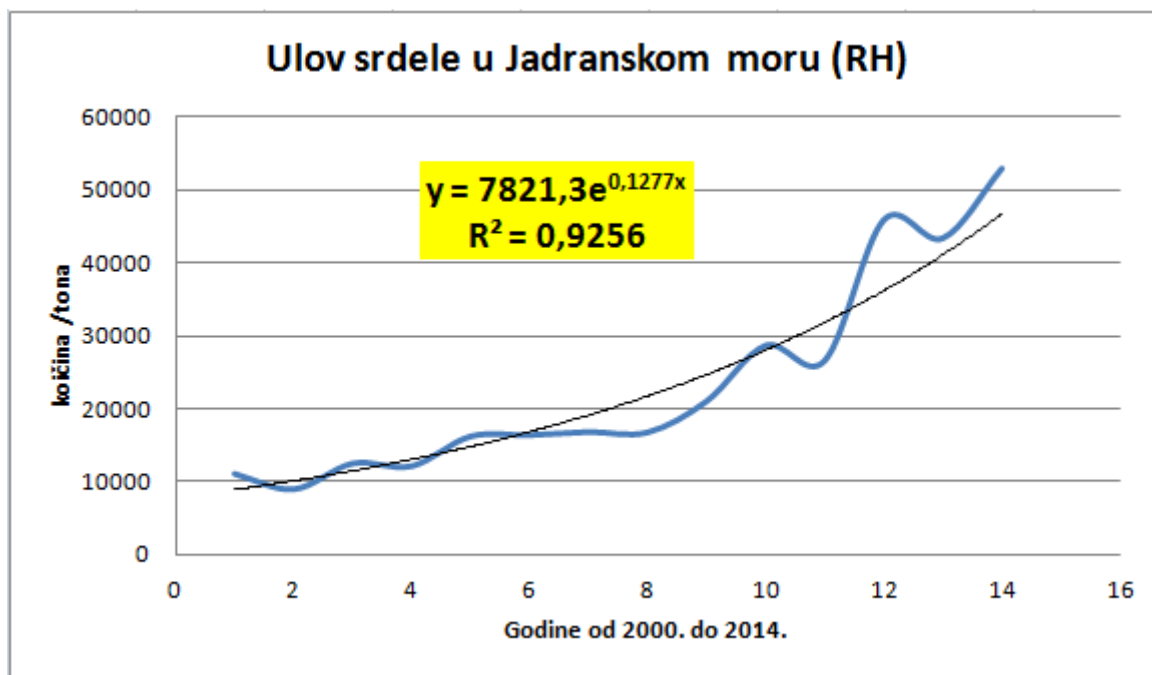
- Kojom funkcijom možemo modelirati rast količine izlovljene sardine?
- U kojem je periodu zabilježen najveći rast? Koliki je on u apsolutnom, a koliki u postotnom iznosu?
- U radnom listu MS Excela modelirajte podatke eksponencijalnom funkcijom.
- Kada bi rast zadržao taj trend koliki bi bio godišnji ulov 2025. godine?
- Mislite li da jadranskoj srdeli prijeti slični kolaps?
- Razmislite o mogućim rješenjima!

Godina	Srdela/tona
2000	11226
2001	9097
2002	12626
2003	12271
2004	16357
2005	16521
2006	16950
2007	16900
2008	21194
2009	28815
2010	26749
2011	46051
2012	43527
2013	53085
2014	55783

Slika 14 Ulov srdele u RH



Slika 15 Kretanje ulova srdele u Jadranskom moru od 2000. do 2014.



Slika 16 Ulov srdele u RH modeliran eksponencijalnim modelom

4. Zaključak

Iz gore prezentiranih primjera vidljiva je snažna veza između matematičkih modela i alata i problematike održivosti prirodnih resursa. Vjerujemo da uključivanjem ovakvih sadržaja, u ponekad suhoparne akademske kolegije, možemo postići sinergiju pozitivnih učinaka. Podučavati matematiku kroz održivost i održivost kroz matematiku. Upotrebom realnih primjera u nastavi matematika postaje i društveno angažirana disciplina. Studenti prepoznaju korisnost izučavanja matematike, a pri tome im raste svijest o ograničenim resursima koje nam planet pruža za život. Time potičemo i njihovu osobnu odgovornost te proaktivno djelovanje za održivu budućnost kako lokalne tako i globalne zajednice. S obzirom na to da je održivost izrazito interdisciplinarno područje, smatramo da je upravo Sveučilišni odjel za stručne studije, zbog svoje politehničke prirode, idealno mjesto za razvoj novih interdisciplinarnih modula kojim će se sveobuhvatno pristupiti problemu održivosti.

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Teaching sustainability in mathematics

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Abstract. The main aim of this paper is to show how to incorporate sustainability into a Mathematics courses curriculum. Sustainability issues are inherently interdisciplinary. There are ample opportunities for introducing sustainability examples in math courses, from algebra and geometry to calculus and statistics. Teaching environmental sustainability to the large undergraduate math courses, as they are at the Department of Professional Studies of the University of Split, will have the greatest reach, due to their size. We suggest ways in which university mathematics teachers can provide a quality learning experience for their students that includes notions of sustainability within the mathematical context, without compromising the mathematical content of their courses. As an additional learning outcome, we can expect embedding the importance of these matters into the minds of the students and raising their environmental awareness.

Key words: *teaching, mathematics, sustainability*

The limits of mathematical models of cities - an example from the Mediterranean region

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Abstract. In this article we explain the metaphor of living in living cities. Urban problems such as traffic congestion can be considered and possibly solved involving living technology. We also introduce the notion of urban scaling - the idea that certain properties of all cities change, on average, with their size in predictable scale-invariant way. We question this hypothesis by measuring some traffic-dependent quantities for several urban scales. Specifically, we investigate the limits of traffic capacity as a feature of Mediterranean cities, questioning simplifications of mathematical model of cities.

Keywords: *living technology, urban scaling, complexity, traffic congestion*

1. Scale invariance emerges from collected data

Scale invariance is a feature of laws that do not change if scales of length (or other variables) are multiplied with some parameter. Examples of power law are:

Newton's law of gravitation

$$F(\lambda r) = \text{const} \cdot (\lambda r)^{-2} = \text{const} \cdot \lambda^{-2} \cdot r^{-2} = \lambda^{-2} \cdot F(r), \text{ for any } \lambda > 0,$$

or Kleiber's law (Kleiber, 1932) that animal's metabolic rate scales to the $\frac{3}{4}$ power of the animal's mass for 27 orders of scale.

Inspired by metaphor of cities as living organisms, Bettencourt L. and all (Bettencourt et al, 2007) collected huge amount of data about some macroscopic aspects of cities and concluded that all cities realize, as they grow, some spatial economies of scales and, simultaneously, attain general socioeconomic productivity gain: volume of infrastructure-roads, pipes, cables-per capita is smaller, wages, patents and crime rate per capita are bigger. Doubling of city population, a city contains about 10-20 % less infrastructure volume per capita.

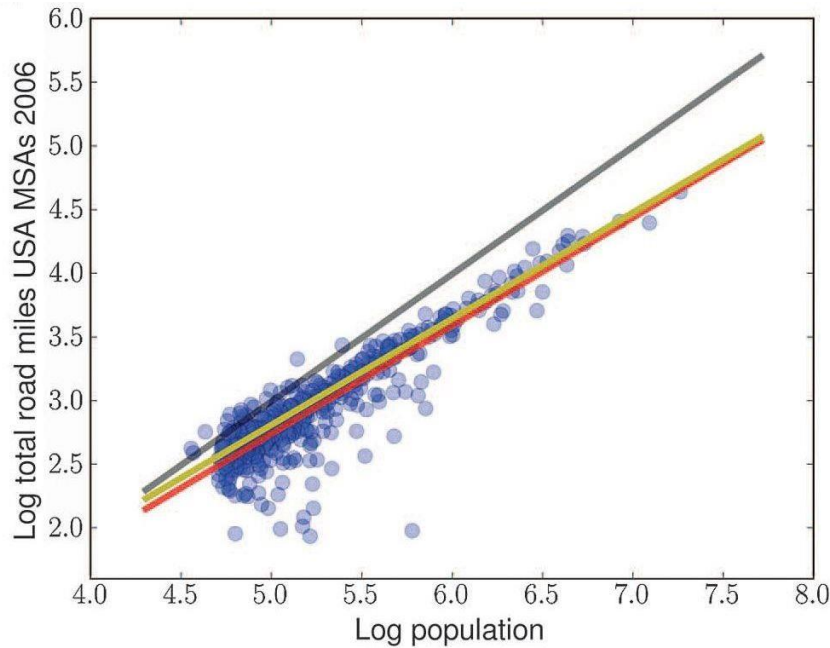


Figure 1. Scaling of urban infrastructure. Total lane miles (volume) of roads in U.S. metropolitan areas (MSAs) in 2006 (blue dots). Lines show the best fit to a scaling relation

$$Y = Y_0 \cdot N^\beta, \beta = 0.85 \pm 0.04 \text{ (red); theoretical prediction } \beta = 5/6 \text{ (yellow); linear scaling } \beta = 1 \text{ (black). (Bettencourt, 2013b, page 1438).}$$

It also displays a 10-20 % increase in rates of wealth production and innovation, but also, less benign fruits of human socioeconomic interactions, crime and traffic congestion (Bettencourt et al, 2013).

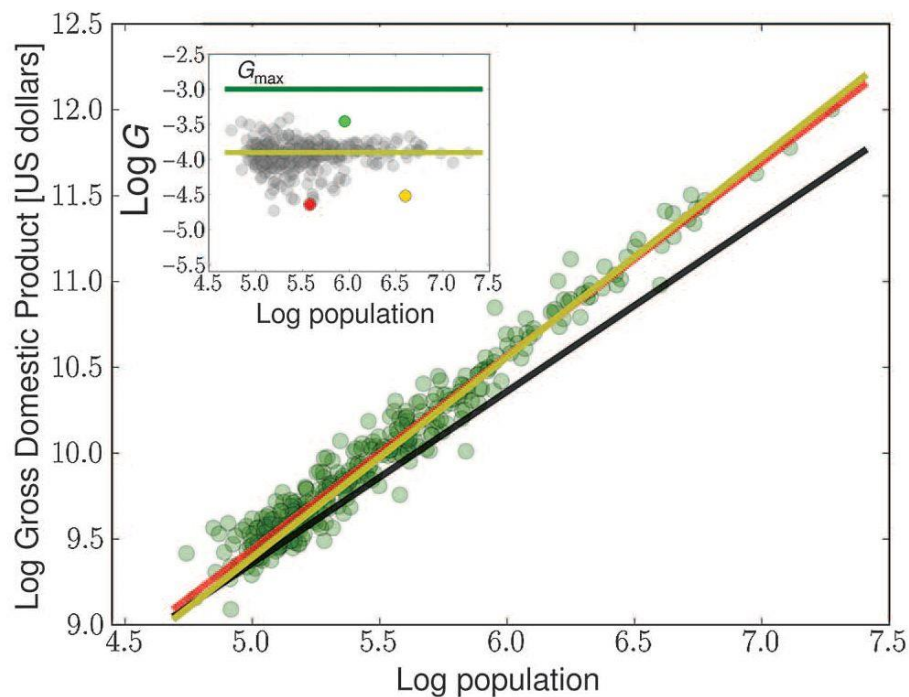


Figure 2. Scaling of socioeconomic variable. Gross metropolitan product of MSAs in 2006 (green dots). Lines describe best fit (red) to data, $\beta = 1.13 \pm 0.02$; theoretical prediction $\beta = 7/6$ (yellow) ; linear scaling $\beta = 1$ (black). (Bettencourt, 2013b, page 1438).

2. Models explaining scale invariance of some city characteristics

Model, introduced by West GB and others (West et al, 1997), explained $\frac{3}{4}$ exponent as emerging from network theory. We will not focus on critics of their approach, which are serious, but on similar models explaining the origins of scaling in cities. After mention of phenomenological model developed by Bettencourt L. (Bettencourt, 2013b), we accentuated some specific features of Mediterranean cities which question author's mathematical simplifications. Instead of original model in (Bettencourt, 2013b), we review slightly simpler derived models (Cesaretti et al, 2015) developed by same author. Namely, in (Cesaretti et al, 2015) authors examine relationship between the population size and settled area in sample of 169 European medieval cities. On base of inferred data of population and cities area in 14. Century, they concluded that population size-settled area relation is sublinear (density of cities grow faster than population).

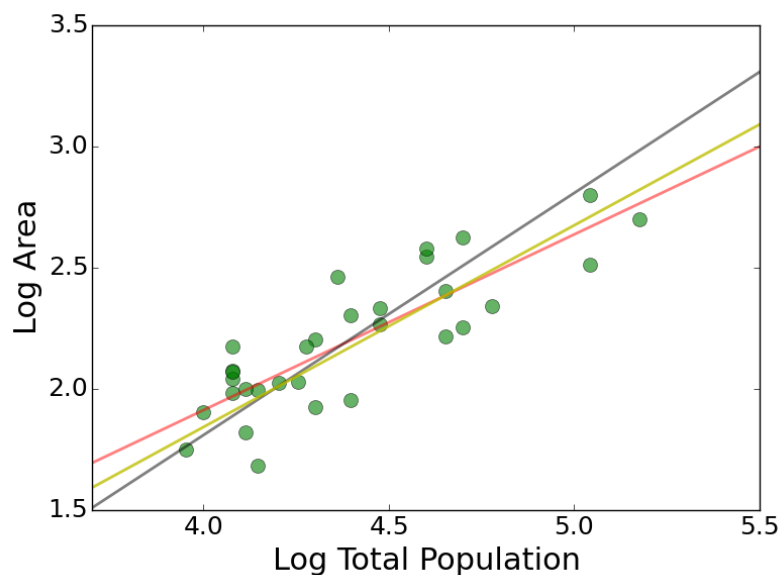


Figure 3. These data refer to cities in Northern and Central Italy. (Cesaretti, 2015, page 3)

In Figure 3. black line is linear relation, red line indicate slower increase of settled area (sublinear), i.e. faster increase of density of city centers as population size increase. It is example of economies of scales.

Similar relationship is valid for contemporary cities. This relation is near linear for some French and Belgian cities, indicating more hierarchical political structure impeding spatial economies of scales. This inspired authors (Cesaretti et al) to explain origin of empirical power law for relation population size-city area developing two models: model of city as social reactor (enforcing movement and social interaction) and the alternative structured interaction model (channeling interactions through strong hierarchical institutions). The second model predicts attenuation of agglomeration effect more the stronger institutional constraints are. Yet, empirical data don't support significantly structured interaction model, so authors in (Cesaretti et al, 2015) suggest social reactor model as unified theoretical framework stressing social networking processing as key factor through history of cities development generating scaling regularities.

2.1 Qualitative remarks on model assumptions

Our critique is related on neglecting costs of area in Mediterranean zone. Although Bettencourt's claim "that cities, at their most fundamentals, are not really agglomerations of people; they are agglomerations of connections between people" is good metaphor which

underline social components, this claim underscores sparsity of resources what, finally, influence quality of connections enabled in cities. Sublinear relation between population size and settled area can be realized so that growing of city causes interpolation of buildings in old center, making city denser. But historic Mediterranean agglomerations, even very small one, were unusually dense from first settlement because of lack of flat terrain. The consequence would be relative independence of settled area on population size. In contemporary context, this density stimulate social connections (desirable in touristic purpose) but make problems in traffic, causing congestion, challenge nonconventional methods of solving traffic sustainability.

2.2 Social reactor model

Here we give summary of the model of city as social reactor as proposed by Cesaretti et al.

City is complex system in state of temporary equilibrium when socioeconomics interactions force appropriate change of land and transportation costs, influencing higher or smaller city population density.

City space is social network where y denotes average benefit that a citizen accrues from interactions. Rate of interactions is proportional to density N/A (A is settled area of city):

$$y = G \cdot \frac{N}{A}, \text{ where parameter } G \text{ denotes net benefit per interaction.}$$

The per capita cost of transportation is c :

$c = \varepsilon \cdot A^{H/2}$, where parameter ε is cost of movement per unit length (depending on technology, e.g. walking vs. horse-riding), H is fractal dimension with values $[0, 2]$. Remark on value of fractal dimension. Point has $H = 0$, line $H = 1$, plane $H = 2$, Koch curve $H = 4/3$.

Equating benefits to costs for individual, and solving for area as function of population one obtains:

$$A = a \cdot N^\alpha, a = \left(\frac{G}{\varepsilon} \right)^\alpha, \alpha = \frac{2}{H+2}$$

If $H = 0$, no agglomeration effects are present. It is characteristic of segregated settlement with minimal or zero connections leading on $A \sim N$.

If $H=1$, $A^{1/2} \sim L$, where L is city diameter, leading to sublinear dependence of area with population :

$$A = a \cdot N^{2/3} \quad (\alpha = 2/3 < 1) \text{ (sublinear)}$$

Population density will rise strongly in such cities:

$$n = \frac{N}{A} = \frac{N}{a \cdot N^{2/3}} = a^{-1} \cdot N^{1/3}$$

Total average socioeconomic output of city (wages, creativity, crime rate) is $Y = N \cdot y$ what, after rearrangement ($Y = Y_0 \cdot N^\beta$, where $\beta = 2 - \alpha = 1 + 1/3 > 1$ and $Y_0 = G^{1-\alpha} \cdot \varepsilon^\alpha$) leads to superlinear dependence on population:

$$Y = Y_0 \cdot N^{4/3} \quad (\beta = 4/3 > 1) \text{ (superlinear)}$$

This model originated from notion of network density is in agreement with power law derived from empirical data.

2.3 Limits of mathematical model of cities

Fractal dimension is included in model, but is not discussed case $H > 1$. $H > 1$ enables more connections in network. For example, Koch curve has $H = 4/3$, $\alpha = 2/3.33$ leading on even faster rise of population density with population

$$n = \frac{N}{A} = \frac{N}{a \cdot N^{2/3.33}} = a^{-1} \cdot N^{1.33/3.33}$$

This stronger confirms our qualitative objection that model is not sensitive in case of Mediterranean cities, which geometry is often fractal, even filling volume with high and narrow buildings (H between 2 and 3), obvious in slum-like old cities centers. In (Cesaretti et al, 2015) is discussed case of medieval cities where social benefits are small compared with costs of transportation leading to small value of a :

$$a = \left(\frac{G}{\varepsilon}\right)^\alpha \leq 1.$$

Because of it:

$$n = \frac{N}{A} \sim \frac{1}{a},$$

and all settlements will be quite dense. Precisely, power of a isn't 1 but $(H+2)/2$, which has neglecting effect on population density change.

Applying this situation on Mediterranean cities founded on scarce terrain, often very steep (Dubrovnik, Hvar on Hvar island, Korčula, Assisi in Italy) we want to conclude that rise of population will not increase population density of old, yet over dense, cities centers, because this not increase socioeconomic benefit but cause traffic congestion. Violent interpolation of new objects in such old cities centers decrease socioeconomic benefit degrading rich network of social connections formed in fractal-like city volume.

Bettecourt and West (TED, 2011) made gigantic effort describing quantitatively cities. Sublinear power law indicating economies of scales (population density, infrastructure) similar to biology organisms and superlinear socioeconomic behavior (wages, creativity) specific for human agglomeration are empirical facts. Models explaining origins of power law in cities give rise understanding city as social reactor capable of building desirable but also adverse complex networks. Now we, followers, can elaborate what cities are not or help refine notion about cities.

3. The science of cities

Emphasizing the trend of global urbanization (currently about 80% of the US and 50% of the world population reside in urban areas) we extend perspective of concerning with cities not as a problem alone, but more as a “social reactor” which can solve unintended consequences of using technology. This perspective include notion of the science of cities (especially urban physics) and metaphor of living cities.

3.1 The new branch of science

Scale invariance characteristics of cities are but only one facet of their complex existence. Short introduction in the new branch of science is properly began quoting Michael Batty (2011):

“A *Science of Cities* has taken a long time coming but there is now considerable momentum in developing formal ideas about how cities are ordered and structured which are part of the rapidly expanding Science of complexity. Cities do not exist in benign environments and cannot be easily closed from the wider world, they do not automatically return to equilibrium

for they are forever changing, indeed they are far-from-equilibrium. Nor are they centrally ordered but evolve mainly from the bottom up as the products of millions of individual and group decisions with only occasional top down centralised action. In short, cities are more like biological than mechanical systems and the rise of the sciences of complexity which has changed the direction of systems theory from top down to bottom up is one that treats such systems as open, based more on the product of evolutionary processes than one of grand design. During the last half century, the image of a city as a ‘machine’ has been replaced by that of ‘organism’ “

3.2 Urban physics

Physics is a science, but is also a set of tools and habit of mind. Similar to applying physics to explain biology or economy, the study of city is successful example of applying physics methods (modeling, approximating and dynamics) to understand hidden underpinnings of human agglomerations. Solving problems of too dense urbanization (noise, transportation, infrastructure), energy use of buildings, emergence response on fire, anticipated sea level rise as a consequence of global climate change are some of challenge which urban physics can help. What makes the science of cities more worthy of physicists attention is enormous quantity of urban data. Rapid proliferation of sensors throughout of society, digitization of commercials records and advances in computing power and computational methods can be combined to create insights into urban dynamics. New scientific centers, like CUSP (the Center for Urban Science and Progress) in New York, apply methods and instruments, developed in astrophysics to understand stars, to explain city.(APS, 2015)

Urban problems as traffic congestion can be considered and possibly solved involving living technology (Gershenson, 2013), concept borrowing meaning from essential features of living systems: adaptive, learning, robust, autonomous, self-repairing and self-reproducing. All different approaches mentioned are but different aspects of science of complexity which methods (sensors, big data, networks, computational modeling and emergent phenomena) give hope of understanding cities as sustainable organism.

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Novi pristup problemu snježne ralice – modeliranje i vizualizacija

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Sažetak. Problem snježne ralice R. P. Agnewa klasičan je uvodni problem u gradivo običnih diferencijalnih jednadžbi i ima više varijanti, među kojima je i problem triju ralica M. S. Klamkina. Po razmatranju problema, u radu se problematiziraju neki nedostaci klasičnog modela i diskutiraju se drugačiji pristupi. Programski paket *Wolfram Mathematica* iskorišten je za vizualizaciju, provjeru i poopćavanje rezultata.

Ključne riječi: *problem snježne ralice, obične diferencijalne jednadžbe, modeliranje, vizualizacija, Wolfram Mathematica.*

1. Uvod

Matematičko modeliranje je važan dio posla jednog inženjera. On mora biti sposoban realne situacije prikazivati na apstraktan način te mora znati iščitavati, razumjeti i kreirati njihove matematičke modele. Otvoreno je pitanje koliko matematičko obrazovanje koje se trenutno nudi na tehničkim studijima u Republici Hrvatskoj odgovara takvom izazovu, odnosno koliko osposobljava studenta za buduće samostalno i inventivno služenje matematičkim alatima i modelima. Pošteno govoreći, samo učenje složenih matematičkih i drugih koncepata neophodnih za razumijevanje matematičkih modela tijekom školovanja traje toliko dugo da do kraja studija i ne ostane mnogo vremena za njihovo razvijanje. Studenta se tako naoruža naprednim alatima matematike i fizike, ali mu se ne objasni kako će ih samostalno kombinirati i primijeniti. To je slično kao da se kandidata priprema za vozački ispit tako da mu se u detalje opiše funkcioniranje automobilskeg motora i tipovi auta na tržištu, ali mu se ne da ni sata vožnje.

Ovaj rad na jednom izdvojenom primjeru (donekle utopijski) promišlja kako bi mogao izgledati matematički kolegij koji bi poučavao matematičko modeliranje na stručnim studijima. Izabran je jednostavni problem koji se često koristi kao uvod u kolegij diferencijalnih jednadžbi. Odabrani problem se analizira, prilagođava, modelira i računalno vizualizira korištenjem programskog paketa *Wolfram Mathematica*. Zatim se uočavaju nedostaci modela, poboljšava ga se i ponovo vizualizira. Konačno, promatraju se složenije situacije, u modeliranju kojih se koriste i alati numeričke matematike pristupačni slušaču stručnih studija.

Wolfram Mathematica (u daljem tekstu WM) programski je paket kojeg je razvila kompanija Wolfram Research. Prva mu je verzija izdana 1998., a od tada je postao jedan od najnaprednijih i najkorištenijih softvera u tehničkim i znanstvenim područjima, a posebno u matematici i fizici. Pored mogućnosti simboličkog i numeričkog računanja, snaga mu je strukturiranost i velika prilagodljivost pa služi kao podloga brojnim aplikacijama. Zbog lakoće kojom se računanja provode moguće je lako napraviti korak od korištenja osnovnih modela k modeliranju složenijih i specijalnih slučajeva. Također, interaktivno sučelje novih programa omogućava da se problem na elegantan način vizualizira, da se mijenja parametre i promatra ishode u animaciji. Treba međutim naglasiti da je WM samo jedan od popularnih programskih paketa integriranih u radno okruženje (drugi takvi programi su *Matlab*, *Maple*, *Sage* itd). Autori su stjecanjem okolnosti koristili baš programski paket WM i nemaju osobnog interesa u njegovom propagiranju.

2. Problem snježne ralice

Profesori matematike često otvaraju kolegij diferencijalnih jednadžbi ovim zanimljivim i isprva ne baš očiglednim problemom koji se pripisuje Ralphu Palmeru Agnewu [1]:

Originalni problem snježne ralice (R. P. Agnew): Snijeg je počeo padati ujutro i padao je gusto, stalnim intenzitetom. Snježna ralica krenula je u podne, prevalivši dva kilometra u prvom satu, a jedan kilometar u drugom satu. U koliko je sati počeo padati snijeg?

Označimo s t [h] vrijeme, s t_0 [h] trenutak u kome je počeo padati snijeg, s $x(t)$ prevaljeni put ralice [km], s $h(t)$ [m] visinu snijega i s w [m] širinu pluga ralice. Problem se klasično rješava tako da se pretpostavi kako je količina snijega koju ralica očisti u jedinici vremena $wh(t)x'(t)$ konstantna, odakle je za neku pozitivnu konstantu k , $x'(t) = \frac{k}{h(t)}$. Uzimajući u

obzir stalan intenzitet padanja snijega, u oznaci a [m/h], dobiva se da je
$$h(t) = \begin{cases} 0, & \text{za } t < t_0 \\ a(t - t_0), & \text{za } t \geq t_0 \end{cases}$$
 i konačno $x'(t) = \frac{k}{a(t - t_0)}$, za $t > 12$. Integriranjem, slijedi da je

$x(t) = \frac{k}{a} \ln(t - t_0) + C$, odakle se uvrštavanjem početnog uvjeta $x(12) = 0$ odmah dobije da je

$C = -\frac{k}{a} \ln(12 - t_0)$ pa je dakle $x(t) = \frac{k}{a} \ln\left(\frac{t - t_0}{12 - t_0}\right)$ jednadžba gibanja ralice. Da se ustanovi

vrijeme t_0 kad je počeo padati snijeg, koriste se uvjeti $2 = x(13) = \frac{k}{a} \ln\left(\frac{13 - t_0}{12 - t_0}\right)$,

$3 = x(14) = \frac{k}{a} \ln\left(\frac{14 - t_0}{12 - t_0}\right)$ pa se dijeljenjem i raspisivanjem dolazi do jednadžbe

$t_0^2 - 25t_0 + 155 = 0$. Slijedi da je $t_0 = \frac{25 - \sqrt{5}}{2} \approx 11.382$ što znači da je snijeg počeo padati u 11 sati, 22 minute i 55,2 sekundi.

Murray Seymour Klamkin postavio je ovakvu varijantu problema snježne ralice [2]:

Velika utrka snježnih ralica (M. S. Klamkin): Snijeg je počeo padati ujutro i padao je gusto, stalnim intenzitetom. Prva snježna ralica krenula je u podne, druga ju je slijedila u 13 sati, a treća u 14 sati i susrele su se u istom trenutku. U koliko je sati počeo padati snijeg?

Uz iste pretpostavke kao u prethodnom modelu, korisno je umjesto $x(t)$ promatrati $t(x)$. Ako je, naime, snijeg počeo padati u t_0 [h], a vremena stizanja i -te ralice u točku x su $t_i(x)$, $i = 1, 2, 3$ diferencijalne jednačbe kretanja glase:

$$t_1'(x) = \frac{a}{k}(t_1(x) - t_0), \quad t_1(0) = 12$$

$$t_2'(x) = \frac{a}{k}(t_2(x) - t_1(x)), \quad t_2(0) = 13$$

$$t_3'(x) = \frac{a}{k}(t_3(x) - t_2(x)), \quad t_3(0) = 14.$$

Integriranjem i uvrštavanjem izlazi da je u trenutku susreta $t_1(x) = t_2(x) = t_3(x) = t \approx 15.1945$, odakle je $t_0 = 11.5$ što znači da je snijeg počeo padati u 11:30 sati.

3. Računalna vizualizacija problema snježne ralice

U originalnom Agnewljevom problemu uvjet da ralica prevali dva kilometra u prvom satu, a jedan kilometar u drugom satu služi uglavnom zato da bi se dobili “zgodni” koeficijenti u kvadratnoj jednačbi, no to bi istovremeno značilo da se ralica do podneva idućeg dana neće probiti ni do osmog kilometra ceste, pošto zbog $\frac{k}{a} = 2 \ln^{-1} \left(\frac{13 - t_0}{12 - t_0} \right) \approx 2.0780$ izlazi da je

$$x(12 + 24) = \frac{k}{a} \ln \left(\frac{12 + 24 - t_0}{12 - t_0} \right) \approx 7.657.$$

Zbog toga ćemo za naše potrebe osmisliti realniju, malo manje arktičku situaciju, primjereniju uvjetima na domaćim cestama koju ćemo moći zgodno računalno modelirati te mijenjanjem parametara detaljnije proučiti.

Modificirani problem snježne ralice: Gračac i Udbina međusobno su udaljeni 35 km. Snijeg je počeo padati u t_0 sati ujutro, stalnim intenzitetom a [m/h]. Ralica kreće iz Gračaca u $t_s > t_0$ sati i poznato je da do $t_1 > t_s$ sati prevali $x_1 > 0$ kilometara. Modelirajte i vizualizirajte kretanje ralice.

Model 1: Označi li se ponovo s $x(t)$ [km] prevaljeni put ralice, s $h(t)$ [m] visina snijega i s w [m] širina pluga ralice, uzimajući da je količina očišćenog snijega u jedinici vremena $wh(t)x'(t)$ konstantna, slijedi da je za neku pozitivnu konstantu k , $x'(t) = \frac{k}{h(t)}$. Uzimajući u

obzir stalan intenzitet padanja snijega, u oznaci a [m/h], dobiva se da je
$$h(t) = \begin{cases} 0, & \text{za } t < t_0 \\ a(t - t_0), & \text{za } t \geq t_0 \end{cases}$$
 i konačno $x'(t) = \frac{k}{a(t - t_0)}$, za $t > t_s$. Integriranjem, slijedi da je

$$x(t) = \frac{k}{a} \ln(t - t_0) + C,$$
 odakle se uvrštavanjem početnog uvjeta $x(t_s) = 0$ odmah dobije da je

$$C = -\frac{k}{a} \ln(t_s - t_0)$$
 pa je dakle
$$x(t) = \frac{k}{a} \ln \left(\frac{t - t_0}{t_s - t_0} \right)$$
 jednačba gibanja ralice. Da se dobije

iznos konstante k , uvrsti se da je $x_1 = x(t_1) = \frac{k}{a} \ln\left(\frac{t_1 - t_0}{t_s - t_0}\right)$, iz čega je $k = ax_1 \ln^{-1}\left(\frac{t_1 - t_0}{t_s - t_0}\right)$ pa

$$\text{je jednačica gibanja ralice } x(t) = x_1 \frac{\ln\left(\frac{t - t_0}{t_s - t_0}\right)}{\ln\left(\frac{t_1 - t_0}{t_s - t_0}\right)}.$$

Ovaj je model zgodno vizualizirati korištenjem WM programa prikazanog na slici 1. Isječak vizualizacije (crtanog filma s ralicom u glavnoj ulozi) za slučaj $a=0.02$, $t_0=6$, $t_s=8$, $t_1=10$, $x_1=12$ vidi se na slici 2.

4. Nedostatak klasičnog modela gibanja snježne ralice

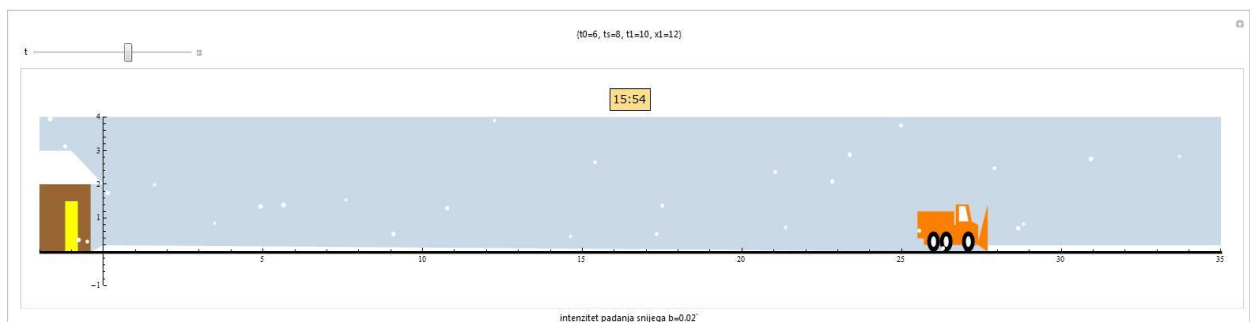
Opisani model gibanja snježne ralice klasično korišten za rješavanje problema snježne ralice Agnewa i Klamkina ima najmanje jedan ozbiljan nedostatak: za taj model bitno je da snijeg pada gusto, a da ralica krene neko vrijeme nakon što snijeg počne padati. Naime, iz jednačice

$$x'(t) = \frac{k}{h(t)} \text{ slijedi da kad visina snijega } h(t) \rightarrow 0, x'(t) \rightarrow \infty. \text{ Prema takvom modelu, ralica}$$

koja bi krenula čistiti snijeg iz prošlog primjera minutu nakon što on počne padati, kretala bi se imponzantnom brzinom od 1308.9 km/h. To znači da je takvim modelom praktično nemoguće opisati slučaj da ralica krene u trenutku kad snijeg počne padati ili čak ranije. Zato se u nastavku razmatra nešto drukčiji model.

```
Clear["Global`*"]
f = Interpolation[{{1, 1, 1, 1, 0.9, 0.4, 0.2, 0.2, 0.1, 0.05, 0, 0, 0, 0, 0.05, 0.1, 0.2, 0.4, 0.8, 0.9, 1, 1, 1, 1}}, InterpolationOrder -> 1];
t0 = Input["Vrijeme t0 u kojem je počeo padati snijeg je..."]; a = Input["Upišite intenzitet padanja snijega a=0 [m/h]"];
ts = Input["Vrijeme ts=t0 u kojem je ralica krenula je..."]; t1 = Input["Vrijeme t1>ts u kojem je dan uvjet je..."];
x1 = Input["Duljina dijela ceste x1 očišćena u vremenu t1 je..."]; h[t_] = Piecewise[{{0.00001, t < t0}, {a*(t - t0), t >= t0}}];
sol1 = DSolve[{h[t]*Derivative[1][x][t] == k, x[ts] == 0}, x[t], t]; x[t_, k_] = x[t] /. sol1[[1]]; sol2 = Solve[x[t1, k] == x1, k]; k = Re[k] /. sol2[[1]];
x[t_] = Re[x[t, k]];
t2 = t0 + (ts - t0)*E^((35*a)/k);
Manipulate[Show[Graphics[{Darker[LightBlue, f[Mod[t, 24] + 1]], Polygon[{{-2, 0}, {35, 0}, {35, 4}, {-2, 4}, {-2, 0}}], Yellow,
Polygon[{{-1.2, 0}, {-1.2, 1.5}, {-0.8, 1.5}, {-0.8, 0}, {-1.2, 0}}], Brown, Polygon[{{-1.3, 1.5}, {-0.8, 1.5}, {-0.8, 0}, {-0.4, 0}, {-0.4, 2}, {-1.3, 2},
{-1.3, 1.5}}], Black, Thickness[0.002], Line[{{-2, -0.02}, {35, -0.02}}], White, Polygon[{{-0.4, 0}, {x[t], 0}, {0, h[t]}, {-0.4, 0}}], Orange,
Polygon[{{x[t] - 1.8, 0.2}, {x[t] - 0.3, 0.2}, {x[t], 0}, {x[t], 1.4}, {x[t] - 0.3, 0.3}, {x[t] - 0.3, 0.8}, {x[t] - 0.5, 0.9}, {x[t] - 0.6, 1.4},
{x[t] - 1, 1.4}, {x[t] - 1, 0.8}, {x[t] - 1.05, 0.8}, {x[t] - 1.05, 1.2}, {x[t] - 2.2, 1.2}, {x[t] - 2.2, 0.4}, {x[t] - 2, 0.4}, {x[t] - 2, 0.2}}], White,
Polygon[{{x[t], 0}, {35, 0}, {35, h[t]}, {x[t], h[t]}, {x[t], 0}}], Black, Disk[{x[t] - 1.7, 0.3}, {0.2, 0.3}], Disk[{x[t] - 1.3, 0.3}, {0.2, 0.3}],
Disk[{x[t] - 0.6, 0.3}, {0.2, 0.3}], White, Polygon[{{x[t] - 0.9, 0.9}, {x[t] - 0.6, 0.9}, {x[t] - 0.7, 1.35}, {x[t] - 0.9, 1.35}}],
Disk[{x[t] - 1.7, 0.3}, {0.08, 0.16}], Disk[{x[t] - 1.3, 0.3}, {0.08, 0.16}], Disk[{x[t] - 0.6, 0.3}, {0.08, 0.16}], Lighter[Red, Clip[8*a*(t - t0)]],
Polygon[{{-2, 2}, {0, 2}, {-1, 3}, {-2, 3}, {-2, 3}}], Brown, Polygon[{{-2, 0}, {-1.2, 0}, {-1.2, 2}, {-2, 2}, {-2, 0}}],
Table[{White, Disk[RandomReal[{-2, 35}], RandomReal[4]], RandomReal[0.05, 0.08]]}], {30}]], PlotRange -> {{-2, 35}, {-1, 4}}, Axes -> True,
ImageSize -> 1500, PlotLabel -> Style[Framed[DateString[{0, 0, 0, Floor[t], 60*(t - Floor[t]), 0}, {"Hour24", ":", "Minute"}]], 14, "Label",
Background -> RGBColor[1, 0.875, 0.537]], ImageMargins -> 8], {{t, ts, "t"}, ts, t2, 0.001},
FrameLabel -> {StringForm["intenzitet padanja snijega a="], a, "", {StringForm["t0=", t0], StringForm["ts=", ts], StringForm["t1=", t1],
StringForm["x1=", x1]}}]
```

Slika 1 – WM program za vizualizaciju modela 1 modificiranog problema snježne ralice



Slika 2 – WM simulacija modela 1 modificiranog problema snježne ralice

Modificirani problem – model 2: neka je v_0 [km/h] brzina kojom se ralica kreće po očišćenoj cesti. Uz iste oznake kao u prvom modelu, slijedi da je prethodnu jednadžbu $x'(t) = \frac{k}{h(t)}$

zgodno korigirati, tako da dobijemo $x'(t) = \frac{k}{h(t)} \cdot \left(1 - \frac{x'(t)}{v_0}\right)$. Dodani faktor će osigurati da

brzina ne premaši maksimalnu brzinu v_0 . Raspisivanjem jednadžbe $x'(t) = \frac{kv_0}{v_0 h(t) + k}$

uzimajući u obzir stalan intenzitet padanja snijega, u oznaci a [m/h], dobiva se $h(t) = \begin{cases} 0, & \text{za } t < t_0 \\ a(t - t_0), & \text{za } t \geq t_0 \end{cases}$ i slijedi da je za $t \geq t_0$, $x'(t) = \frac{kv_0}{av_0(t - t_0) + k}$, odakle je

$$x(t) = \frac{k}{a} \ln \left[t - t_0 + \frac{k}{av_0} \right] + C.$$

U slučaju da ralica krene nakon što snijeg počne padati, $t_0 < t_s$, početni uvjet daje

$$0 = x(t_s) = \frac{k}{a} \ln \left[t_s - t_0 + \frac{k}{av_0} \right] + C \text{ pa je } x(t) = \frac{k}{a} \ln \left[\frac{av_0(t - t_0) + k}{av_0(t_s - t_0) + k} \right].$$

U protivnom, za $t_s \leq t_0$, $x'(t) = \begin{cases} 0, & \text{za } t < t_s \\ v_0, & \text{za } t_s \leq t < t_0 \\ \frac{kv_0}{v_0 h(t) + k}, & \text{za } t > t_0 \end{cases}$ i početni uvjet daje

$$v_0(t_0 - t_s) = x(t_0) = \frac{k}{a} \ln \left[t_0 - t_0 + \frac{k}{av_0} \right] + C,$$

$$\text{pa je } x(t) = \begin{cases} 0, & \text{za } t < t_s \\ v_0 t, & \text{za } t_s \leq t < t_0 \\ \frac{k}{a} \ln \left[\frac{av_0(t - t_0) + k}{k} \right] + v_0(t_0 - t_s), & \text{za } t > t_0 \end{cases}.$$

Korištenjem uvjeta $x(t_1) = x_1$ i neke od metoda numeričkog rješavanja jednadžbi npr. metodu bisekcije, dolazi se do iznosa konstante k . Na slici 3 je WM program korišten za vizualizaciju, a na slici 4 vidi se rezultat za slučaj da je granična brzina ralice $v_0 = 30$, $a = 0.02$, $t_0 = 6$, $t_s = 8$, $t_1 = 10$, $x_1 = 12$ (izlazi da je $k \approx 0.4363$). Na slici 5 su grafovi puta i brzine ralice.

Dodatno, na slici 6 su grafovi puta $x(t)$ i brzine $x'(t)$ ralice za slučaj da je ralica krenula u 5 sati i 45 minuta, brzinom od 30 km/h, a snijeg počeo padati u 6 sati, uz uvjete $a = 0.02$, $t_1 = 9$, $x_1 = 28$. Ovo potvrđuje da model dobro opisuje i slučaj da je ralica na cesti i prije početka padanja snijega.

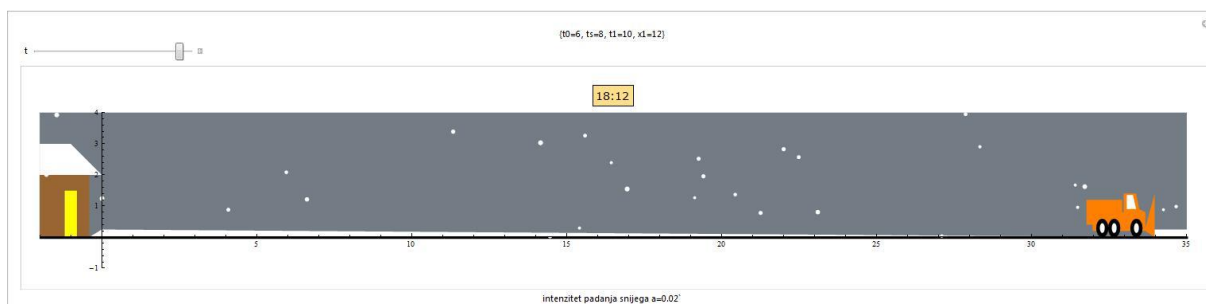
```

Clear["Global`*"]

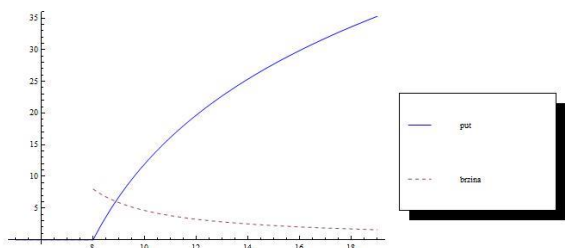
f = Interpolation[{{1, 1, 1, 0.9, 0.4, 0.2, 0.2, 0.1, 0.05, 0, 0, 0, 0, 0.05, 0.1, 0.2, 0.4, 0.8, 0.9, 1, 1, 1, 1}, InterpolationOrder -> 1];
v0 = Input["Maksimalna brzina v0 [km/h] ralice je..."]; t0 = Input["Vrijeme t0 u kojem je počeo padati snijeg je..."];
a = Input["Upišite intenzitet padanja snijega a=0 [m/h]"]; ts = Input["Vrijeme ts=t0 u kojem je ralica krenula je..."];
t1 = Input["Vrijeme t1>ts u kojem je dan uvjet je..."]; x1 = Input["Duljina dijela ceste x1 očišćena u vremenu t1 je..."];
h[t_] = Piecewise[{{0, t < t0}, {a (t - t0), t >= t0}}]; If[t0 < ts, {sol1 = DSolve[{x'[t] ==  $\frac{k(v0 - x'[t])}{av0(t - t0)}$ , x[ts] = 0}, x[t], t]; x[t_, k_] = x[t] /. sol1[[1]]};
sol2 = FindRoot[x[t1, k] == x1, {k, 1}]; k = Re[k]; sol2[[1]]; x[t_] = Piecewise[{{0, t < ts}, {x[t, k], t >= ts}}];
{sol1 = DSolve[{x'[t] ==  $\frac{k(v0 - x'[t])}{av0(t - t0)}$ , x[t0] == 0}, x[t], t]; x[t_, k_] = x[t] /. sol1[[1]]; sol2 = FindRoot[x[t1, k] + v0(t0 - ts) == x1, {k, 1}]; k = Re[k]; sol2[[1]]};
x[t_] = Piecewise[{{v0(t - ts), ts <= t < t0}, {x[t, k] + v0(t0 - ts), t >= t0}, {0}]; sol3 = FindRoot[x[t2] == 35, {t2, t1}]; t2 = Re[t2] /. sol3[[1]];
Manipulate[
Show[Graphics[{{Darker[LightBlue, f[Mod[t, 24] + 1]], Polygon[{{-2, 0}, {35, 0}, {35, 4}, {-2, 4}, {-2, 0}}], Yellow,
Polygon[{{-1.2, 0}, {-1.2, 1.5}, {-0.8, 1.5}, {-0.8, 0}, {-1.2, 0}}],
Brown, Polygon[{{-1.3, 1.5}, {-0.8, 1.5}, {-0.8, 0}, {-0.4, 0}, {-0.4, 2}, {-1.3, 2}, {-1.3, 1.5}}], Black, Thickness[.002], Line[{{-2, -0.02}, {35, -0.02}}],
White, Polygon[{{-0.4, 0}, {x[t], 0}, {0, h[t]}, {-0.4, 0}}],
Orange, Polygon[{{(x[t] - 1.8, 0.2), (x[t] - 0.3, 0.2), (x[t], 0), (x[t], 1.4), (x[t] - 0.3, 0.3), (x[t] - 0.3, 0.8), (x[t] - 0.5, 0.9), (x[t] - 0.6, 1.4),
(x[t] - 1, 1.4), (x[t] - 1, 0.8), (x[t] - 1.05, 0.8), (x[t] - 1.05, 1.2), (x[t] - 2.2, 1.2), (x[t] - 2.2, 0.4), (x[t] - 2, 0.4), (x[t] - 2, 0.2)}}], White,
Polygon[{{(x[t], 0), {35, 0}, {35, h[t]}, {x[t], h[t]}, {x[t], 0}}], Black, Disk[{x[t] - 1.7, 0.3}, {0.2, 0.3}], Disk[{x[t] - 1.3, 0.3}, {0.2, 0.3}],
Disk[{x[t] - 0.6, 0.3}, {0.2, 0.3}], White, Polygon[{{(x[t] - 0.9, 0.9), (x[t] - 0.6, 0.9), (x[t] - 0.7, 1.35), (x[t] - 0.9, 1.35)}], Disk[{x[t] - 1.7, 0.3}, {0.08, 0.16}],
Disk[{x[t] - 1.3, 0.3}, {0.08, 0.16}], Disk[{x[t] - 0.6, 0.3}, {0.08, 0.16}], Lighter[Red, Clip[8 a (t - t0)]], Polygon[{{-2, 2}, {0, 2}, {-1, 3}, {-2, 3}, {-2, 3}}],
Brown, Polygon[{{-2, 0}, {-1.2, 0}, {-1.2, 2}, {-2, 2}, {-2, 0}}], Table[{White, Disk[(RandomReal[{-2, 35}], RandomReal[0.05, 0.08]]], {30}} ]}],
PlotRange -> {{-2, 35}, {-1, 4}}, Axes -> True, ImageSize -> 1450,
PlotLabel -> Style[Framed[DateString[{0, 0, 0, Floor[t], 60 (t - Floor[t]), 0}, {"Hour24", ":", "Minute"}], 14, "Label", Background -> RGBColor[1, .875, .537]], ImageMargins -> 8],
{{t, ts, "t"}, ts, t2, 0.001},
FrameLabel -> {StringForm["intenzitet padanja snijega a="], a, "", {StringForm["t0="], t0, StringForm["ts="], ts, StringForm["t1="], t1, StringForm["x1="], x1}}]

```

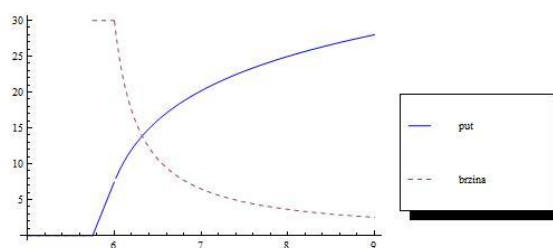
Slika 3 – WM program za vizualizaciju modela 2 modificiranog problema snježne ralice



Slika 4 – WM simulacija modela 2 modificiranog problema snježne ralice



Slika 5 – Grafovi puta i brzine ralice, $t_0 < t_s$



Slika 6 – Grafovi puta i brzine ralice, $t_s \leq t_0$

5. Modificirani problem snježne ralice – dvije složenije situacije

Od Gračaca do Udbine i natrag: Snijeg je počeo padati u t_0 sati ujutro, stalnim intenzitetom a [m/h]. Ralica kreće iz Gračaca u t_s sati i poznato je da do $t_1 > t_0$ sati prevali $x_1 > 0$ kilometara. Kad stigne do Udbine, vozač ode nešto pojesti, da bi nakon $T \geq 0$ [h] vremena ponovo krenuo put Gračaca. Modelirajte i vizualizirajte kretanje ralice.

Model: Ako je $x_1(t)$ put koji ralica prevali u smjeru Udbine, a $x_2(t)$ put koji ista ralica prevali

u smjeru Gračaca, imamo da je $x_i'(t) = \frac{k}{h(t)} \cdot \left(1 - \frac{x_i'(t)}{v_0}\right)$, $i=1,2$. Slično kao u analizi

Klamkinova modela, ovdje je zgodnije umjesto $x_i(t)$ razmatrati $t_i(x)$. U slučaju da je $t_0 \leq t_s$,

gibanje ralice opisano je jednačbama $t_1'(x) = \frac{h(t_1(x))}{k} + \frac{1}{v_0}$, gdje je

$$h(t_1(x)) = \begin{cases} 0, & \text{za } t_1(x) < t_0 \\ a(t_1(x) - t_0), & \text{za } t_0 \leq t_1(x) \end{cases}, \quad t_1(0) = t_s, \quad t_2'(x) = \frac{a}{k}(t_2(x) - t_1(35 - x)),$$

$t_2(0) = t_1(35) + T$. Na slici 7 je WM program korišten za vizualizaciju, a na slici 8 vidi se njegov rezultat za slučaj da je granična brzina ralice $v_0 = 30$, $a = 0.02$, $t_0 = 6$, $t_s = 8$, $t_1 = 10$, $v_1 = 12$, $T = 2$.

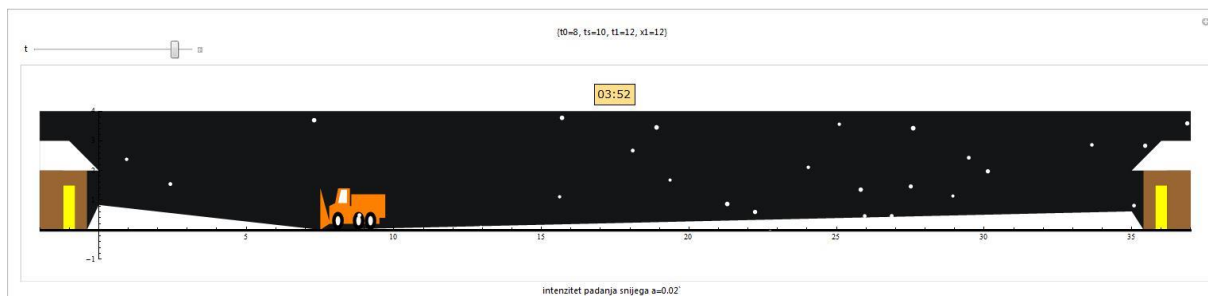
```
Clear["Global`*"]

f = Interpolation[{{1, 1, 1, 1, 0.9, 0.4, 0.2, 0.2, 0.1, 0.05, 0, 0, 0, 0, 0.05, 0.1, 0.2, 0.4, 0.8, 0.9, 1, 1, 1, 1}, InterpolationOrder -> 1];
v0 = Input["Maksimalna brzina v0 [km/h] ralice je..."];
t0 = Input["Vrijeme t0 u kojem je počeo padati snijeg je..."];
a = Input["Upišite intenzitet padanja snijega a=0 [m/h]"]; ts = Input["Vrijeme ts=t0 u kojem je ralica krenula je..."]; t1 = Input["Vrijeme t1=ts u kojem je dan uvjet je..."];
x1 = Input["Duljina dijela ceste x1 očišćena u vremenu t1 je..."]; T = Input["Vrijeme T [h] u kojem se vozač odmarā je..."];

sol1 = DSolve[{tt1'[z] == -\frac{a(tt1[z]-t0)}{k} + \frac{1}{30}, tt1[0] == ts}, tt1[z], z]; tt1[x_] := tt1[z] /. sol1[[1]];
sol2 = FindRoot[tt1[x1, k] == t1, {k, 1}]; k = k /. sol2[[1]]; tt1[x_] := tt1[x, k]; t2 = tt1[35];
sol3 = DSolve[{x'[t] == -\frac{k(30-x'[t])}{30a(t-t0)}, x[ts] == 0}, x[t], t]; x[t_] = Re[x[t]] /. sol3[[1]];

If[ts < t0, x[t] = v0 (ts - t0) + x[t]; sol4 = DSolve[{tt2'[y] == -\frac{a(tt2[y]-tt1[y])}{k} + \frac{1}{30}, tt2[0] == t2}, tt2[y], y];
tt2[y_] := tt2[y] /. sol4[[1]]; tt2[y_] := tt2[35 - y]; t3 = tt2[0];
h1[x_, t_] = Piecewise[{{0, xx < 0 || xx > 35 || tt < t0}, {a (tt - t0), 0 ≤ xx ≤ 35 && t0 ≤ tt < ts},
{a (tt - t0), 0 ≤ xx ≤ 35 && ts ≤ tt < tt1[xx]}, {a (tt - tt1[xx]), 0 ≤ xx ≤ 35 && tt1[xx] ≤ tt < t2},
{a (tt - tt1[xx]), 0 ≤ xx ≤ 35 && t2 ≤ tt < tt2[xx]}, {a (tt - tt2[xx]), 0 ≤ xx ≤ 35 && tt2[xx] ≤ tt}}];
sol5 = NDSolve[{y'[t] == -\frac{k(30-y'[t])}{a(t-tt1[y[t])30}, y[t2+T] == 0}, y, {t, t2+T-20, t3+10}]; y[t_] = y[t] /. sol5[[1]]; y[t_] = 35 - y[t];
z[t_] = Piecewise[{{x[t], ts ≤ t < t2}, {35, t2 ≤ t < t2+T}, {y[t], t2+T ≤ t ≤ t3}}];
Manipulate[Show[Graphics[{{Darker[LightBlue, f[Mod[t, 24] + 1]}, Polygon[{{-2, 0}, {37, 0}, {37, 4}, {-2, 4}, {-2, 0}}],
Yellow, Polygon[{{-1.2, 0}, {-1.2, 1.5}, {-0.8, 1.5}, {-0.8, 0}, {-1.2, 0}}],
Yellow, Polygon[{{36.2, 0}, {36.2, 1.5}, {35.8, 1.5}, {35.8, 0}, {36.2, 0}}],
Brown, Polygon[{{-1.3, 1.5}, {-0.8, 1.5}, {-0.8, 0}, {-0.4, 0}, {-0.4, 2}, {-1.3, 2}, {-1.3, 1.5}}],
Brown, Polygon[{{36.3, 1.5}, {35.8, 1.5}, {35.8, 0}, {35.4, 0}, {35.4, 2}, {36.3, 2}, {36.3, 1.5}}],
Black, Thickness[.002], Line[{{-2, -0.02}, {37, -0.02}}],
White, Polygon[{{-0.4, 0}, {z[t], 0}, {0, h1[0, t]}, {-0.4, 0}}],
Orange, Polygon[{{x[t], -1.8, 0.2}, {x[t], -0.3, 0.2}, {x[t], 0}, {x[t], 1.4}, {x[t], -0.3, 0.3}, {x[t], -0.3, 0.8}, {x[t], -0.5, 0.9}, {x[t], -0.6, 1.4},
{x[t], -1, 1.4}, {x[t], -1, 0.8}, {x[t], -1.05, 0.8}, {x[t], -1.05, 1.2}, {x[t], -2.2, 1.2}, {x[t], -2.2, 0.4}, {x[t], -2, 0.4}, {x[t], -2, 0.2}}],
Orange, Polygon[{{y[t], 1.8, 0.2}, {y[t], 0.3, 0.2}, {y[t], 0}, {y[t], 1.4}, {y[t], 0.3, 0.3}, {y[t], 0.3, 0.8}, {y[t], 0.5, 0.9}, {y[t], 0.6, 1.4},
{y[t], 1, 1.4}, {y[t], 1, 0.8}, {y[t], 1.05, 0.8}, {y[t], 1.05, 1.2}, {y[t], 2.2, 1.2}, {y[t], 2.2, 0.4}, {y[t], 2, 0.4}, {y[t], 2, 0.2}}],
White, Polygon[{{x[t], 0}, {35.4, 0}, {35, h1[35, t]}, {z[t], h1[x[t], t]}, {z[t], 0}}],
Black, Disk[{x[t], -1.7, 0.3}, {0.2, 0.3}], Disk[{x[t], -1.3, 0.3}, {0.2, 0.3}], Disk[{x[t], -0.6, 0.3}, {0.2, 0.3}], White,
Polygon[{{x[t], -0.9, 0.9}, {x[t], -0.6, 0.9}, {x[t], -0.7, 1.35}, {x[t], -0.9, 1.35}], Disk[{x[t], -1.7, 0.3}, {0.08, 0.16}], Disk[{x[t], -1.3, 0.3}, {0.08, 0.16}],
Disk[{x[t], -0.6, 0.3}, {0.08, 0.16}], Black, Disk[{y[t], 1.7, 0.3}, {0.2, 0.3}], Disk[{y[t], 1.3, 0.3}, {0.2, 0.3}], Disk[{y[t], 0.6, 0.3}, {0.2, 0.3}],
White, Polygon[{{y[t], 0.9, 0.9}, {y[t], 0.6, 0.9}, {y[t], 0.7, 1.35}, {y[t], 0.9, 1.35}], Disk[{y[t], 1.7, 0.3}, {0.08, 0.16}], Disk[{y[t], 1.3, 0.3}, {0.08, 0.16}],
Disk[{y[t], 0.6, 0.3}, {0.08, 0.16}], Lighter[Red, Clip[8 a (t - t0)], Polygon[{{-2, 2}, {0, 2}, {-1, 3}, {-2, 3}, {-2, 3}}, Lighter[Red, Clip[8 a (t - t0)],
Polygon[{{37, 2}, {35, 2}, {36, 3}, {37, 3}, {37, 3}],
Brown, Polygon[{{-2, 0}, {-1.2, 0}, {-1.2, 2}, {-2, 2}, {-2, 0}}],
Brown, Polygon[{{37, 0}, {36.2, 0}, {36.2, 2}, {37, 2}, {37, 0}], Table[{White, Disk[{RandomReal[{-2, 37}], RandomReal[4]}, RandomReal[{0.05, 0.08}]}], {30}]]],
PlotRange -> {{-2, 37}, {-1, 4}}, Axes -> True, ImageSize -> 1450,
PlotLabel -> Style[Framed[DateString[{0, 0, Floor[t], 60 (t - Floor[t]), 0}, {"Hour24", ":", "Minute"}]], 14, "Label", Background -> RGBColor[1, .875, .537]], ImageMargins -> 8],
{{t, ts, "t"}, ts, t3, 0.001],
FrameLabel -> {StringForm["intenzitet padanja snijega a="], a}, {"", {StringForm["t0="], t0}, StringForm["ts="], ts}, StringForm["t1="], t1}, StringForm["x1="], x1]]]
```

Slika 7 – WM program za vizualizaciju modela problema ralice koja se vraća



Slika 8 – WM simulacija modela problema ralice koja se vraća

Problem dviju snježnih ralica: Snijeg je počeo padati u t_0 sati ujutro, stalnim intenzitetom a [m/h]. Prva ralica kreće iz Gračaca u t_s sati i poznato je da do $t_1 > t_0$ sati prevali $x_1 > 0$ kilometara. $T \geq 0$ [h] vremena nakon polaska prve ralice, iz Udbine kreće druga ralica, u smjeru prve ralice. Modelirajte i vizualizirajte kretanje ralica.

Model: Ako je $x_1(t)$ put koji prva ralica prevali u smjeru Udbine, a $x_2(t)$ put koji druga ralica prevali u smjeru Gračaca, označimo li opet imamo da je $x_i'(t) = \frac{k}{h(t)} \cdot \left(1 - \frac{x_i'(t)}{v_0}\right)$, $i = 1, 2$.

U slučaju da je $t_0 \leq t_s$, gibanje ralica opisano je s $t_1'(x) = \frac{h(t_1(x))}{k} + \frac{1}{v_0}$, gdje je

$$h(t_1(x)) = \begin{cases} 0, & \text{za } t_1(x) < t_0 \\ a(t_1(x) - t_0), & \text{za } t_0 \leq t_1(x) \end{cases}, \quad t_1(0) = t_s, \quad t_2'(x) = \frac{h(t_2(x))}{k} + \frac{1}{v_0},$$

$$h(t_2(x)) = \begin{cases} a(t_2(x) - t_0), & \text{za } t_2(x) < t_2 \\ a(t_2(x) - t_1(35 - x)), & \text{za } t_2 \leq t_2(x) \end{cases}, \quad t_2(0) = t_s + T, \quad \text{gdje je } t_2 \text{ numeričko rješenje}$$

jednadžbe $x_1(t) = 35 - x_2(t)$.

Na slici 9 je WM program korišten za vizualizaciju, a na slici 10 vidi se njegov rezultat za slučaj da je granična brzina ralice $v_0 = 30$, $a = 0.02$, $t_0 = 6$, $t_s = 8$, $t_1 = 10$, $x_1 = 12$.

```
Clear["Global`*"]

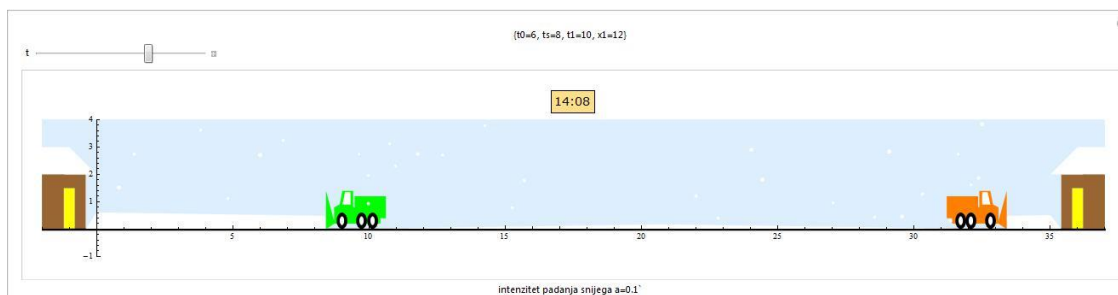
f = Interpolation[{{1, 1, 1, 1, 0.9, 0.4, 0.2, 0.2, 0.1, 0.05, 0, 0, 0, 0, 0.05, 0.1, 0.2, 0.4, 0.8, 0.9, 1, 1, 1, 1}, InterpolationOrder -> 1];
v0 = Input["Maksimalna brzina v0 [km/h] ralice je..."]; t0 = Input["Vrijeme t0 u kojem je počeo padati snijeg je..."];
a = Input["Opisite intenzitet padanja snijega a=0 [m/h]"]; ts = Input["Vrijeme ts=t0 u kojem je ralica krenula je..."];
t1 = Input["Vrijeme t1=ts u kojem je dan uvjet je..."]; x1 = Input["Duljina dijela ceste x1 očišćena u vremenu t1 je..."];
T = Input["Vrijeme T koje protekne između polaska prve i druge ralice je..."];

sol1 = DSolve[{tt1'[z] == \frac{a (tt1[z] - t0)}{k} + \frac{1}{30}, tt1[0] == ts}, tt1[z], z]; tt1[x_] = tt1[z] /. sol1[[1]]; sol2 = FindRoot[tt1[x1] == t1, {k, 1}];
k = k /. sol2[[1]]; tt1[x_] = tt1[x, k]; sol3 = DSolve[{tt2'[z] == \frac{a (tt2[z] - t0)}{k} + \frac{1}{30}, tt2[0] == ts + T}, tt2[z], z]; tt2[x_] = tt2[z] /. sol3[[1]];
sol6 = FindRoot[tt1[xx] == tt2[35 - xx], {xx, 12}]; xx = xx /. sol6[[1]]; t2 = tt1[xx];
sol7 = DSolve[{tt12'[x] == \frac{a (tt12[x] - tt2[35 - x])}{k} + \frac{1}{30}, tt12[xx] == t2}, tt12[x], x]; tt12[x_] = tt12[x] /. sol7[[1]];
sol8 = DSolve[{tt22'[y] == \frac{a (tt22[y] - tt1[35 - y])}{k} + \frac{1}{30}, tt22[35 - xx] == t2}, tt22[y], y]; tt22[y_] = tt22[y] /. sol8[[1]];

t3 = tt12[35]; t4 = tt22[35]; tt1[x_] = Piecewise[{{tt1[x], x < xx}, {tt12[x], x >= xx}}]; tt2[y_] = Piecewise[{{tt2[y], y < 35 - xx}, {tt22[y], y >= 35 - xx}}];
x[t_] = InverseFunction[tt1][t]; y[t_] = 35 - InverseFunction[tt2][t];
h[x_, t_] = Piecewise[{{0, x < 0 || x > 35 || t < t0}, {a (t - t0), 0 <= x <= 35 && t0 <= t <= ts}, {a (t - t0), 0 <= x <= xx && ts < t <= tt1[x]}, {a (t - tt1[x]), 0 <= x <= xx && tt1[x] < t <= t2},
{a (t - t0), xx < x <= 35 && ts <= t <= T}, {a (t - t0), xx < x <= 35 && ts + T < t <= tt2[35 - x]},
{a (t - tt2[35 - x]), xx < x <= 35 && tt2[35 - x] < t <= t2}, {a (t - tt1[x]), 0 <= x <= xx && t2 < t <= tt2[35 - x]}, {a (t - tt2[35 - x]), 0 <= x <= xx && tt2[35 - x] < t},
{a (t - tt2[35 - x]), xx < x <= 35 && t2 < t <= tt1[x]},
{a (t - tt1[x]), xx < x <= 35 && tt1[x] < t}}];

Manipulate[Show[Graphics[{{Darker[LightBlue, f[Mod[t, 24] + 1]}, Polygon[{{-2, 0}, {37, 0}, {37, 4}, {-2, 4}, {-2, 0}}],
Yellow, Polygon[{{-1.2, 0}, {-1.2, 1.5}, {-0.8, 1.5}, {-0.8, 0}, {-1.2, 0}}],
Yellow, Polygon[{{36.2, 0}, {36.2, 1.5}, {35.8, 1.5}, {35.8, 0}, {36.2, 0}}],
Brown, Polygon[{{-1.3, 1.5}, {-0.8, 1.5}, {-0.8, 0}, {-0.4, 0}, {-0.4, 2}, {-1.3, 2}, {-1.3, 1.5}}],
Brown, Polygon[{{36.3, 1.5}, {35.8, 1.5}, {35.8, 0}, {35.4, 0}, {35.4, 2}, {36.3, 2}, {36.3, 1.5}}],
Black, Thickness[.002], Line[{{-2, -0.02}, {37, -0.02}}], White,
If[t < t2, Polygon[{{Max[Min[x[t], y[t]], 0], 0}, {Min[Max[x[t], y[t]], 35], 0}, {Min[Max[x[t], y[t]], 35], h[Min[Max[x[t], y[t]], 35], t]},
{Max[Min[x[t], y[t]], 0], 0}, {h[Max[Min[x[t], y[t]], 0], t]}, {Max[Min[x[t], y[t]], 0], 0}}],
Polygon[{{Max[Min[x[t], y[t]], 0], 0}, {Min[Max[x[t], y[t]], 35], 0}, {Min[Max[x[t], y[t]], 35], h[Min[Max[x[t], y[t]], 35], t]},
{Max[Min[x[t], y[t]], 0], 0}, {Max[Min[x[t], y[t]], 0], h[Max[Min[x[t], y[t]], 0], t}}],
If[t < t2, Polygon[{{-0.4, 0}, {Min[x[t], y[t]], 0}, {0, h[0, t]}, {-0.4, 0}},
Polygon[{{-0.4, 0}, {Min[x[t], y[t]], 0}, {Min[x[t], y[t]], h[Min[x[t], y[t]], t]}, {0, h[0, t]}, {-0.4, 0}}, ],
If[t < t2, Polygon[{{35.4, 0}, {35, h[35, t]}, {Min[Max[x[t], y[t]], 35], 0}, {Min[Max[x[t], y[t]], 35], 0}, {35.4, 0}},
Polygon[{{35.4, 0}, {Min[Max[x[t], y[t]], 35], 0}, {Min[Max[x[t], y[t]], 35], h[Min[Max[x[t], y[t]], 35] + 0.01, t]}, {35, h[35, t]}, {35.4, 0}}], Orange,
Polygon[{{x[t] - 1.8, 0.2}, {x[t] - 0.3, 0.2}, {x[t], 0}, {x[t], 1.4}, {x[t] - 0.3, 0.3}, {x[t] - 0.3, 0.8}, {x[t] - 0.5, 0.9}, {x[t] - 0.6, 1.4}, {x[t] - 1, 1.4},
{x[t] - 1, 0.8}, {x[t] - 1.05, 0.8}, {x[t] - 1.05, 1.2}, {x[t] - 2.2, 1.2}, {x[t] - 2.2, 0.4}, {x[t] - 2, 0.4}, {x[t] - 2, 0.2}},
Green, Polygon[{{y[t] + 1.8, 0.2}, {y[t] + 0.3, 0.2}, {y[t], 0}, {y[t], 1.4}, {y[t] + 0.3, 0.3}, {y[t] + 0.3, 0.8}, {y[t] + 0.5, 0.9}, {y[t] + 0.6, 1.4},
{y[t] + 1, 1.4}, {y[t] + 1, 0.8}, {y[t] + 1.05, 0.8}, {y[t] + 1.05, 1.2}, {y[t] + 2.2, 1.2}, {y[t] + 2.2, 0.4}, {y[t] + 2, 0.4}, {y[t] + 2, 0.2}}, Black,
Disk[{x[t] - 1.7, 0.3}, {0.2, 0.3}], Disk[{x[t] - 1.3, 0.3}, {0.2, 0.3}], Disk[{x[t] - 0.6, 0.3}, {0.2, 0.3}], White,
Polygon[{{x[t] - 0.9, 0.9}, {x[t] - 0.6, 0.9}, {x[t] - 0.7, 1.35}, {x[t] - 0.9, 1.35}}, Disk[{x[t] - 1.7, 0.3}, {0.08, 0.16}], Disk[{x[t] - 1.3, 0.3}, {0.08, 0.16}],
Disk[{x[t] - 0.6, 0.3}, {0.08, 0.16}],
Black, Disk[{y[t] + 1.7, 0.3}, {0.2, 0.3}], Disk[{y[t] + 1.3, 0.3}, {0.2, 0.3}], Disk[{y[t] + 0.6, 0.3}, {0.2, 0.3}], White,
Polygon[{{y[t] + 0.9, 0.9}, {y[t] + 0.6, 0.9}, {y[t] + 0.7, 1.35}, {y[t] + 0.9, 1.35}}, Disk[{y[t] + 1.7, 0.3}, {0.08, 0.16}], Disk[{y[t] + 1.3, 0.3}, {0.08, 0.16}],
Disk[{y[t] + 0.6, 0.3}, {0.08, 0.16}], Lighter[Red, Clip[8 a (t - t0)]]], Polygon[{{-2, 2}, {0, 2}, {-1, 3}, {-2, 3}, {-2, 3}}, Lighter[Red, Clip[8 a (t - t0)]]],
Polygon[{{37, 2}, {35, 2}, {36, 3}, {37, 3}, {37, 3}},
Brown, Polygon[{{-2, 0}, {-1.2, 0}, {-1.2, 2}, {-2, 2}, {-2, 0}}], Brown, Polygon[{{37, 0}, {36.2, 0}, {36.2, 2}, {37, 2}, {37, 0}}],
Table[White, Disk[RandomReal[{-2, 37}], RandomReal[4]], RandomReal[{0.05, 0.08}]], {30} ]], PlotRange -> {{-2, 37}, {-1, 4}}, Axes -> True, ImageSize -> 1250,
PlotLabel -> Style[Framed[DateString[{0, 0, Floor[t], 60 (t - Floor[t]), 0}, {"Hour24", ":", "Minute"}]], 14, "Label", Background -> RGBColor[1, .875, .537]], ImageMargins -> 8],
{{t, ts, "t"}, ts, t4, 0.001],
FrameLabel -> {StringForm["intenzitet padanja snijega a="], a, "", {StringForm["t0="], t0, StringForm["ts="], ts, StringForm["t1="], t1, StringForm["x1="], x1}}]
```

Slika 9 – WM program za vizualizaciju modela dviju ralica



Slika 10 – WM simulacija modela dviju ralica

6. Zaključak

Treba uočiti da se zadani problem rješava matematičkim modeliranjem, ali da računalna simulacija donosi sasvim novu kvalitetu: ona vizualizira problem, omogućava proučavanje alternativnih scenarija promjenom vrijednosti parametara, kao i eksperimentiranje s promjenom postavki. Sve ovo pobuđuje zanimanje studenata i otvara neslućene mogućnosti za nastavu i istraživanje. To će još više doći do izražaja u narednim godinama, kako programi za računanje i simulaciju budu još snažniji i pristupačniji.

Idući korak u našem zamišljenom kolegiju predstavljalo bi samostalno zadavanje i razrada problema. Primjerice, evo nekih pravaca razmišljanja koji bi se u opisanom problemu mogli ostaviti studentima za samostalni rad:

1. Računalno vizualizirati originalni Klamkinov model problema triju ralica.
2. Modificirati originalni Klamkinov model, računalno ga vizualizirati i usporediti rezultate.
3. Što bi se u Klamkinovu problemu triju ralica dogodilo nakon trenutka kad se ralice susretnu? Čiste li ralice tada trostruko efikasnije ili smetaju jedna drugoj? Kako bi mogle nesmetano čistiti zajedno? Koji je granični broj ralica nakon kojeg nove ralice postaju smetnja?
4. Realizirati model i računalnu simulaciju ralice koja stalno ide od Gračaca prema Udbini i natrag.
5. Na istu cestu pustiti više ralica, koje se kreću pravilnim ili nepravilnim ritmom, modelirati i vizualizirati. Razmotriti rekurzivne formule za n ralica.
6. Uvesti “dispečera” koji pokreće i zaustavlja ralice klikom miša. Postoji li neka optimalna strategija čišćenja? Kako ocijeniti optimalnost strategije?
7. Razmotriti i vizualizirati modele koji bi opisivali situacije s promjenjivim intenzitetom padanja snijega ili različite dubine snijega u startu te situaciju kad snijeg počinje ili prestaje padati na klik miša.
8. Razmotriti i vizualizirati drugačije (primjerice, fizikalne) modele kretanja ralice kroz snijeg.
9. Razmisliti može li se koji od korištenih modela upotrijebiti za rješavanje nekog drugog problema: na primjer, može li model gibanja snježne ralice poslužiti za modeliranje dinamike rješavanja predmeta na sudu opterećenom velikim zaostacima?

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Snow plow problem: a new approach - modeling and visualization

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Abstract. The snow plow problem, usually attributed to R. P. Agnew is a classic introductory problem in the textbooks of ordinary differential equations. It has several variants, including The great snow plow chase problem by M. S. Klamkin. After investigating the problems, the paper discusses some shortcomings of the classical model and proposes different approaches. The software package Wolfram Mathematica is used for the visualization, verification and generalization of the results.

Key words: *snow plow problem, ordinary differential equations, modeling, visualization, Wolfram Mathematica*

Teškoće u savladavanju i upotrebi engleskog jezika za posebne namjene

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Sažetak. Zadnjih dvadeset godina raste svijest o važnosti usvajanja leksičkih kolokacija u učenju stranog jezika. Kolokacijska se kompetencija očituje u upotrebi kombinacija riječi koje se na sintagmatskoj razini pojavljuju zajedno i pri tome ulaze u različite semantičke odnose. Svojom kolokacijskom kompetencijom izvorni govornici prepoznaju kolokacije, dok neizvorni korisnici kolokacijsko slaganje moraju učiti, te nije dovoljno usvojiti samo značenje riječi nego i njen kolokacijski raspon. Kolokacije predstavljaju veliki problem za neizvorne korisnike zbog utjecaja materinskog jezika. Ovo se istraživanje bavi glagolskim kolokacijama engleskog jezika medicinske struke, najčešćim greškama u njihovoj upotrebi, percepcijom studenata o načinu na koji najčešće usvajaju kolokacije te pojavljuju li se greške češće na receptivnoj ili produktivnoj razini.

Ključne riječi: kolokacije, kolokacijska kompetencija, medicinski engleski, studenti

1. Uvod

Poznavanje engleskog jezika medicinske struke je od presudne važnosti za praćenje razvoja medicine znajući da je gotovo cjelokupna medicinska literatura napisana na engleskom jeziku i da je službeni jezik većine medicinskih konferencija engleski. Višerječne jedinice, koje uključuju kolokacije, imaju vrlo značajnu ulogu i u učenju i u upotrebi jezika (Nation i Webb, 2011). Veliki dio engleskog jezika s kojim se učenici susreću i koriste u stvarnom engleskom se sastoji od takvih leksičkih isječaka (Biber, Conrad i Cortes, 2004. u Phoocharoensil, 2014). Iz ovog proizlazi da učeničko razumijevanje i produkcija engleskog kao stranog jezika mogu biti olakšani znanjem višerječnih jedinica. Inkorporiranje kolokacija u nastavne planove i programe engleskog jezika je sada i u budućnosti neizbježno; štoviše, istraživanje višerječnih jedinica će, prema Nation i Webbu i dalje biti središnji dio istraživanja izrade kurikulumu i teorije i prakse učenja jezika (Phoocharoensil, 2014).

2. Teorijski okvir

2.1. Definicija i klasifikacija kolokacija

J. R. Firth je prvi put upotrijebio termin kolokacija pedesetih godina prošlog stoljeća. Firth (1957) kolokaciju ne smatra samo jednom razinom značenja, već i sintagmatskom kombinacijom dviju riječi. Ivir pojam kolokacije definira kao susmjestaj (prema latinskom *com* 'zajedno' + *locare* 'smjestiti'), odnosno suprotstavljavanje ili kombiniranje riječi u sintagmatskome nizu (Ivir, 1992–1993). „U literaturi prevladava binarni pristup raščlanjivanju kolokacijske sveze na njezine sastavnice, prema kojemu se razlikuje glavna sastavnica čiji se značenjski potencijal prilagođuje značenjskomu potencijalu promjenjivih sastavnica s kojima

tvori svezu. Ustaljeni i najfrekventniji naziv za promjenjivu sastavnicu jest kolokat“ (Siepmann i dr. u Blagus Bartolec, 2012). Hausmann (1984) je prvi uveo nazive baza i kolokator za jedinice koje tvore kolokaciju, a koji se koriste još i danas. Podjela kolokacije na njezine sastavnice bitna je i za klasifikaciju strukture kolokacija koja se može odrediti prema gramatičkoj strukturi ili prema vrsti riječi kojoj pripada baza. Uvriježena strukturna klasifikacija kolokacija je Bensonova (Benson prema Stojić i Murica, 2010). Temelji se na vrsti riječi koja dominira u kolokacijskoj svezi. Benson tako razlikuje gramatičke i leksičke kolokacije. Gramatičkim kolokacijama smatra sveze riječi koje se sastoje od dominirajućega dijela (glagola, imenice ili pridjeva) i podređenog dijela (prijedloga), a leksičkim kolokacijama one sastavljene od dviju ravnopravnih leksičkih jedinica (Benson u Stojić i Murica, 2010). Najvažnije leksičke kolokacije su pridjev + imenica, imenica + glagol, glagol + imenica, prilog + pridjev i glagol + prilog. Rečenice, infinitivi ili prijedlozi obično nisu među njima (Duplančić Rogošić, 2014).

2.2. Važnost kolokacija u usvajanju jezika

Pri usvajanju jezika upotreba kolokacija predstavlja poseban problem za neizvorne korisnike zbog oslanjanja na materinski jezik. Istraživanje je pokazalo da su pogreške u kolokacijama među najučestalijim pogreškama neizvornih korisnika.

NAJOZBILJNIJE:

Rječnik > pisanje > negacija > redoslijed riječi > prijedlozi >

NAJMANJE OZBILJNE:

glagolski oblici > slaganje

Hijerarhija grešaka prema McCretton and Rider. Preuzeto od James (1998, p. 229)

Prema McCrettonu i Rideru (Sl.1) leksičke greške su najozbiljnije. „Govornika se može razumjeti ako upotrijebi krivo vrijeme, ali upotreba krive riječi može izazvati nerazumjevanje“ (McCretton i Rider u James, 1998). Neizvorni korisnik mora prepoznati kolokaciju kao vezanu sintagmu da bi izbjegao prevođenje svake pojedinačne sastavnice ili istovjetne strukture u materinskome jeziku. Nepostojanje kolokacijske kompetencije dovodi do pogrešaka jer načelna sloboda biranja riječi u svakome jeziku podliježe raznim leksičkim i morfosintaktičkim selekcijskim ograničenjima, što implicira da nije dovoljno učiti pojedine riječi, već i kolokacijski sklop (Stojić i Murica, 2010). Neizvorni korisnici ponekad tvore kombinacije leksičkih jedinica koje zvuče neprirodno i pogrešno izvornom govorniku, pa ako nisu upoznati s pojmom kolokacija i sa svim posebnostima vezanima za njihovo uspješno prevođenje, napraviti će pogreške koje ponekad zvuče smiješno (Leonardi, 2000). To je razlog zbog kojeg je Hill (1999) predložio termin „kolokacijska kompetencija“ i insistirao na usvajanju rječnika ne samo učenjem značenja riječi, već i njenog kolokacijskog raspona.

2.3. Prethodna relevantna istraživanja o usvajanju engleskih kolokacija u stranom jeziku

Mnogi istraživači su proučavali kolokacijsku kompetenciju kao važnu komponentu usvajanja vokabulara. Brashi (2012) je u svom istraživanju pokazao da ispitanici postižu bolje rezultate u receptivnim vještinama slušanja i čitanja, dok je u produktivnim vještinama govora i pisanja upotreba širokog raspona kolokacija uglavnom ograničena. To je razlog zašto je to jedno od područja kojem je potrebno pokloniti više pažnje u istraživanju i nastavi.

Glavni problem leži, dakle, ne samo u razumijevanju značenja kolokacija, već i u njihovoj sposobnosti da ih koriste na odgovarajući način u pisanju i govoru. Čini se da je transfer s materinskog jezika najvažniji faktor kolokacijskih pogrešaka. Studenti uvelike ovise o kolokacijskim uzoracima iz njihovog materinskog jezika i oslanjaju se na sinonimiju i poopćenje Phoocharoensil (2014). Antle (2013) uspoređuje učenje vokabulara individualnim riječima sa učenjem vrlo učestalih glagolskih kolokacija. Rezultati su pokazali da studenti percipiraju učenje vokabulara putem kolokacija mnogo korisnijim. Henriksen (2013) napominje kako bi učenici trebali biti dovoljno izloženi kolokacijama da bi stvarali, jačali i

održavali asocijativne veze između sastavnih dijelova, što uglavnom nije slučaj. Laufer i Waldman (2011) u svom istraživanju pokazuju da skoro polovina pogrešnih kolokacija proizlazi iz utjecaja materinskog jezika te da se te greške ne smanjuju tijekom učenja.

Među istraživanjima nema puno onih koje se bave kolokacijama u engleskom jeziku medicinske struke. U Hrvatskoj se Pavičić Takač i Miščin (2014) u svom istraživanju bave leksemima engleskoga jezika medicinske struke i njihovim glagolskim kolokatima. Različite grupe neizvornih korisnika engleskog jezika medicinske struke, studenti medicine i liječnici, su rješavale zadatke na receptivnoj i produktivnoj razini. Bolji rezultati su sveukupno postignuti na receptivnoj razini, a liječnici su pokazali veći nivo znanja kolokacija na produktivnoj razini od studenata, što autorice objašnjavaju duljom i intenzivnijom izloženosti medicinskom engleskom jeziku pisanjem i čitanjem stručnih članaka neophodnim za njihov profesionalni razvoj i zaključuju da se poznavanje kolokacija povećava kontinuiranom i aktivnom upotrebom medicinskog engleskog jezika.

3. Istraživanje

3.1. Ispitanici

Ispitanici su bili redoviti studenti pete i šeste godine studija medicine Medicinskog Fakulteta Sveučilišta u Splitu akademske godine 2014/2015. Sudjelovalo su 84 ispitanika. Predmet medicinski engleski jezik je obavezan za sve studente bez obzira na duljinu prethodnog učenja. Broj godina učenja je prikazan u tablici 1.

Tablica 1. *Broj godina učenja engleskoga jezika*

Godine učenja	N	%
0 – 4	3	3,6
5 – 10	32	38,1
11 – 15	42	50
16 – 20	7	8,3
Ukupno	84	100,0

Studenti imaju po 20 sati nastave medicinskog engleskog jezika na svakoj od 6 godina studija. Izabrani su studenti završnih godina kako bi se provjerilo stečeno znanje kolokacija. Tijekom nastave prepoznavali su kolokacije u izabranim nastavnim tekstovima te ih upotrebljavali u simuliranim situacijama.

3.2. Cilj istraživanja

Glavni cilj ovog istraživanja je istražiti razinu kolokacijske kompetencije studenata 5. i 6. godine medicine. U skladu s tim postavljena su ova istraživačka pitanja:

Koje se greške najčešće pojavljuju u upotrebi kolokacija u engleskom jeziku medicinske struke? Pojavljuju li se greške češće na receptivnoj ili produktivnoj razini?

Kakva je percepcija studenata o načinu na koji najčešće usvajaju kolokacije?

3.3. Instrument

Instrument mjerenja kolokacijske kompetencije ispitanika bio je test s dva zadatka i upitnikom. Informacije o testu su bile na hrvatskom jeziku, a zadaci i upute za njihovo rješavanje na engleskom. Kolokacije su odabrane prema kriteriju njihovog pojavljivanja u nastavnim materijalima. Prvi zadatak sadržavao je deset pitanja i testirao je receptivnu razinu poznavanja kolokacija, a sastavljen je od pitanja višestrukog izbora. Drugi zadatak je također sadržavao

deset pitanja. Podijeljen je u dva dijela koja su provjeravala produktivnu razinu znanja, a činili su ih prijevod s hrvatskog na engleski jezik i s engleskog na hrvatski. Treći dio testa je bio upitnik na hrvatskom jeziku koji se sastojao od četiri čestice u kojima su studenti procjenjivali na Likertovoj skali od 1 do 5 (od 1 – nikad do 5 – uvijek) koliko često i na koji način smatraju da usvajaju kolokacije u engleskom jeziku medicinske struke.

3.4. Postupak

Testiranje je provedeno za vrijeme redovite nastave na Medicinskome fakultetu u Splitu. Nakon što je ispitanicima na hrvatskome jeziku objašnjen način rješavanja testa, imali su 30 minuta na raspolaganju za odgovore. Svaki točan odgovor je vrednovan jednim bodom. Svaka skupina zadataka je imala maksimalno 10 bodova, ukupno 20.

Točnim odgovorom priznavale su se kolokacije iz rječnika kolokacija (Oxford Collocations Dictionary, 2002) i Glosara najčešćih glagolskih kolokacija u engleskom jeziku medicinske struke (Miščin E., 2012). U prijevodu se pazilo na potertane kolokacije i nije se provjeravala točnost prijevoda ostalih dijelova rečenice već samo razina poznavanja kolokacija.

3.5. Analiza podataka

Rezultati testiranja analizirani su programom SPSS (Statistički paket za društvene znanosti, engl. Statistical Package for Social Sciences, version 20, pomoću kojeg je izvedena statistička analiza podataka (deskriptivna statistika i korelacija).

3.6. Rezultati i rasprava

Da bismo odgovorili na prvo istraživačko pitanje, analizirani su odgovori na postavljene zadatke. Rezultati su prikazani u tablicama 2., 3. i 4.

I. Zadatak višestrukog izbora

Ispitanici su dobili zadatak u kojem su u svakoj od 10 rečenica morali izabrati jedan od 3 ponuđena odgovora.

U tablici 2. predstavljeni su rezultati zadatka višestrukog izbora.

Tablica 2. Rezultati zadatka višestrukog izbora

Ciljana kolokacija	Hrvatski prijevod	Točno (%)	Najčešće pogreške
Establish the diagnosis	Postaviti dijagnozu	69	Make the diagnosis
Develop headache	Dobiti glavobolju	77,4	Acquire headache
Contract influenza	Dobiti gripu	53,6	Collect influenza
Excrete water	Izlučiti vodu	70,2	Evacuate water
Affect growth	Utjecati na rast	79,8	Disturb growth
Aggravate injury	Pogoršati ozljedu	56	Impair injury
Vomit blood	Povraćati krv	73,8	Throw up
Cause seizures	Izazvati epileptični napadaj	46,4	Provoke seizures
Feel the abdomen	Opipati trbuh	72,6	Palpitate
Provide relief	Pružiti olakšanje	76,2	Give relief

II. Zadaci s prijevodom

Studenti su dobili dva zadatka koji su provjeravali njihovo poznavanje kolokacija u engleskom jeziku medicinske struke i sposobnost točnog prevođenja na hrvatski jezik. U prvom su morali prevesti pet rečenica s engleskog na hrvatski, a u drugom s hrvatskog na engleski jezik. Studenti su upozoreni da pri prijevodu posebnu pažnju obrate na potcrtane kolokacije. Greške koje se nisu odnosile na kolokacije nisu analizirane.

Tablica 3. *Rezultati zadatka s prijevodom kolokacija s engleskoga na hrvatski jezik*

Ciljana kolokacija	Hrvatski prijevod	Točan prijevod	Najčešće pogreške	Ostali odgovori
Abort migraine headache	Zaustaviti migrenu	61,9%	Spriječiti migrenu 7%	Spriječiti migrenu, ublažiti migrenu, uzrokovati migrenu, omogućiti prestanak migrene, smanjiti migrenu, poništiti migrenu, izazvati migrenu, dovesti do prestanka migrene, prevenirati migrenu
Sustain a broken arm	Pretrpjeti prijelom ruke	6%	Slomiti ruku 40%	Zadobiti prijelom, zaraditi prijelom, završiti sa prijelomom
Release into the bloodstream	Otpustiti u krvotok	79,8%	Osloboditi u krvotok 2%	Lučiti u krvotok, povisiti u krvotoku, uzrokovati u krvotoku, poticati lučenje u krvotok, izazvati izlučivanje u krvotok, uzrokovati porast u krvotoku
Develop bedsores	Dobiti dekubitus	16,7%	Razviti dekubitus 60%	Javiti se, dobiti ozljede ležanja, oboliti od dekubitusa, osjećati se loše
Precipitate an attack	Ubrzati, pospješiti napad	4,8%	Uzrokovati napad 27%	Dovesti do napada, izazvati napad, prethoditi napadu, provocirati napad, <i>precipitirati</i> napad, ukazati na napad, pogodovati napadu, rizici napada, okidači napada,

Tablica 4. *Rezultati zadatka s prijevodom kolokacija s hrvatskog na engleski jezik*

Ciljana kolokacija	Engleski prijevod	Točan prijevod	Najčešće pogreške	Ostali odgovori
Suzbiti simptome	Suppress the symptoms	14,3%	Stop the symptoms 8%	Prevent the symptoms, abort the symptoms, decrease the symptoms, alleviate the symptoms, eliminate the symptoms, deprive of the symptoms, reduce the symptoms, provide relief, lower the symptoms

Podvrgnuti kirurškom zahvatu	Have / Undergo surgery	20,2%	Will be operated 9,6%	Undertake surgery, go on surgery, apply surgery, go under surgery, obtain surgery, set for surgic procedure, surgery will be made, will have surgery, will be subjected to surgery, will be taken to the operation, go through surgery, go to surgery, will be admitted for surgery
Nadražiti želudac	Irritate the stomach	14,3%	Upset the stomach 17,8%	Affect the stomach, cause nausea, provoke stomach, aggravate the stomach, cause sore stomach, harm the stomach, arouse the stomach, stomach is bad
Naškoditi fetusu	Harm a foetus	47,6%	Affect a foetus 8,3%	Damage a foetus, hurt a foetus, make trouble to a foetus, cause damage to a foetus
Naručiti ultrazvuk	Order ultrasound	57,1%	Request ultrasound 2,4%	Ask ultrasound, offer ultrasound, make ultrasound, ordinate ultrasound, receive ultrasound, schedule ultrasound, sign for ultrasound

Drugo istraživačko pitanje se odnosilo na učestalost grešaka na receptivnoj i produktivnoj razini. Tablica 5. pokazuje rezultate deskriptivne statistike za receptivnu, produktivnu i sveukupnu kolokacijsku kompetenciju

Tablica 5. Kolokacijska kompetencija

	Broj	Minimalna vrijednost %	Maksimalna vrijednost %	Srednja vrijednost %	Standardna devijacija
Receptivno znanje kolokacija	84	20	100	67,38	17,977
Produktivno znanje – prijevod na hrvatski jezik	84	0	80	33,81	16,998
Produktivno znanje – prijevod na hrvatski jezik	84	0	100	30,71	24,729
Produktivno znanje kolokacija – ukupno	84	0	80	31,90	17,526
UKUPNO	84	10	85	49,76	14,560

Ispitanici su postigli bolje rezultate na receptivnoj razini, na kojoj su trebali izabrati točnu kolokaciju između tri ponuđene. Ovi su rezultati kompatibilni s prethodnim istraživanjima (Brashi, 2012; Duplančić Rogošić, 2014; Pavičić Takač i Miščin, 2013) koja su također pokazala da je kolokacijska kompetencija ispitanika veća na receptivnoj razini. Ipak se mora naglasiti činjenica da su neki od odgovora mogli biti i slučajno pogodeni. Puno je teži zadatak za ispitanike predstavljao prijevod jer su trebali proizvesti točnu kolokaciju i na materinskom i na stranom jeziku. Strategije kojima su najčešće služili u situacijama kad nisu znali točan

odgovor su bile doslovan prijevod s prvog jezika i aproksimacija. Ispitanici su često pribjegavali doslovnom prijevodu kad se nisu mogli sjetiti odgovarajućeg glagola (npr. doslovni prijevod glagola develop kao razviti u kolokaciji develop bedsores – dobiti dekubitus), što su pokazala i prijašnja istraživanja (Laufer i Waldman, 2011; Phoocharoensil, 2014). Često su imali problema i u pronalaženju pravog kolokata u materinskom jeziku, npr. sustain a broken arm je kolokacija koja je zadala muke velikom broju studenata jer im nije bio poznat glagol sustain. Samo 6% ispitanika ga je točno prevelo, a 40% ih se fokusiralo na broken arm i cijelu kolokaciju prevelo sa slomiti ruku ili kolokacijama zadobiti, zaraditi prijelom. Ispitanici su se također služili aproksimacijom kad ne bi znali točan odgovor, tj. upotrijebili bi riječ sa sličnim značenjem (npr. upset umjesto irritate u kolokaciji irritate the stomach). Iako to može ponekad biti uspješno, istraživanja su pokazala manjkavosti takve strategije (Boonyasaquan, 2006; Howarth, 1996; 1998; Mongkolchai, 2008, u Phoocharoensil, 2014), jer među jezicima nema simetrije i često dolazi do udaljavanja od pravog značenja (Štefić i sur., 2010).

U nastavku će biti prikazani rezultati korelacijske analize koja je imala za cilj pokazati odnos između pokazanog receptivnog i produktivnog znanja.

Tablica 6. Vrijednosti Pearsonovih koeficijenata korelacije između receptivnog i produktivnog znanja kolokacija

	Receptivno znanje kolokacija	Produktivno znanje– prijevod na hrvatski jezik	Produktivno znanje – prijevod na engleski jezik
Receptivno znanje kolokacija	1	0,412 ^{xx}	0,191
Produktivno znanje – prijevod na hrvatski jezik		1	0,357 ^{xx}
Produktivno znanje – prijevod na engleski jezik			1

Napomena: ^{xx} $p < 0,01$

Studenti koji su postigli bolje rezultate u prevođenju kolokacija s engleskog jezika na hrvatski, pokazali su se uspješnijima i u prijevodima s hrvatskog na engleski jezik ($r=0,412$; $p<0,01$). Također, oni s boljim uspjehom u prevođenju kolokacija s engleskog na hrvatski jezik ostvarili su bolje rezultate i na receptivnoj razini u zadacima višestrukog izbora ($r=0,357$; $p<0,01$).

III. Percepcija ispitanika

U trećem zadatku ispitanici su procjenjivali na Likertovoj skali od 1 do 5 (1 – nikad, 2 – rijetko, 3 – ponekad, 4 – često, 5 – uvijek) koliko često i na koji način, po njihovom mišljenju, usvajaju kolokacije u engleskom jeziku medicinske struke. U tablici 7. su prikazane dobivene vrijednosti.

Tablica 7. Stavovi ispitanika o načinu usvajanja kolokacija

	Mean	Std. deviation	Minimum	Maximum
Pohađanjem kolegija medicinskog engleskog na fakultetu	2,89	2,07	2,52	3,46
Čitanjem obvezne ispitne literature	1,042	1,015	1,103	1,069

Čitanjem znanstvenih/ stručnih radova	1	1	1	1
Gledanjem tv sadržaja medicinske tematike	5	5	5	5

Prema mišljenju studenata, oni najčešće usvajaju kolokacije putem *gledanja tv sadržaja medicinske tematike*, a najrjeđe čitanjem obvezne ispitne literature. Mogući razlog ovakvim rezultatima leži u činjenici da je većina obvezne ispitne literature na hrvatskom jeziku, pa studenti nemaju dojam da na taj način usvajaju kolokacije. S druge strane, učestalost izloženosti tv sadržajima medicinske tematike ispitanici izjednačavaju s usvajanjem, tj. što više gledaju takve sadržaje, više imaju dojam da su naučili. Međutim, da to nije tako potvrđuju rezultati prema kojima su bili znatno uspješniji u rješavanju zadatka na receptivnoj razini znanja kolokacija u usporedbi sa produktivnom razinom.

Nadalje, u tablici 8. se nalaze rezultati povezanosti različitih razina poznavanja kolokacija s percepcijom ispitanika o načinu usvajanja.

Tablica 8. Vrijednosti Pearsonovih koeficijenata korelacije između rezultata na receptivnoj i produktivnoj razini i načina usvajanja kolokacija

	Receptivno znanje kolokacija	Produktivna razina – prijevod na hrvatski jezik	Produktivna razina – prijevod na engleski jezik
Pohađanjem kolegija medicinskog engleskog na fakultetu	0,002	0,003	-0,067
Čitanjem obvezne ispitne literature	0,024	-0,072	-0,021
Čitanjem znanstvenih/ stručnih radova	0,070	0,059	0,127
Gledanjem tv sadržaja medicinske tematike	0,120	-0,052	0,074

Napomena: ^{xx} $p < 0,01$

Iz tablice 8. se vidi da percepcija studenata o usvajanju kolokacija pohađanjem kolegija medicinskog engleskog jezika na fakultetu, čitanjem obvezne ispitne literature, čitanjem znanstvenih stručnih radova i gledanjem tv sadržaja medicinske tematike nije statistički značajno povezana s uspjehom ni na receptivnoj ni na produktivnoj razini. Ovakvi rezultati ukazuju na to da studente treba eksplicitno poučavati kolokacijama, upozoravati ih na mogućnost transfera elemenata iz materinskog jezika u strani i obrnuto te da sama izloženost kolokacijama nije preduvjet i njihovoga usvajanja.

4. Zaključak

Kolokacije često predstavljaju problem za neizvorne korisnike jezika. Učenje individualnih riječi i njihovog značenja nije dovoljno da bi se postigla fluentnost u stranom jeziku, potrebno je poznavati način na koji se riječi kombiniraju u leksičke isječke, jer što je riječnik bogatiji kolokacijama, veća je preciznost, točnost i vjerodostojnost govora (Martyńska, 2004). Rezultati ovog istraživanja su pokazali da se neizvorni govornici u upotrebi kolokacija jako oslanjaju na materinski jezik i upotrebu riječi sa sličnim značenjem. Nastava medicinskog engleskog se nije na Likertovoj skali pokazala kao najčešći oblik usvajanja medicinskih kolokacija, što implicira da se u upotrebi kolokacija uglavnom oslanjaju na već naučeno. Također se pokazalo da se s

godinama učenja ne poboljšava razina poznavanja kolokacija, što su potvrdila i druga istraživanja (Martynska, 2004; Phoocharoensil, 2014).

Od početka učenja medicinskog engleskog potrebno je postepeno uvoditi leksičke kolokacije i u materinskom i engleskom jeziku i pritom upozoravati studente na kolokacije koje su nespojive u oba jezika, komparirajući različite upotrebe istog para sinonima ukazujući na to da se riječi slične po značenju ne mogu upotrijebiti u svim kontekstima.

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Difficulties in mastering and using English for specific purposes

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Abstract. In the last two decades there has been a growing awareness of the importance of acquisition of lexical collocations in learning a foreign language. Collocational competence is evident in using combination of words that appear together on the syntagmatic level and thereby enter into various semantic relations. By their collocational competence native speakers recognize collocation, while non-native users must learn them. It is not enough to acquire only the meaning of the word but also its collocational span. Collocation is a big problem for non-native users due to the influence of their mother tongue. This research deals with verb collocations in English language of medical profession, the most common mistakes, perceptions of students about the way they usually acquire collocations and whether the mistakes appear more frequently at receptive or productive level.

Key words: *collocation, collocational competence, medical English, students*

**CIET
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Track 1

Finance & Accounting

Bank Liquidity Creation and Recessions

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Abstract. We investigate the relationship between bank liquidity creation and recessions in the U.S. For the 1984-2010 sample, we find that (i) bank on-balance sheet liquidity creation forecasts recessions four quarters into the future: lower on-balance sheet liquidity creation signals recessions; (ii) while off-balance sheet liquidity is not a robust predictor of recessions at higher forecast horizons, approximately one quarter prior to recessions, bank off-balance sheet liquidity creation falls in tandem with on-balance sheet liquidity creation, and hence aggregate of on- and offbalance sheet liquidity creation falls; (iii) aggregate, on- and off-balance sheet bank liquidity creation continue to decline during and up to five quarters after recessions; (iv) liquidity creation of larger banks rather than that of smaller ones contains more information about future recessions. The findings have important preemptive macro-prudential policy implications.

Keywords: *Treasury yield curve; Bank liquidity creation; Recessions; Financial Stability; Monetary Policy.*

JEL classification: E43; E47; E52; E58; G17; G18; G21; O40; O43

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1. Introduction

Accurately predicting the onset of recessions is important for households, investors, businesses and policymakers. Prior research has shown that economic and financial variables have significant forecasting power for recessions in the U.S. Estrella and Hardouvelis (1991) and Estrella and Mishkin (1998) have shown that the slope of the Treasury yield curve contains information about future recessions at horizons up to eight quarters into the future. In this paper, we concentrate on bank liquidity creation as a forecasting variable for recessions since monetary policy is one of the determinants of bank liquidity creation and of the slope of the Treasury yield curve. While banks play a central role in virtually all financial crises (e.g., Diamond and Rajan 2005), the existing banking literature does not investigate the relationship between bank liquidity creation and recessions. We find that bank liquidity creation contains information about the onset of the National Bureau of Economic Research (NBER) recessions, and it contracts up to four quarters prior to recessions and continue to fall for about five quarters

past recessions. We further show that bank liquidity creation significantly improves the ability of the slope of the Treasury yield curve to predict recessions.

The existing literature linking bank lending and economic activities find inconclusive evidence of a “credit crunch” (e.g., Bernanke and Lown 1991; Kashyap and Stein 1994). One of the reasons for the inconclusive results is that, for reputational reasons commercial banks act as a buffer for long-standing customers with pre-arranged credit lines, an off-balance sheet bank activity (e.g., Thakor 2005). Thus, the evidence in the literature suggests that we investigate the impact of bank off-balance sheet activities on the role of economic development. In particular, it is important that we investigate bank on-balance sheet activities prior to recessions since banks’ inability to manage their balance sheet is believed to be the root cause of the most recent financial crisis. However, to our knowledge, a comprehensive study on the relationship is rare.

Berger and Bouwman (2009) propose an innovative measure of bank liquidity creation, an all-inclusive measure of bank output factoring in both banks’ on- and off-balance sheet activities such as loans, deposits, equity, derivatives and loan commitments etc.¹ Bank liquidity creation in essence measures bank output. While measuring bank liquidity creation is important, investigating its impact on the real economy is central to monetary policy.

Berger and Sedunov (2015) investigate the relationship in the U.S. state level and find that higher bank liquidity creation in the present quarter leads to higher per capita GDP for the next quarter. The authors further show that liquidity creation of small banks rather than that of large banks has higher impact on economic growth. While their results are important of their own, large banks create over 90% of aggregate bank liquidity (e.g., Berger and Bouwman 2009), and hence one would expect that large banks have higher impact on the economy. The authors further find inconclusive evidence that during crises banks create less liquidity. For instance, the authors do not find any relationship between bank liquidity creation and per capita GDP during the 2007-2009 sub-prime crisis. However, the literature finds that during the last crisis banks were unable to provide liquidity (e.g., Acharya and Mora 2015). Importantly, Berger and Sedunov (2015) do not investigate whether lower bank liquidity creation leads to recessions; a variable that predicts real GDP may not forecast recessions. For example, the Treasury termspread (the difference in yields on 10-year and 3-months Treasuries) is found to be a robust predictor of recessions (e.g., Estrella and Hardouvelis 1991), but it has limited predictive power for real GDP (e.g., Næs, Skjeltorp, and Ødegaard 2011).

Berger and Bouwman (2014) investigate the relationship between bank liquidity creation and crises, and their crises definition includes the NBER recession quarters and events, such as the Long-Term Capital Management (LTCM) bailout and the Russian debt crisis. The authors show that higher aggregate U.S. bank liquidity creation relative to a linear trend leads to crises, but their results contradict that of Berger and Sedunov (2015). Given the disagreement between the findings in the literature, this paper revisits the relationship between bank liquidity creation and economic growth. In particular, we investigate whether bank liquidity creation forecasts the NBER recessions. While predicting recessions with precision is one of the objectives, we are particularly interested in investigating the dynamics of bank on- and off-balance sheet liquidity creation prior to and after recessions since this knowledge may help formulate monetary policy.

¹ Banks exist to create liquidity and transform credit risk (e.g., Diamond 1984; Diamond and Rajan 2001; Berger and Bouwman 2009) and monetary policy is generally altered to change bank liquidity creation. Banks not only create liquidity on the balance sheet by activities, such as providing loans to businesses and individuals funded by deposits (e.g. Diamond and Dybvig 1983; Berger and Bouwman 2009), but also create liquidity off the balance sheet by activities, such as extending standby letters of credit and loan commitments to their customers (e.g., Holmstrom and Tirole 1998; Kashyap, Rajan and Stein 2002; Thakor 2005; Diamond and Rajan 2005; Berger and Bouwman 2009).

Our study differs from that of Berger and Bouwman (2014) in several ways. *First*, we investigate recessions, but not exogenous shock-driven crises, such as the Russian debt crisis. We argue that liquidity creation of the U.S. banks cannot possibly cause such one-time extreme events. *Second*, following the literature (e.g., Estrella and Hardouvelis 1991), we employ a probit model to forecast recessions, while the authors use a logit model. Estrella and Hardouvelis (1991) argue that probit models are perhaps better when the dependent is a recession binary variable. *Third*, the authors use *de-trended* bank liquidity creation data, while we use bank liquidity creation *growth* data.² *Fourth*, we augment the benchmark Treasury term-spread model with bank liquidity creation growth data. Berger and Bouwman (2014), however, do not use the

Treasury term-spread neither as a benchmark nor as a control variable. *Finally*, their model predicts crises one quarter ahead of the events, while we forecast recessions one to four quarters into the future.

Using the Berger and Bouwman (2009) bank liquidity creation measures, our results show that it is an important predictor of recessions. In particular, we show that bank on-balance sheet liquidity creation decreases at about four quarters prior to recessions and continues to fall leading to recessions. We further show that on-balance sheet liquidity creation of large banks rather than that of small and medium ones decreases before recessions. This set of results is robust to the exclusion of the recent 2007-2009 recession. The interpretation is that a downward sloping or a flat yield curve prior to recessions forces banks, particularly large banks, to contract their on-balance sheet activities as such activities are no longer profitable.

By contrast, if the 2007-2009 recession is excluded, we find that bank off-balance sheet liquidity creation increases four quarters prior to recessions, and banks continue to create liquidity through off-balance sheet activities up to three quarters before recessions. The results suggest that banks shift their preference towards off-balance sheet liquidity creation while contracting on-balance sheet activities at approximately four quarters before recessions, thus supporting the existing view that banks extend liquidity through off-balance sheet activities prior to economic downturns. However, with the 2007-2009 recession in the sample, we do not find any such relationship. One possible interpretation of the results is that the relationship between bank off-balance sheet liquidity creation and recessions is not robust. An alternative interpretation is that banks did not create as much off-balance sheet liquidity before the 2007-2009 recession as they did prior to other recessions. This potentially explains the severity of the recent recession in that banks could not provide enough liquidity to its long-standing customers through off-balance sheet activities.

However, irrespective of the sample choice, in the quarter leading to recessions off-balance sheet liquidity contracts in tandem with on-balance sheet liquidity creation and aggregate liquidity creation falls. Our results further suggest that the fall in aggregate, on- and off-balance sheet liquidity creation continues for up to five quarters after recessions. By contrast, at some point between one and two quarters past recessions, the relationship between the term-spread and recessions turns positive. The results thus imply that, while monetary policy is loosened around recession quarters or market participants expect such accommodating policies (resulting in an upward sloping yield curve), banks continue to shrink their balance sheet for another five quarters. We further do not find any evidence that bank liquidity creation increases even eight

² Berger and Bouwman (2014) use Hodrick-Prescott (1997) (HP) filter to extract the cyclical component of bank liquidity creation under the assumption that the original series has a trend component and a cyclical component. However, the HP filter is known to be sensitive to the endpoints, and hence we avoid this sensitivity of transformed data by using the log difference of bank liquidity creation, which is standard in the literature (e.g., Næs, Skjeltorp, and Ødegaard 2013, among others).

quarters post-recessions. This relationship between the term-spread and bank liquidity creation (before and after recessions) is not investigated in the existing literature.³

The term-spread-augmented bank liquidity creation models have Pseudo R-squared values of about 16%, 16%, 23% and 32% at one to four quarters forecast horizons, respectively. By contrast, the benchmark term-spread model has Pseudo R-squared values of about 1%, 6%, 19% and 30% for the same forecast horizons. At the four quarters forecast horizon, while the term-spread model assigns a peak average recession probability of approximately 54% for the past three recessions, the on-balance sheet-augmented term-spread model assigns that at about 68%. The recession probability estimates at the four quarter forecast horizon are shown in Figure 2 for a visual comparison. Out-of-sample results further show that our models outperform the Survey of Professional Forecasters' estimates of recession probabilities at higher (two to four quarters) forecast horizons.

Our findings contribute to two strands of the literature. Since Bagehot (1873), the importance of banking to spur economic development and future growth has been debated. The connection between the components of bank liquidity creation and economic growth has both theoretically and empirically argued in the literature (e.g., Bencivenga and Smith 1991; Boot,

Greenbaum and Thakor 1993; Jayaratne and Strahan 1996; Bernanke and Blinder 1988; Kashyap, Rajan and Stein 2002). Our study contributes to this strand of the literature by showing that lower bank liquidity creation leads to recessions. The Levine (1991) model shows that liquid stock markets accelerate growth by allowing investors to trade ownership of firms without disturbing such firms' productive ability. By conducting a cross-country analysis, Levine and Zervos (1993) empirically support the view that liquid stock market and bank loans are important determinants of economic development. However, in this paper, we show that stock market liquidity has limited forecasting power for recessions when we control for bank liquidity creation. Nevertheless, our findings strengthen the view that bank activities and economic growth are related.

The relationship between an inverted Treasury yield curve and recessions is widely investigated in the literature.⁴ Estrella and Mishkin (1996, 1998) confirm that the term-spread is the single best predictor of recessions at higher forecast horizons. Rudebusch and Williams (2009) show that the enduring power of the term-spread to forecast recessions. Lahiri, Monokroussos, and Zhao (2013) report that the term-spread remains the best predictor.⁵

The link between the above two strands of the literature, while implied, is not empirically tested. The traditional explanation for the recession-forecasting power of the Treasury yield curve is the forward looking information content of the yield curve. An inverted yield curve may reflect future expectations about the states of the economy such as lower future inflation. This paper provides a plausible alternative explanation of the forecasting power of the yield curve.

Our results imply that, when an inversion of the yield curve materializes, banks create less liquidity, thereby ushering in economic contractions.

The findings presented in this paper have important monetary policy implications. *First*, our results suggest that bank on-balance sheet liquidity creation is an important feedback to regulators about the efficacy of the credit tightening policy. We show that such feedback is

³ Estrella and Hardouvelis (1991), among others, investigate the relationship during and up to eight quarters prior to recessions.

⁴ An incomplete list includes Laurent (1988); Harvey (1988, 1989); Stock and Watson (1989); Chen (1991); Estrella and Hardouvelis (1991).

⁵ Erdogan, Bennett and Ozyildirim (2014) show that stock market liquidity is a leading indicator of recessions at one quarter forecast horizon. As discussed earlier, we find stock market liquidity has limited forecasting power for recessions at any four quarters prior to recessions if we control for bank liquidity creation.

available four quarters before recessions. This knowledge, along with other feedback signals such as employment and inflation could be used to smooth out the business cycle by restraining the credit tightening cycle. *Second*, our results suggest that expansionary monetary policy measures during or after recessions come too late to have a real impact on the economy. While the term-spread turns positive right after recessions, possibly because of the loosened monetary policy, banks are reluctant to expand their balance sheet and create more liquidity for five quarters after recessions. *Finally*, we show that policymakers and professional forecasters should place a proper weight on observable variables such as bank liquidity creation when forecasting recessions.

In this paper, we do not investigate how banks manage components of their balance sheet during economic downturns. Future research may investigate whether or how banks shift their assets (e.g., cash, semi-liquid assets and loans) and liabilities (e.g., deposit and non-deposit borrowings) composition before and after recessions.

The paper proceeds as follows. Section 2 describes bank liquidity creation and other data, reports data sources and investigates data characteristics. Sections 3 and 4 presents the main empirical results and conducts robustness checks, respectively. Section 5 discusses monetary policy implications and Section 6 concludes.

2. Data and Sample Construction

The sample under investigation dates from the first quarter of 1984 to the fourth quarter of 2010 since the Federal Deposit Insurance Corporation (FDIC) call report data is only available from 1984.⁶ Since we augment the Estrella and Hardouvelis (1991) Treasury term-spread model with bank liquidity creation measures, which are described in sub-section 2.1, one of our primary predictor variables is the term-spread (TERM). TERM is computed as the difference between the yields on the 3-month Treasury-bill and the 10-year Treasury bond index.

We further use real GDP, stock market returns (RET), stock market volatility (VOL) and the Federal funds rate (FED) as other predictors as is standard in the literature (e.g., Estrella and Mishkin 1998). Stock market variables are computed using all NYSE stocks. Since the literature finds that asset market liquidity and credit-spreads are important indicators for bank liquidity creation, we use those variables as controls. We obtain the Moody's corporate AAA and BAA rated bond indices yield data to compute credit-spreads (CREDIT), the difference between the yields on 10 year AAA and BAA rated corporate bonds. Asset market liquidity measures are described in sub-section 2.2.

We compare the estimates of recession probabilities of our models with that of the Survey of Professional Forecasters' (SPF), and hence we use the SPF estimates in the analysis. Every quarter the SPF asks its participants to provide estimates of the probability of negative real GDP for the current and next four quarters.

Unless noted otherwise, all data are collected from the U.S. Federal Reserve Bank. The Treasury bonds and stocks trading data such as bid-ask spreads are obtained from the CRSP (Center for Research in Security Prices). The GDP and inflation data is obtained from the U.S. Bureau of Economic Analysis.

⁶ The related literature (see, e.g., Haubrich and Dombrosky 1996; Rudebusch and Williams 2009) argues for recent data for reasons, such as lowered inflation expectations in the recent years, to investigate the relationship between recessions and the term-spread.

2.1. Bank Liquidity Creation

Bank liquidity creation (Berger and Bouwman 2009) is computed for almost all commercial banks in the U.S. using the call reports data from the FDIC. We obtain the bank liquidity creation data of individual banks from Christa Bouwman's website.⁷ We use CATFAT and CATNONFAT as preferred liquidity creation measures, where we keep the description of liquidity creation variables as in their paper. CATFAT is the weighted sum of bank on-balance sheet (loans, deposits and equity etc.) and off-balance sheet (standby letter of credits etc.) variables, where weights are assigned based on the liquidity and location (whether on- or off-balance sheet) of each item; CATNONFAT only accounts for bank on-balance sheet items. We further investigate bank off-balance sheet activities and denote this variable as OFFBALANCE since the literature argues that banks may create more off-balance sheet liquidity before recessions. Following Berger and Bouwman (2014), we compute an aggregate measure of bank liquidity creation and Figure 1 graphically presents bank liquidity creation measures. We alternatively investigate CATNONFAT, OFFBALANCE and CATFAT to identify the variable that best forecasts recessions.

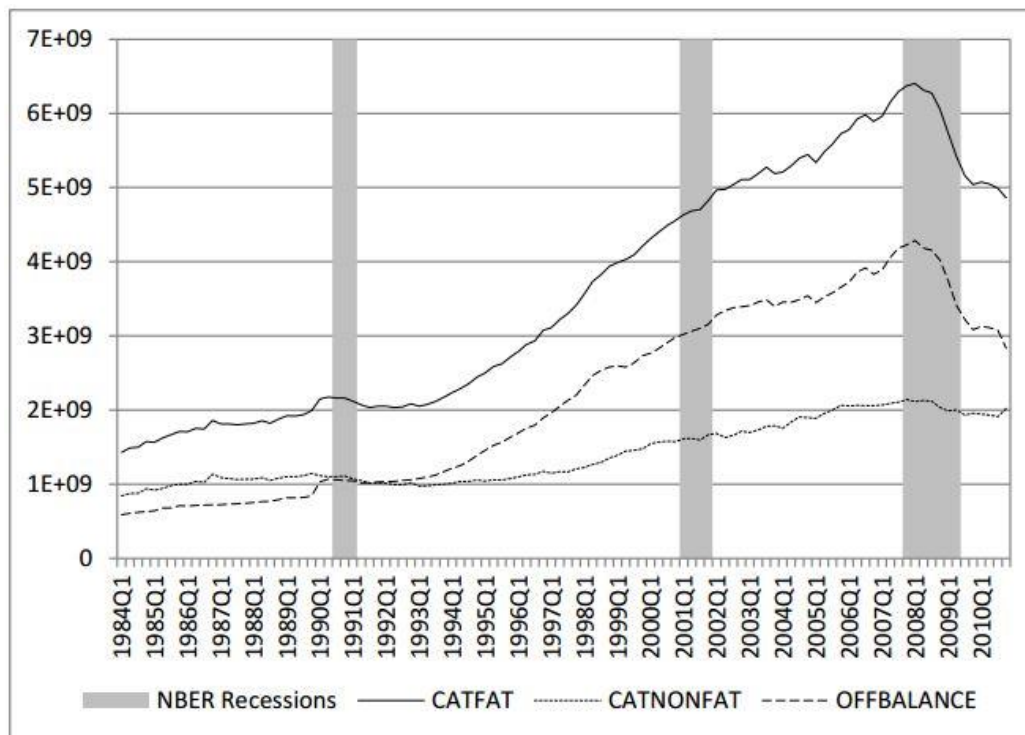


Figure 1 Bank On- and Off-balance Sheet Liquidity Creation

Figure 1 plots bank liquidity creation variables (in US\$) for the U.S. banks. The variables are CATFAT: aggregate bank liquidity creation measure that includes both bank on- and off-balance sheet activities; CATNONFAT: bank on-balance sheet liquidity creation measure that includes bank on-balance sheet activities; OFFBALANCE: bank off-balance sheet liquidity creation measure includes bank off-balance sheet activities.

Berger and Bouwman (2009) do not use the liquidity creation measure by bank loan maturity or the 'mat' measure. Instead, they focus on the 'cat' measure or liquidity creation by bank loan category. There are important reasons for this preference of the 'cat' measure over the 'mat' measure: 1) business loans, while have short maturity, they are not as liquid, and hence maturity based measurements may not capture bank liquidity creation; 2) the 'mat' measure does not include off-balance sheet items or 'fat', and hence 'mat' measure is not consistent with the literature (e.g., Holmstrom and Tirole 1998, Kashyap, Rajan and Stein 2002). In

⁷ We sincerely thank Christa Bouwman for providing the data.

essence, the ‘mat’ measure of Berger and Bouwman (2009) becomes the LT gap measure of Deep and Schaefer (2004).

2.2. Asset Market Liquidity

Chatterjee (2015) shows that asset market liquidity measured by both the Treasury bond and stock market liquidity explains bank liquidity creation. In particular, it is shown that illiquidity of off-the-run T-bills of short-maturity has a higher impact on bank on-balance sheet liquidity creation, and stock market illiquidity computed by Amihud measure (Amihud 2002) explains both on- and off-balance sheet liquidity creations. As a result, we control for asset market liquidity to test the forecasting power of bank liquidity creation.

Stock Market Illiquidity Measure

The Amihud’s illiquidity ratio (ILR) measure is based on the price impact to the order flow and is calculated as the ratio of the price movement to the trading volume of a stock and is defined as:

$$ILR_{i,t} = \frac{1}{D_{i,t}} \sum_{d=1}^{D_{i,t}} |R_{i,d,t}| / VOL_{i,d,t} \quad (1)$$

where $|R_{i,d,t}|$ and $VOL_{i,d,t}$ are absolute returns, the dollar volume of security i on date d , respectively and $D_{i,t}$ is the number of days over which ILR is calculated. It is customary to multiply ILR by 10^6 . Consistent with the literature (e.g., Amihud 2002), we consider stocks that have share prices of more than \$5 and less than \$1000; additionally stocks must be traded for 20 days in a month to be included in the sample. We first calculate the liquidity of each stock based on the ILR proxy. Next, we calculate the equally weighted quarterly average liquidity of all NYSE stocks to get a measure of stock market liquidity, which we denote as ILR. Note that the measure is a proxy for market illiquidity.

Bond Illiquidity Measure

We use off-the-run illiquidity (referred to as OFFSHORT) measure of T-bills with maturities up to one year for the investigation.⁸ Following the literature (e.g., Goyenko and Ukhov 2009), the quoted spread of T-bills is used to measure bond illiquidity. The quoted spread of each bond of specific maturity is calculated daily and the equally-weighted average over each quarter is computed as follows:

$$QS_{i,t} = \frac{1}{D_{i,t}} \sum_{d=1}^{D_{i,t}} \frac{(ASK-BID)_{i,d,t}}{0.5(ASK+BID)_{i,d,t}} \quad (2)$$

where ‘i’ in the above equation is a bond of specific maturity.

We conduct ADF (Augmented Dickey-Fuller, 1979) unit-root tests in conjunction with KPPS (Kwiatkowski et al., 1992) stationarity tests to ascertain that the variables are stationary. Variables that are transformed to attain stationarity are reported with a prefix ‘d’. For example, dCATFAT, and dGDP are the log first difference of CATFAT and real GDP.

⁸ Once a bond of certain maturity is issued, it is on-the-run and older bonds of the same maturity become off-the-run. We investigate but do not report the results for T-bonds of higher maturities for parsimony since the results show higher maturity T-bonds have no information about recessions; the results are available on request.

Table 1 Summary Statistics

Panel A: Summary Statistics											
	CATNONFAT	OFFBALANCE	CATFAT	dCATFAT	dCATNONFAT	dOFFBALANCE	TERM				
	(US\$ Trillion)										
Mean	1.41	2.19	3.59	0.01	0.01	0.01	1.92				
Median	1.17	2.13	3.26	0.01	0.01	0.01	1.95				
Maximum	2.14	4.29	6.40	0.08	0.10	0.20	3.70				
Minimum	0.84	0.61	1.43	-0.06	-0.05	-0.09	-0.45				
Std. Dev.	0.42	1.22	1.62	0.02	0.02	0.03	1.15				
Observations	108	108	108	107	107	107	108				

Panel B: Pairwise Correlation Coefficients											
	RECESSION	dCATFAT	dCATNONFAT	dOFFBALANCE	TERM	FED	CREDIT	RET	VOL	dILR	dOFFSHORT
dCATFAT	-0.40										
dCATNONFAT	-0.19	0.63									
dOFFBALANCE	-0.37	0.83	0.12								
TERM	0.10	-0.32	-0.15	-0.29							
FED	-0.22	0.35	0.08	0.38	-0.42						
CREDIT	0.51	-0.53	-0.19	-0.52	0.33	-0.17					
RET	-0.09	-0.07	0.06	-0.09	0.08	-0.03	-0.08				
VOL	0.44	-0.31	-0.15	-0.29	0.06	-0.21	0.57	-0.46			
dILR	0.11	0.15	0.06	0.16	-0.08	0.07	0.07	-0.50	0.43		
dOFFSHORT	0.17	-0.23	-0.10	-0.22	0.11	-0.15	0.17	0.13	0.11	0.05	
dGDP	-0.65	0.42	0.29	0.35	0.03	0.22	-0.53	0.18	-0.44	-0.08	-0.17

Panel C: Bank Liquidity Creation Auto-correlation Structure			
	Lag 1	Lag 2	Lag 3
dCATFAT	0.12	0.26	0.00
dCATNONFAT	-0.13	0.10	0.13
dOFFBALANCE	0.25	0.03	-0.00

Table 1 Panel A shows the sample summary statistics for two important variables: liquidity creation measures and the term-spread. Table 1 Panel B presents the pairwise correlation among the variables of interests. The correlation analysis shows that bank liquidity creation growth measures are negatively correlated to recessions. We further observe that aggregate bank liquidity creation growth and real GDP are positively related and this correlation is consistent with the Berger and Sedunov (2015) results. While the contemporaneous correlation results may not hold in predictive probit regressions, the correlation analysis highlights the relationship between bank liquidity creation growth and recessions that we expect to see. Table 1 Panel C further shows that bank liquidity creation growth variables have low auto-correlations.

3. In-sample Forecasting of Recessions with Bank Liquidity Creation

Following Estrella and Hardouvelis (1991) and Estrella and Mishkin (1995), we estimate the probability of recessions using the following probit model:

$$(X_t = 1) = \Phi(\alpha + \beta * TERM_{t-l} + \gamma * V_{t-l}) \quad (3)$$

where $X_t = 1$ if the economy is in the NBER recession quarters and '0' otherwise, TERM is the term-spread, V is a vector of augmenting variables that includes bank liquidity creation etc. and

l is the number of lags used for the estimation. We evaluate the model performance using the Pseudo R-squared values.

Table 2 In-sample Probit Estimates of Recessions with Bank Liquidity Creation

Panel A: Bank liquidity creation, the Treasury Term-Spread and Prediction of Recessions: Excluding the recent Crisis (1984-2002 Sub-sample)								
	One-Quarter		Two-Quarters		Three-Quarters		Four-Quarters	
TERM	-0.52 (-3.01)***	-0.64 (-3.11)***	-0.95 (-3.07)***	-1.37 (-2.97)***	-2.32 (-3.52)***	-3.01 (-3.74)***	-3.41 (-3.11)***	-4.59 (-3.06)***
dCATNONFAT		-17.46 (-2.24)***		-35.02 (-2.88)***		-41.04 (-2.50)***		-44.58 (-2.03)**
Pseudo R-Sq.	0.12	0.17	0.27	0.41	0.52	0.62	0.61	0.70
TERM		-0.66 (-3.02)***		-0.91 (-2.84)***		-2.63 (-2.70)***		-6.87 (-2.06)**
dOFFBALANCE		-28.17 (-2.28)***		6.24 (1.02)		14.97 (2.83)***		22.87 (2.96)***
Pseudo R-Sq.		0.22		0.29		0.59		0.74
TERM		-0.79 (-3.05)***		-0.98 (-3.15)***		-2.42 (-2.81)***		-6.22 (-2.24)***
dCATFAT		-35.71 (-3.13)***		-5.16 (-0.31)		14.99 (0.74)		46.52 (1.92)**
Pseudo R-Sq.		0.24		0.27		0.53		0.69
Panel B: Bank liquidity creation, the Treasury Term-Spread and Prediction of Recessions: Full Sample (1984-2010)								
	One-Quarter		Two-Quarters		Three-Quarters		Four-Quarters	
TERM	-0.13 (-1.17)	-0.22 (-1.99)***	-0.33 (-2.47)***	-0.45 (-3.07)***	-0.61 (-3.50)	-0.68 (-3.41)***	-0.88 (-3.38)***	-0.95 (-3.29)***
dCATNONFAT		-17.57 (-2.73)***		-21.81 (-2.86)***		-14.46 (-1.99)**		-14.71 (-1.74)*
Pseudo R-Sq.	0.01	0.07	0.06	0.16	0.19	0.23	0.30	0.32
TERM		-0.31 (-2.61)***		-0.31 (-2.44)***		-0.57 (-3.34)***		-0.84 (-3.22)***
dOFFBALANCE		-20.24 (-3.12)***		0.22 (0.03)		4.42 (0.78)		-14.71 (0.69)
Pseudo R-Sq.		0.13		0.06		0.19		0.32
TERM		-0.37 (-2.88)***		-0.41 (-3.17)***		-0.62 (-3.72)***		-0.88 (-3.56)***
dCATFAT		-28.81 (-4.03)***		-11.08 (-1.17)		-2.01 (-0.21)		4.24 (-0.09)
Pseudo R-Sq.		0.16		0.09		0.19		0.30

$$^9 \text{Pseudo } R^2 = 1 - \left[\frac{\log(L_u)}{\log(L_c)} \right]^{-\left(\frac{2}{n}\right) \log(L_c)}$$

where L_u is the likelihood of the full model and L_c is the likelihood of the intercept only model.

Since the 2007-2009 recession is viewed as “the great recession”, to understand the dynamics between bank liquidity creation and the recent recession, we conduct our studies using the full sample of 1984:Q1 to 2010:Q4 and a sub-sample from 1984:Q1 to 2002:Q4, which includes both the 1990-1991 and 2001 recessions, but not the 2007-2009 recession. In Table 2, we present the coefficient estimates of Equation (3) with different measures of bank liquidity creation for up to four quarters prior to recessions.

First, we present the results for the sub-sample in Table 2 Panel A, where predictor variables of interests are bank on-balance sheet liquidity creation growth (dCATNONFAT) and off-balance sheet liquidity creation growth (dOFFBALANCE) and bank aggregate liquidity creation growth (dCATFAT). Next, we present the results for dCATNONFAT, dOFFBALANCE and dCATFAT for the full sample in Table 2 Panel B. We restrict our

investigation to four quarters before recessions for two reasons. First, the term-spread is shown to have the best performance at that forecast horizon (e.g., Estrella and Hardouvelis 1991). Second, we do not find bank liquidity creation variables have robust predictive power at forecast horizons higher than four quarters.

Table 2 Panel A results show that TERM is an important predictor for each quarter for a four quarters forecast horizon. These results conform to the literature (Rudebusch and Williams 2009; Lahiri, Monokroussos, and Zhao 2013) results that enduring power of TERM as a predictor for recessions persists. The negative signs of the coefficient of dCATNONFAT imply that banks create less liquidity through on-balance sheet activities in all four quarters prior to recessions and the results are statistically significant at least at the 10% level. At each forecast horizon, we find dCATNONFAT-augmented models have higher Pseudo R-squared values relative to that of the benchmark TERM model.

We further observe that dOFFBALANCE is positively (and statistically significant at the 1% level) related to recessions at four and three quarters forecast horizons. However, one quarter prior to recessions, dOFFBALANCE is negatively related to recessions at the 1% level of significance. Thus, we find some evidence that, while bank off-balance sheet liquidity creation compensate for the on-balance sheet liquidity creation in the third and fourth quarters prior to recessions. The existing literature argues that prior to recessions banks create liquidity through the off-balance sheet activities (e.g., Thakor 2005) and we find some evidence to that argument. Eventually, at the one quarter forecast horizon, off-balance sheet liquidity creation catches up with that of on-balance sheet liquidity creation and becomes negative.

We next investigate the relationship between aggregate bank liquidity creation and recessions. Four quarters prior to recessions, the results show that dCATFAT is positively and significantly (at the 5% level of significance) related to recessions. This result suggests that bank off-balance sheet liquidity creation rises more than the fall in the on-balance sheet liquidity creation. For two and three quarters forecast horizons, dCATFAT has no predictive power for recessions. However, for a one quarter forecast horizon, the coefficient estimate of dCATFAT is statistically significant at the 1% level. The negative sign of dCATFAT implies that bank aggregate liquidity creation falls at about one quarter prior to recessions and the result is consistent with the results reported earlier that both on- and off-balance sheet liquidity creation falls one quarter prior to recessions. The overall evidence thus suggests that some point between four and one quarters before recessions, bank aggregate liquidity creation switches from positive to negative since bank off-balance sheet liquidity cannot compensate for the loss of on-balance sheet liquidity creation.

Looking next at Table 2 Panel B, where we present the results for the full sample, we find qualitatively similar results as presented in Table 2 Panel A. dCATNONFAT, bank on-balance sheet liquidity creations falls in all four quarters prior to recessions and the statistical significance of the corresponding coefficients is generally higher than the 10% level and dCATNONFAT-augmented models have higher Pseudo R-squared values than those of the benchmark TERM model. One quarter prior to recessions, both dCATFAT and dOFFBALANCE is inversely related to recessions at the 1% level of significance. However, while the sign of the coefficient of dOFFBALANCE is similar to that of the 1984-2002 sub-sample, none of them are statistically significant at forecast horizons greater than one. Similarly, dCATFAT has no statistically significant relationship at higher forecast horizons indicating off-balance sheet liquidity creation could not compensate for falling on-balance sheet liquidity creation. Since we find that the predictive power of bank on-balance sheet is more robust at higher forecast horizons and the forecasting ability at higher horizons is more valuable for policy measures, we primarily concentrate on dCATNONFAT for the rest of our analysis.

Figure 2 graphically shows the bank on-balance sheet liquidity creation-augmented model implied recession probabilities for a four quarters forecast horizon for the full sample. The figure shows that the dCATNONFAT-augmented model performed better than the benchmark term-spread model for the past three recessions. In particular, the dCATNONFAT-augmented term-spread model did well predicting the 1990-1991 and 2007-2009 recessions, both of which are known to be primarily driven by banking crises.

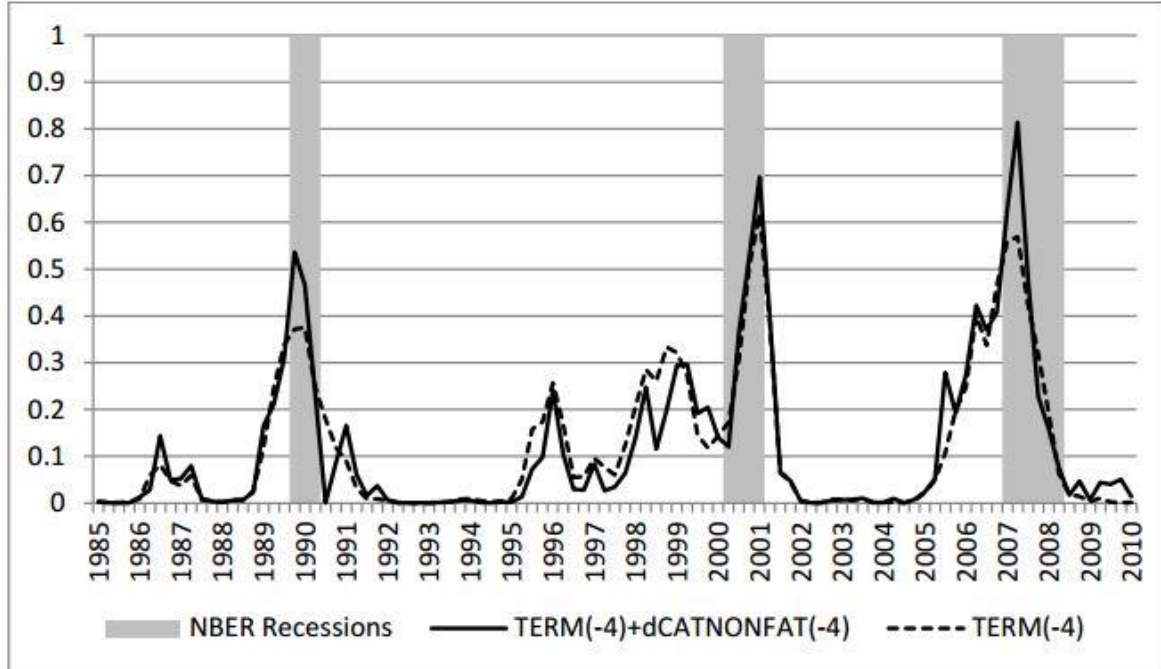


Figure 2 Estimates of Recessions Probabilities at Four Quarters Forecast Horizon

3.1. The Term-Spread and Bank Liquidity Creation

It is well-known that the Treasury term structure is the primary driver of bank on-balance sheet activities since the term structure is one of the determinants of bank short-term borrowing and long-term lending. Thus, for robustness, we first conduct Granger causality tests to investigate whether the term-spread contains information about bank on- and off-balance sheet liquidity creation and *vice versa*. Our focus is on bank on-balance sheet liquidity creation, since the results for this variable is robust to sample selection as shown in Table 2. Next, based on the Granger causality results we use a two-stage approach to estimate robust coefficients.

Table 3 Panel A presents the pairwise Granger causality test results for three variables: TERM, dCATNONFAT and dOFFBALANCE. The optimal lag length for the Granger causality tests is chosen in a vector autoregression (VAR) framework and is based on both the Schwarz information criterion (SIC) and Akaike information criterion (AIC).

Looking from the top in Table 3 Panel A, we show that while TERM Granger causes dCATNONFAT at the 10% level of significance, there is no reverse Granger causality running from dCATNONFAT to TERM. Thus the results suggest that TERM contains information about dCATNONFAT and this is consistent with the fact that the term structure is one of the determinants of bank on-balance sheet activities. By contrast, TERM and dOFFBALANCE do not Granger cause each other. Finally, dCATNONFAT Granger causes dOFFBALANCE at the 5% level of significance, but the reverse is not true.

We next employ a two-stage approach to eliminate any effect of the term-spread on bank liquidity creation may have and this allows for robust coefficient estimates. In the first stage, we estimate the orthogonal (to TERM and other variables) components ($X_t = \theta_t$) of bank

onbalance sheet liquidity creation using Equation (4), where Y is a vector of five variables: TERM, dILR, dOFFSHORT, FED and CREDIT since the last four variables are found to affect bank liquidity creation, c_t is the intercept term, and θ_t is the error term.

$$X_t = c_t + \Phi_t X_{t-1} + \omega_t Y_{t-1} + \theta_t \quad (4)$$

In the second stage, we use the estimates (X_t) of bank liquidity creation to forecast recessions using Equation 3. Table 3 Panel B shows that the results for orthogonalized dCATNONFAT (referred to as dCATNONFAT_hat). The orthoganilization of dCATNONFAT increases the model Pseudo R-squared values at one and two quarters forecast horizon and the Zstatistics for dCATNONFAT_hat is higher than that of dCATNONFAT. However, the results are qualitatively similar to our earlier results and do not change our main conclusion that bank onbalance sheet liquidity creation is an important predictor for recessions. Given the slight variation of the coefficient estimates and Z-statistics, for the rest of the analysis we use the orthogonalized version of bank liquidity creation variables.

Table 3 The Term Structure and Bank On-balance Sheet Liquidity Creation

Panel A: Pairwise Granger Causality of Bank on- and Off-balance sheet Liquidity Creation Growth and the term-spread		
Null Hypothesis:	F-Statistic	p-value
TERM does not Granger Cause dCATNONFAT	2.99	0.09*
dCATNONFAT does not Granger Cause TERM	2.38	0.13
TERM does not Granger Cause dOFFBALANCE	2.37	0.13
dOFFBALANCE does not Granger Cause TERM	2.40	0.12
dOFFBALANCE does not Granger Cause dCATNONFAT	1.90	0.17
dCATNONFAT does not Granger Cause dOFFBALANCE	5.05	0.03**

Table 4 Panel B: Orthogonalized Bank on-balance sheet liquidity creation and the Treasury Term-Spread: Full Sample (1984-2010)				
	One-Quarter	Two-Quarters	Three-Quarters	Four-Quarters
TERM	-0.17 (-1.58)	-0.41 (-2.82)***	-0.65 (-3.33)***	-0.92 (-3.27)***
dCATNONFAT_hat	-19.76 (-3.02)***	-24.78 (-3.18)***	-16.53 (-2.25)***	-16.41 (-1.93)**
Pseudo R-Sq.	0.09	0.17	0.23	0.33

3.2. Two-stage Probit Models with Additional Control Variables

In this section, we investigate whether two-stage method described in the previous section with additional controls has any effect on the forecasting power of bank liquidity creation. Thus, bank liquidity creation variables are orthogonalized version of bank liquidity creation variables: dCATNONFAT_hat, dOFFBALANCE_hat and dCATFAT_hat computed using Equation (4). We use a set of control variables in this specification. Among other control variables, we include real GDP since lags of it in the specification reduces endogeneity issues that may exist between the states of the economy and bank liquidity creation.⁹ The results for the extended probit models are presented in Table 4.

⁹ While Chatterjee (2015) shows that real GDP has no effect on bank liquidity creation after controlling for asset market liquidity and credit spreads, we thank an anonymous seminar participant for suggesting the inclusion of real GDP in our analysis. The inclusion of real GDP is further consistent with the related literature (e.g., Estrella and Hardouvelis 1991). While both TERM and bank liquidity creation measures may have endogenous relationship with recessions, especially during recession quarters, for a four quarters prediction horizon (and

Table 4 Two-Stage Probit Estimates of Recessions with Extended Models

Aggregate Bank Liquidity Creation, Asset Market Liquidity, the Treasury Term-Spread and Recessions: Full Sample (1984-2010)							
	1-Quarter			2-Quarters	3-Quarters	4-Quarters	
TERM	-0.42 (-2.58)***	-0.22 (-1.38)	-0.35 (-2.34)***	-0.58 (-2.46)***	-0.75 (-3.07)***	-0.96 (-3.48)***	-1.05 (-3.07)***
dCATFAT_hat	-36.75 (-3.46)***					-4.36 (-0.32)	
dCATNONFAT_hat		-9.54 (-1.73)*		-20.70 (-2.20)***	-12.05 (-1.70)*		-19.66 (-2.21)***
dOFFBALANCE_hat			-32.16 (-3.03)***				
dGDP	-127.11 (-2.14)***	-116.56 (-1.92)*	-147.77 (-2.61)***	-34.09 (-0.74)	-12.97 (-0.34)	27.48 (0.60)	38.06 (0.92)
RET	-2.07 (-0.75)	-1.44 (-0.54)	-2.59 (-0.87)	-1.53 (-0.52)	-3.12 (-1.28)	-4.52 (-1.63)	-3.91 (-1.36)
VOL	87.84 (1.93)*	102.76 (2.23)***	73.80 (1.66)*	72.71 (1.52)	13.69 (0.39)	-10.59 (-0.27)	-4.09 (-0.12)
FED	-0.05 (-0.67)	-0.12 (-1.35)	-0.03 (-0.43)	-0.12 (-1.34)	-0.11 (-1.06)	-0.07 (-0.64)	-0.05 (-0.56)
CREDIT	0.68 (0.59)	0.78 (1.00)	-0.53 (-0.38)	0.35 (0.47)	1.99 (1.12)	7.40 (2.03)**	5.24 (1.51)
dILR	1.01 (0.67)	0.18 (0.12)	1.15 (0.81)	1.26 (0.73)	0.92 (0.54)	1.16 (0.57)	1.29 (0.66)
dOFFSHORT	-3.87 (-1.52)	-2.86 (-1.19)	-4.55 (-1.64)	-2.70 (-1.12)	-1.05 (-0.39)	2.86 (1.29)	3.48 (1.58)
Pseudo R-Sq.	0.45	0.37	0.47	0.34	0.34	0.38	0.41

Looking from the left, for a one quarter forecast horizon, it is shown that dCATFAT_hat, dCATNONFAT_hat and dOFFBALANCE_hat are negatively related to recessions even after we control for important predictor variables such as real GDP, RET and VOL, etc. We find that real

GDP is an important predictor at shorter forecast horizons and this is not surprising since the NBER recessions are determined by the real negative GDP and is consistent with the literature (Estrella and Hardouvelis 1991). However, we further observe that VOL and CREDIT have some predictive power for recessions, but those two variables are not robust predictors at each forecast horizon.

For a two, three and four quarters forecast horizons, dCATNONFAT_hat is negatively related to recessions and the results conform to those of Table 2. The results for dCATFAT_hat and dOFFBALANCE_hat are similar to the estimates presented in Table 2, and hence except for the four quarters prediction horizon of dCATFAT_hat, the results are not reported. Thus, the overall results with a larger set of control variables show that bank liquidity creation, specifically bank on-balance sheet liquidity creation, is an important predictor for recessions.

4. Robustness Checks

This section conducts robustness checks of the results presented earlier. First, we investigate the relationship between alternative measures of bank liquidity creation and recessions. Next, we conduct out-of-sample tests to ascertain that in-sample results hold.

in a probit framework) we believe such endogeneity, if any, is minimal. Importantly, as in Estrella and Hardouvelis (1991) we are interested in evaluating the recession-forecasting power of bank liquidity creation.

4.1. Alternative Measures of Bank Liquidity Creation

Berger and Bouwman (2009) provide alternative measures of bank liquidity creation and we conduct robustness checks with this measure. In the alternative measures, off-balance sheet activities are computed differently.

Table 5 Predicting Recessions with Alternative Measures of Bank liquidity Creation

Alternative Measures of Bank liquidity creation, the Treasury Term-Spread and Recessions: Excluding the recent Crisis (1984-2002 Sub-sample)				
	One-Quarter	Two-Quarters	Three-Quarters	Four-Quarters
TERM	-0.56 (-2.98)***	-1.14 (-2.76)***	-2.64 (-3.88)***	-3.86 (-3.09)***
dCATNONFATSECADJ	-13.52 (-1.99)**	-25.35 (-2.59)***	-27.98 (-2.14)**	-19.19 (-2.04)**
Pseudo R-Sq.	0.16	0.36	0.58	0.64
TERM	-0.54 (-3.28)***	-0.75 (-3.01)***	-2.55 (-2.34)***	-6.87 (-2.06)**
dOFFBALANCESECADJ	-27.39 (-2.15)***	6.83 (1.10)	16.56 (3.01)***	22.87 (2.96)***
Pseudo R-Sq.	0.22	0.29	0.59	0.73
TERM	-0.75 (-3.03)***	-1.04 (-3.07)***	-2.36 (-3.00)***	-7.92 (-2.40)***
dCATFATSECADJ	-34.45 (-2.98)***	-13.30 (-0.80)	11.15 (0.40)	94.43 (1.98)*
Pseudo R-Sq.	0.23	0.28	0.52	0.70

For example, while CATFAT uses *available* loan commitments and standby letters of credits, CATFATSECADJ (an alternative measure of CATFAT) considers the *likelihood* of usage of loan commitments and standby letters of credits. The reason for this adjustment is that customers may not fully drawdown available loan commitments and standby letters of credit. In Table 5, we present the results for alternative measures of bank liquidity creation and the corresponding forecasting variables are dCATFATSECADJ, dCATNONFATSECADJ and dOFFBALANCESECADJ for the 1984-2002 sub-sample. We find that alternative measures of bank liquidity creation have similar forecasting power as our preferred measure of bank liquidity creation: dCATFAT, dCATNONFAT and dOFFBALANCE. Unreported results for the full sample conform to our previous conclusions drawn from Table 2 Panel B.

4.2. Out-of-Sample Tests

In this section, we conduct out-of-sample tests to verify that the in-sample results that bank liquidity creation contain information about future recessions hold out-of-sample. In addition to comparing our models to the benchmark term-spread model, we investigate how estimates of recession probabilities of our models compare to the SPF estimates. First, we discuss a short description of the out-of-sample forecasts evaluation methodologies. Next, we present the out-of-sample test results.

We use 1984:Q1-1991:Q4 data for estimation, which includes at least one of the recessions, and then predict the recession probabilities for 1992:Q1 through 2010:Q4. Following Rudebusch and Williams (2009), we use MAE (mean absolute error) and RMSE (root mean squared error) as performance measures.¹⁰ We use the Diebold and Mariano (Diebold and

¹⁰ Rudebusch and Williams (2009) also use log probability score (LPS) as an alternative evaluation method. However, the authors show that at forecast horizons greater than one quarter, three evaluation methods produce

Mariano 1995) or the DM-statistics to test for equal MAEs. Since the DM-statistics is not available for the RMSE loss function, we test statistical significance for equal MSEs. The loss differentials at a horizon h for the above two loss functions are as follows:

$$d(MAE)_t = |(error1)_{t|t-h}| - |(error2)_{t|t-h}| \quad (5)$$

$$diff(MSE)_t = (error1)_{t|t-h}^2 - (error2)_{t|t-h}^2 \quad (6)$$

where *error* is the forecast error of the two competing models 1 and 2. Following Rudebusch and Williams (2009), we regress the loss differential on a constant, and test the resulting t -statistics for a zero coefficient and reject the null that models have the same MAE or RMSE based on the differentials with HAC corrections.

Out-of-Sample Performance

First, we test whether bank liquidity creation adds to the predictive power of the term-spread for up to four quarters forecast horizons. That is, we test the out-of-sample performances for the insample results presented in Tables 2 and 4. The corresponding out-of-sample results are presented in Table 6.

Looking at Table 6 from the top, we present MAE and RMSE values of the baseline term-spread model, the term-spread-augmented bank liquidity creation models, the SPF estimates, and the term-spread-augmented extended models, respectively. From the left we progressively present the out-of-sample results for one to four quarters forecast horizons. We show the results for models that are comparable to the term-spread model and the SPF estimates for brevity. At each forecast horizon, bold MAE/RMSE represents that the corresponding model has higher statistically significant (at least at the 10% level) forecast errors than that of the lowest MAE/RMSE model.

Table 6 Out-of-Sample Tests

Panel A: Forecasting Recessions by Bank Liquidity Creation									
Estimation Sample		1984:Q1-1991:Q4							
Forecasts for 1992:Q1-2010:Q4		One-quarter		Two-quarters		Three-quarters		Four-quarters	
Model	Predictor Variables	MAE	RMSE	MAE	RMSE	MAE	RMSE	MAE	RMSE
Model A	TERM	22.02	35.91	20.97	34.29	18.55	33.03	15.46	33.42
Model B	TERM, dCATFAT_hat	19.18	34.24	21.45	34.19	19.13	33.75	12.47	31.09
Model C	TERM, dCATNONFAT_hat	20.14	34.51	17.77	34.01	15.84	32.82	12.94	32.18
Model D	TERM, dOFFBALANCE_hat	20.22	33.97	20.74	34.02	24.35	46.94	13.11	33.77
Model E	SPF	16.83	23.06	19.91	27.02	22.17	30.22	23.61	32.08
Model F	TERM, dCATFAT_hat, RET, dGDP	11.56	23.73	16.87	29.37	17.24	29.71	16.21	28.68
Model G	TERM, dCATNONFAT_hat, RET, dGDP	9.61	23.78	16.23	30.01	12.89	33.95	11.95	33.61

For a single quarter forecast horizon, based on MAEs and RMSEs, all bank liquidity creation augmented models (Models B through D) perform better than a parsimonious termspread model (Model A). Thus, bank liquidity creation-augmented term-spread models have more information than that of the term-spread model.

Based on MAEs, the SPF estimates (Model E) are better than Models A through D.

similar conclusions. Additionally, the authors argue that forecast horizons greater than one quarter is more important for monetary policy purposes. Thus, we prefer the well understood MAE and RMSE loss functions.

However, Models F and G with the term-spread, bank liquidity creation growth, stock market returns and real GDP as predictors are better than the SPF estimates. Based on RMSEs, the SPF estimates are better than Models A through D. However, the SPF estimates are not statistically different from those of Models F and G. Thus, we show that the SPF one quarter estimates, while better than that of the term-spread model, those estimates are similar to the models that include observable variables such as bank liquidity creation, real GDP and stock market returns. Looking at two and three quarters forecast horizons, we observe that bank liquidity creation models (Models B through D and Models F and G) forecasts recessions better than both the SPF estimates and a parsimonious term-spread model in terms of forecast accuracy measured by either MAE or RMSE. At the four-quarter forecast horizon, we observe similar results. Overall, we find that the out-of-sample test results confirm our in-sample findings that bank liquidity creation has information about future recessions that is not captured in the term-spread. The out-of-sample results further show that professional forecasts may not have included observable variables such as the term-spread or bank liquidity creation when forecasting recessions.

5. Monetary Policy Implications

In this section we outline monetary policy implications of our results. First, we investigate the relationship between liquidity creation of banks of different sizes. Next, we investigate the dynamics between bank liquidity creation and the term-spread (both of which on theory should be affected by monetary policy) during and after recessions. Finally, we discuss monetary policy implications.

5.1. Liquidity Creation of Large Banks and Recessions

Since the recent crisis much has been discussed about “too large to fail” banks and their role in the economy. This section investigates the relationship between recessions and liquidity creation of banks of different sizes, where bank size is defined by bank gross total assets, which is bank total assets (call report code RCFD 2170) plus allowance for loan and lease losses (call report code RCFD 3123) and the allocated transfer risk reserve (call report code RCFD 3128), a reserve for certain foreign loans losses. Large, medium and small banks have more than \$3 billion, between \$1 billion-\$3 billion and up to \$1 billion gross total assets, respectively, and bank size as defined is also consistent with the literature (e.g., Berger and Bouwman 2014). Furthermore, bank size is shown to be an important factor in the literature (e.g., Carter and McNulty 2005; Berger and Black 2011).

Table 7 On-balance Sheet Liquidity Creation of Banks of Different Sizes and Recessions

On-balance sheet Liquidity creation of banks of different sizes, the Treasury Term-Spread and Recessions								
Excluding the recent Crisis (1984-2002 Sub-sample)					Full Sample (1984-2010)			
	One-Quarter	Two-Quarters	Three-Quarters	Four-Quarters	One-Quarter	Two-Quarters	Three-Quarters	Four-Quarters
TERM	-0.50 (-3.22)***	-1.10 (-3.14)***	-2.96 (-3.85)***	-4.65 (-3.04)***	-0.23 (-2.13)***	-0.47 (-2.58)***	-0.69 (-3.35)***	-0.97 (-3.71)***
Large-Sized	-14.56 (-2.06)**	-30.48 (-2.78)***	-42.23 (-2.33)***	-43.90 (-1.94)*	-17.92 (-2.82)***	-22.27 (-2.97)***	-14.52 (-2.04)**	-15.35 (-1.89)*
Pseudo R-Sq.	0.13	0.35	0.63	0.71	0.08	0.15	0.22	0.32
TERM	-0.45 (-3.29)***	-0.77 (-3.54)***	-2.07 (-3.47)***	-3.43 (-3.26)***	-0.12 (-0.82)	-0.31 (-2.01)**	-0.59 (-3.09)***	-0.87 (-3.47)***
Mid-Sized	4.47 (0.75)	0.22 (0.03)	-6.21 (-0.51)	-8.12 (-0.56)	0.10 (0.02)	-0.93 (-0.19)	-2.37 (-0.44)	-0.52 (-0.09)
Pseudo R-Sq.	0.09	0.23	0.53	0.64	0.01	0.06	0.19	0.30
TERM	-0.50 (-3.28)***	-0.85 (-3.67)***	-2.13 (-3.38)***	-3.46 (-3.25)***	-0.18 (-1.14)	-0.37 (-2.28)**	-0.63 (-3.16)***	-0.91 (-3.48)***
Small-Sized	5.46 (1.80)*	3.04 (0.73)	-1.99 (-0.33)	-2.33 (-0.34)	3.81 (1.30)	2.94 (1.01)	1.22 (0.39)	1.66 (0.49)
Pseudo R-Sq.	0.14	0.24	0.52	0.63	0.03	0.08	0.19	0.30

In Table 7, we show the relationship between on-balance sheet liquidity creation of banks of different sizes and recessions for the full sample. The results show that on-balance sheet liquidity creation of larger banks rather than that of smaller banks forecast recessions. Thus, our findings suggest that the forecasting power of dCATNONFAT for recessions (see, Table 2 Panel B) is driven by the on-balance sheet liquidity creation of larger banks. The results for off-balance sheet and aggregate liquidity creation of large banks are similar to that for dOFFBALANCE and dCATFAT, and hence those are not reported for parsimony.¹¹ Unreported results for off-balance sheet and aggregate liquidity creation of medium and small banks further show that they do not have any forecasting power for recessions. This set of results are not surprising in that over 90% of bank liquidity creation is attributed to large-sized banks as per the literature (see, e.g., Berger and Bouwman 2009). Therefore, the different policy measures targeted at “too large to fail” banks right after the last financial crisis find some support.

5.2. The Term-spread and bank liquidity creation during and after recessions

The efficacy of monetary policy depends on how it affects bank liquidity creation and monetary policy is generally loosened during recessions/crisis so that banks can create more liquidity. To better understand the dynamics, we next investigate the behavior of the term-spread and bank liquidity creation during and for a period of eight quarters after recessions. We use the following probit model:

$$(X_t = 1) = \Phi(\alpha + \beta * TERM_{t+l} + \gamma * V_{t+l}) \quad (7)$$

where $X_t = 1$ when the economy is in recession or ‘0’ otherwise, TERM is the term-spread, V is one of the bank liquidity creation growth measures, and l varies from 0 to 8. For parsimony, we present the results in Table 8 for $l = 0, 1, 3, 5$ and 8.

Table 8 Bank Liquidity Creation During and After Recessions

¹¹ These results and all unreported findings are available from the author.

Bank liquidity creation and the Treasury Term-Spread During and After Recessions										
	Excluding the recent Crisis (1984-2002 Sub-sample)					Full Sample (1984-2010)				
	R-Q	Plus 1	Plus 3	Plus 5	Plus 8	R-Q	Plus 1	Plus 3	Plus 5	Plus 8
TERM	0.14 (1.23)	0.42 (2.94)***	1.00 (3.94)***	1.21 (3.94)***	1.47 (2.45)***	-0.19 (-0.99)	0.18 (1.10)	0.57 (2.83)***	0.95 (3.36)***	1.36 (3.13)***
dCATFAT_hat	-31.90 (-3.18)***	-32.02 (-3.13)***	-25.80 (-2.51)***	-15.00 (-1.57)	0.85 (0.55)	-26.25 (-1.84)***	-32.80 (-3.22)***	-36.12 (-3.16)***	-26.43 (-3.22)***	-3.42 (-0.39)
Pseudo R-Sq.	0.17	0.23	0.32	0.33	0.37	0.10	0.28	0.39	0.37	0.35
TERM	0.14 (1.30)	0.38 (2.93)***	0.97 (3.97)***	1.15 (4.19)***	1.49 (2.45)***	0.12 (1.08)	0.36 (2.83)***	0.97 (3.97)***	1.11 (3.19)***	1.43 (3.23)***
dCATNONFAT_hat	-15.88 (-2.04)***	-17.39 (-2.14)***	-22.16 (-2.50)***	-6.03 (-0.80)	5.24 (0.55)	-15.93 (-2.03)***	-17.42 (-2.15)***	-22.31 (-2.56)***	-6.53 (-1.40)	6.78 (1.19)
Pseudo R-Sq.	0.08	0.15	0.33	0.31	0.38	0.07	0.14	0.33	0.31	0.36
TERM	0.10 (0.91)	0.38 (2.65)***	0.92 (4.16)***	1.16 (4.01)***	1.43 (2.53)***	-0.07 (-0.64)	0.20 (1.35)	0.55 (3.01)***	0.94 (3.52)***	1.37 (3.04)***
dOFFBALANCE_hat	-24.49 (-3.23)***	-24.20 (-3.12)***	-18.28 (-2.07)***	-9.98 (-1.50)	-10.05 (-0.87)	-22.00 (-3.56)***	-22.92 (-3.01)***	-21.93 (-2.93)***	-17.69 (-2.93)***	-5.57 (0.81)
Pseudo R-Sq.	0.15	0.21	0.30	0.32	0.37	0.18	0.26	0.33	0.36	0.36

For the 1984-2002 sub-sample, we find that all three bank liquidity creation measures fall for up to five quarters after recessions. By contrast, the relationship between the term-spread and recessions turns positive approximately one quarter after recessions. The coefficient estimates of TERM keep rising in each five quarters after recessions. The results thus suggest that the Treasury yield curve becomes steeper, possibly because of looser monetary policy around recession quarters. By contrast, bank liquidity creation falls to its lowest level around the third post-recession quarter.

The results for the 1984-2010 sample are similar to those of the 1984-2002 sub-sample for bank on-balance sheet liquidity creation. However, both off-balance sheet and aggregate liquidity creation keep falling beyond five quarters after recessions. At eight quarters after recessions with an upward sloping yield curve, we do not find any evidence that bank liquidity creation expands.

5.3. Monetary Policy Implications

One of the goals of monetary policy is to provide financial stability and our findings have important policy implications. First, if contractionary policy is designed to fight against the overexpansion of the economy, our results show that, when the term-spread contracts with tighter such policy, banks, particularly large banks, create less liquidity through on-balance sheet activities. Thus, the results imply that bank on-balance sheet activities before recessions are an important input to regulators concerning the efficacy of the credit tightening policy. Particularly, we show that the feedback is available about four quarters before recessions. This knowledge, along with other signals such as employment and inflation could be used to smooth out the business cycle by restricting the credit tightening cycle.

Second, our results show that while the term-spread turns positive right after recessions, possibly because of looser monetary policy, bank liquidity creation continues to fall for approximately five quarters after recessions. The results suggest that expansionary policy measures after recessions come too late to have a real impact on the economy through bank liquidity creation.

Finally, the out-of-sample results in section 4.2. show that the bank liquidity creation augmented term-spread models display better performance at higher forecast horizons. Our

results thus suggest that policymakers and forecasters should place weight on observable variables such as bank liquidity creation when forecasting recessions.

6. Concluding Remarks

Banks create liquidity on the balance sheet and off the balance sheet. Berger and Bouwman (2009) propose a measure of bank liquidity creation that factors in banks' on- and off-balance sheet activities. While measuring bank liquidity creation is important, investigating its impact on bank liquidity creation is central to evaluate the efficacy of monetary policy. It is well-known that monetary policy changes the slope of the Treasury yield curve and bank liquidity creation.

While there is extensive literature on the relationship between the slope of the Treasury yield curve and recessions (e.g., Estrella and Hardouvelis 1991; Estrella and Mishkin 1998), empirical literature on the relationship between bank liquidity creation and recessions is rare. This paper augments the benchmark term-spread model (e.g., Estrella and Hardouvelis 1991) with bank liquidity creation and shows that it contains information about future recessions.

In this paper, while we find evidence that bank on-balance sheet activities contract prior to and after recessions, we do not investigate whether or how banks manage their balance sheet by rebalancing their asset/liability composition during recessions. Future research may investigate how banks shift their cash, liquid assets and loan portfolios prior to recessions. It is further interesting to investigate whether banks change their sources of borrowing (e.g., deposits versus non-deposits) during recessions.

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Management and supervisory board gender diversity as an indicator of financial institutions' profitability in Croatia

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Abstract. The role of women on the labour market is quite significant in terms of economic growth and sustainable development. However, women are still underrepresented in leading positions in companies. This particularly refers to boardroom positions in financial institutions, such as banks and insurance companies, which are traditionally held by men. Given the above, the paper aims to investigate whether board gender diversity was an important driver of banks' and insurance companies' performance in 2014. Board composition variables used in our model include: share of women on supervisory boards (%), share of women on management boards (%), female members on supervisory board dummy variable, female members on management board dummy variable as well as supervisory and management board Blau index. Accounting measures, namely return on assets and return on equity, were used as company profitability variables. In order to investigate the true relationship between board gender diversity and bank/insurance company profitability, authors employed various empirical research methods, namely; correlation, t-test and ordinary least squares (OLS) regression method. The main finding is that there is a statistically positive relationship between the share of women on management boards and the business performance of financial institutions. Moreover, financial institutions with at least one female management board member performed better in terms of both return on assets and return on equity.

Key words: board gender diversity, profitability, financial institutions

1. Introduction

Gender equality in all aspects of life and business has been increasingly attracting the attention of public, scientists, and legislative authorities. Numerous documents, such as Council of Europe Gender Equality Strategy 2014-2017 and European Commission Strategy for equality between women and men 2010-2015, have been adopted to highlight the importance of gender equality as a focus for protection of human rights, functioning of democracy, and respect for the rule of law and economic growth and competitiveness.

As stated in the Opinion on how to overcome occupational segregation by Advisory Committee on Equal Opportunities for Women and Men of the European Commission, women's access to certain occupational sectors is limited, remaining overrepresented in others. Labour market is marked by segregation, especially vertical one that takes place where opportunities for career progression for a particular gender are narrowed. When women have equal chances as men to be socially and politically active, economies and societies thrive, and overall, women's more balanced participation in decision-making contributes to positive transformative processes for societies (Gender Equality Strategy 2014-2017). This is a largely cited statement in many documents dealing with gender equality. For example, International Labour Organization's Report on Women in Business and Management (2015) underlines the

fact that women's presence in the labour market is increasingly significant for economic growth and development at both national and enterprise levels.

In February 2016, the Council of Europe published the 2015 annual report on the implementation of its 2014-2017 Gender Equality Strategy. Although substantial progress has been made, there is still a lot to be done in order to achieve the main goal of the strategy: de facto gender equality. Given the popularity of the issue, it does not come as a surprise that in many countries there has been pressure for government reforms to foster gender diversity in the boardroom. Today, there are only four EU countries where women account for at least 25% of board members, namely: France, Latvia, Finland and Sweden (Global Center for Corporate Governance 2015, p 33.). The situation is particularly worrisome when speaking in terms of financial sector where major gaps remain.

While female representation in the boardroom is beyond dispute for ethical and social reasons, the performance effects of increasing female representation on boards is still rather ambiguous. While some studies have come to the conclusion that women's participation in decision-making is positive for business performance (Lückerath-Rovers, 2011; Barta, Kleiner, & Neumann, 2012), some indicate a negative link (Bøhren & Strøm, 2007; Gallego-Alvarez, Garcia-Sanchez, & Rodrigues-Dominguez, 2010; Francoeur, Labelle, & Sinclair-Desgagne, 2007) or no link at all (Rose, 2007; Randøy, Oxelheim, & Thomsen, 2006).

Given the above it was the authors' intention to examine if board gender diversity in financial institutions in Croatia affects their financial performance. Although, only banks and insurance companies were covered by the analysis, they accounted for almost 80% of total financial intermediaries in 2014, based on assets. Therefore, several empirical approaches were implemented in order to test the hypotheses that the share of women on both management and supervisory boards has a positive impact on financial institutions' profitability in Croatia.

The remainder of the paper is structured as follows. After the literature review given in the second part, section Sample and methodology proceeds with description of data collection, variables and methodology used. Fourth section deals with descriptive statistics analysis while the findings are reported in section 5 and in the final section we conclude with a discussion of our results.

2. Literature review

The volume of academic literature exploring the influence of gender diversity on performance is increasing, but still there is scarce empirical evidence of this relationship in financial sector, especially when insurance companies are involved. Therefore, the selection of papers the authors give in this literature review is based on the fact whether they show positive, negative or no impact on performance.

Lückerath-Rovers (2011) investigated financial performance of 99 Dutch companies that were listed on the Amsterdam Euronext stock exchange on June 30, 2008 while the analysis covered the period 2005–2007. Performance measures used in the study were return on equity (ROE), return on sales (ROS), return on invested capital (ROIC) and total shareholder return (TSR). Control variables employed in the OLS regression analysis includes board size and firm size (natural log of total assets) as well as a dummy variable for companies operating in the financial sector. The results of the analysis suggest that on average the presence of women on the board is a distinctive feature of companies that perform better in terms of ROE.

On the contrary, Bøhren and Strøm (2007) have found that the firm's performance measured by Tobin's Q is higher when, among other things, the board has low gender diversity. Their analysis was conducted using the panel model on the sample of non-financial firms listed on the Oslo Stock Exchange (OSE) at year-end at least once over the period 1989–2002. Rose (2007) investigated the influence of female board representation on firm performance

measured by Tobin's Q. The paper used a sample of listed Danish firms during the period of 1998-2001 in a cross sectional analysis. In spite of the fact that Denmark has achieved a high level of development in terms of gender diversity, the paper did not find any significant link between firm performance and female board representation.

For a thorough investigation of the literature please see; Joecks, Pull, and Vetter (2013), Pletzer, Nikolova, Kedzior, and Voelpel (2015) and Post and Byron (2015).

3. Sample and methodology

3.1 Sample and data collection

Data on assets, profit or loss, equity as well as data on management and supervisory boards on banks was collected from various issues of Banks Bulletin, a regular publication of Croatian National Bank. As for the insurance companies, the majority of data was collected from annual reports available through official corporate web sites and through the Croatian Financial Agency (FINA) web site. In particular, this refers to data on assets, profit or loss and equity as well as data on supervisory boards. Data regarding insurance companies' management board characteristics were taken from annual publications issued by the Croatian Insurance Bureau (HUO).

The initial sample consisted of all banks (a total of 28) and insurance companies (a total of 25) that operated in the Croatian bank/insurance market in 2014. However, since one bank (Jadranska Bank) reported loss, as well as negative equity, it was omitted from the analysis for having a false positive return on equity (ROE). In addition, when initial descriptive statistics data analysis were performed, it turned out that two more banks should be omitted from the sample for data on ROE and return on assets (ROA) was found to be non-normal. In order to make data more normal (which is extremely important when dealing with rather small samples such as this one) we further omitted: Tesla Savings Bank (ROA: -37.75, ROE: -68.87) and Croatian Postal Bank (ROA: -3.66, ROE: -75.23) for those two banks had extreme ROA/ROE values. By eliminating those two banks, ROA and ROE sample variances were reduced by more than 50%. The remaining banks still cover the vast majority of the market (95%). Therefore, the results obtained on basis of selected data should be representative. Finally, our sample comprised 25 banks and 25 insurance companies (reinsurance companies were not taken into consideration), i.e. a total of 50 financial institutions.

3.2. Variables

3.2.1. Dependent variables

Since only a small fraction of financial institutions covered by the analysis is listed on stock exchange, the authors opted for accounting measures of performance following approach by Moscu (2013), de Cabo, Nogues, and Nieto (2009).

Firm's performance is represented by ROA – return on assets and ROE – return on equity variables. ROA ratio is calculated by comparing net profit or loss to total assets, and is expressed as a percentage. ROA indicates how profitable a company is relative to its total assets i. e. it illustrates how well management is employing the company's total assets to make profit. ROE indicator is determined by dividing annual profit or loss after taxes by equity (capital and reserves). It measures a company's profitability by revealing how much profit a company generates with money shareholders have invested.

3.2.2. Independent variables

As proxies of gender diversity of management and supervisory boards we use several measures. The first variable used is the share of women on management board (W_MB),

calculated as the number of female board members divided by the total number of management board members. Using the same principle we also calculated the share of women on supervisory boards; W_SB .

Additionally two dummy variables were calculated; MB_D1 and SB_D1 . Dummy variables take a value of 0 if there are no women on the board (management or supervisory) and 1 otherwise (if there is one or more female board members).

Lastly, Blau index is calculated, as a true measure of board gender diversity for it has been suggested as an optimal measure of diversity to capture variations within a group of people (Miller & Triana, 2009). Blau's index is calculated using the following formula:

$$1 - \sum (p_k^2) \quad (1)$$

where variety can take k possible categories and p represents the proportion of the members in the k -th category. The minimum index value is always zero while the maximum depends on the number of categories of a particular variable. The theoretical maximum can be calculated as: $(K - 1) / K$, where K refers to the number of categories of the particular variable (Biemann & Kearney, 2009). In this case the maximum of Blau's index is 0.5 for there are only two possible categories for the variable gender; male or female. If we assume that 20% of board members are female, and the rest are male, the calculation of the Blau index would be as follows: first, share of female board members is 0.2 which should be squared ($0.2^2=0.04$), and the same should be done with the share of male board members ($0.8^2=0.64$). After that, the sum of the squared shares of male and female members ($0.04+0.64=0.68$) is subtracted from 1 ($1-0.68=0.32$), and the result is Blau index. As the board gender diversity increases, Blau index gets larger; closer to its maximum value; 0.5. It should be noted that if the Blau index value is 0, this means that the board is homogenous in terms of gender, meaning all board members are of the same gender, but it does not tell us if the board members are male or female. On the other hand, if Blau index value is 0.5, this means that both genders are equally (50%: 50%) represented within the board.

Apart from proposed independent variables we also use a set of control variables, specifically: EMP - number of employees (natural logarithm), $SIZE$ - size (natural logarithm of assets) and AGE - number of years operating in the market (natural logarithm). As our preliminary correlation analysis proved, it is logical to assume that the board size increases as the firm grows bigger (in terms of size, number of employees and/or the number of years operating in the market). When boards get bigger this should affect, among other things, board gender diversity, i.e. as the board size increases the likelihood of at least one board member differing in gender also increases.

3.2.3. Methodology

For the purposes of statistical analysis the majority of related studies relied on conventional approaches such as ordinary least squares (OLS) regression and correlation methods. Other than pre mentioned methods, t-test as well as ANOVA – analysis of variance will be employed where possible.

As mentioned earlier, three gender diversity measures will be tested in relation to ROA and ROE as firm performance variables. Given the relatively small size of the sample ($N=50$), we constructed three (3) regression models for the construction of a single regression model with a large number of independent variables that would provide results with no statistical significance. The following models are estimated:

$$Y = \beta_0 + \beta_1 EMP + \beta_2 SIZE + \beta_3 AGE + \beta_4 W_SB + \beta_5 W_MB \quad (2)$$

$$Y = \beta_0 + \beta_1 EMP + \beta_2 SIZE + \beta_3 AGE + \beta_4 SB_D1 + \beta_5 MB_D1 \quad (3)$$

$$Y = \beta_0 + \beta_1 EMP + \beta_2 SIZE + \beta_3 AGE + \beta_4 SB_Blau + \beta_5 MB_Blau \quad (4)$$

where:

Y: dependent variable; ROA, ROE,

EMP: number of employees, ln (control variable),

SIZE: firm assets, ln (control variable),

AGE: number of years operating in the market, ln (control variable),

W_SB: share of women on supervisory boards (%),

W_MB: share of women on management boards (%),

SB_DI: female members on supervisory board dummy variable,

MB_DI: female members on management board dummy variable,

SB_Blau: supervisory board Blau index, and

MB_Blau: management board Blau index.

SPSS statistical software, version 17.0., was used for empirical research.

4. Descriptive statistics

Empirical analysis includes both banks and insurance companies (in the same sample). However, it is the authors' opinion that a detailed descriptive analysis of separate groups could be beneficiary in terms of noticing similarities and/or differences among them.

Looking at financial performance, specifically ROA and ROE, it is obvious that, even though we excluded two extreme cases of negative ROA and ROE, the range of both variables is quite large, especially for insurance companies. This is why the standard deviation is quite large for both (for ROE in particular) highlighting relatively high variances of financial performance indicators round mean value, within both groups.

Comparing bank and insurance company results, a few things can be seen: the minimum size of boards is equal in both samples (2 for management board and 3 for supervisory board) however, the maximum size is grater for banks (7 for managerial and 10 for supervisory board). The share of women on management boards is 36.66% on average in insurance companies and 32.20% on average in banks; with number of board female members ranging from 0 to 2, while the number of male members range from 0 to 4 in insurance companies and from 1 to 6 for banks management boards i.e. there are no bank management boards without at least one male member. If we look at the range of male supervisory board members, it varies from 1 to 7 in insurance companies and from 1 to 10 in banks, meaning that none of the analysed companies has all female supervisory board i.e. the all have at least one male supervisory board member.

Gender structure of management and supervisory boards is quite diverse. When analysing gender diversity descriptive statistics in more detail (based on the data in Appendix I) it is evident that there are over 30% of insurance companies with no female management board members, while the majority (44%) has only one female board member. If we take a closer look at banks, it is evident that there are only 5 (20%) of them with no female management board members, while the majority of bank management boards has just one female member (15 in total or 60%). Women are most underrepresented in bank supervisory boards; the majority, or 52% to be exact, has no female members, and 32% have only one female member. Another interesting fact is worth noting when bank supervisory boards are taken under consideration, the maximum number of female supervisory board members is 3 (only in one bank) while the size of board ranges from 3 to 10 members; with 0.7 average female members and an astonishing average of 4 male members per board.

In addition to previous gender diversity variables, Blau index analysis also indicates higher level of gender diversity in management boards (average value of 0.25 and 0.36), while gender inequality in supervisory boards is lower (more homogenous, i.e. male

overrepresentation) and quite similar among bank and insurance companies supervisory boards (average value of 0.18 and 0.19).

Table 1: Descriptive statistics

Variable	Insurance companies (N=25)				Banks (N=25)			
	min	max	mean	S.D.	min	max	mean	S.D.
ROA	-32,8	8,47	-0,560	7,92	-2,4	1,14	-0,055	0,88
ROE	-52,7	23,34	1,906	16,72	-20,4	8,97	-0,878	7,83
Share of women on Management board (%)	0	100	36,66	33,33	0	66,67	32,20	20,43
Management board female members, number	0	2	0,84	0,75	0	2	1,00	0,62
Management board male members, number	0	4	1,60	1,04	1	6	2,33	1,36
Total number of management board members	2	4	2,44	0,71	2	7	3,33	1,52
Share of women on Supervisory board (%)	0	80	20,81	20,82	0	75	15,20	18,65
Supervisory board female members, number	0	4	1,04	1,02	0	3	0,70	0,82
Supervisory board male members, number	1	7	4,00	1,44	1	10	4,00	1,71
Total number of supervisory board members	3	7	5,04	1,13	3	10	4,70	1,61
Management board female members dummy	0	1	0,64	0,49	0	1	0,81	0,39
Supervisory board female members dummy	0	1	0,68	0,48	0	1	0,52	0,51
Management board Blau index	0	0,5	0,25	0,25	0	0,5	0,36	0,18
Supervisory board Blau index	0	0,5	0,25	0,18	0	0,5	0,19	0,19

5. Empirical research

As our primary interest is not only to show that board gender inequality in Croatian financial sector exists, but how it affects financial performance, we next turn to analysing ROA and ROE in respect to various gender diversity variables.

The first step is to test for correlation between the selected variables. Due to space limitations, we provide the correlation matrix with financial performance indicators and gender diversity variables (control variables excluded). From the correlation matrix (Table 2) a few conclusions can be drawn, the most important being that both ROA and ROE are positively correlated with the share of women on management boards, and ROE positively correlated with management board dummy variable (meaning that firms that have female management board members have, on average, higher ROE values). Correlation coefficients are not very high but are statistically significant at 5% level. Apart from these findings an interesting notion should be made regarding a statistically significant correlation between the share of women on management boards and the share of women on supervisory boards.

Table 2: Correlation matrix

	1.	2.	3.	4.	5.	6.	7.	8.
1. ROE								
2. ROA	0,883***							
3. Share of women on MB	0,291**	0,235*						
4. Share of women on SB	-0,058	-0,046	0,344**					
5. Dummy SB	-0,027	-0,119	0,207	0,751***				
6. Dummy MB	0,315**	0,237	0,780***	0,338**	0,282**			
7. MB Blau index	0,195	0,133	0,487***	0,240	0,252	0,848***		
8. SB Blau index	-0,043	-0,122	0,242	0,829***	0,953***	0,336**	0,330**	

***, **, *, correlation is significant at; 1%, 5%, 10%, respectively

As the correlation matrix indicated, the importance of the share of women on management boards as opposed to supervisory boards, we next turn to generating a clustered bar chart with number of female management board members (ranging from 0 to 2) as grouping variable. The analysis showed that (a total of 14) firms with no female management board members had a negative ROA/ROE average, as opposed to the rest (with 1 or 2 female members) that had positive ROA/ROE average values.

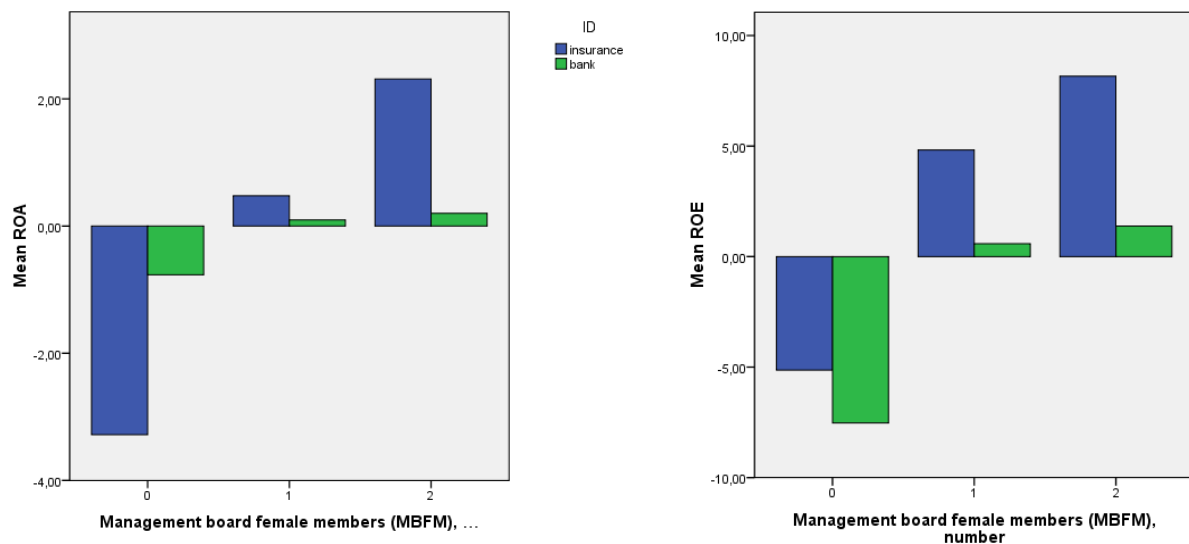


Figure 1: Mean ROA and ROE values; grouping variable: management board female members (number)

Afterwards, an Analysis of variance (ANOVA) was performed as to determine if the ROA/ROE mean difference between these groups was statistically significant. ANOVA analysis can be used if homogeneity of variances assumption is satisfied. The computed Levene statistics in Table 3 indicate that (both for ROA and ROE) variances within the groups, as noted earlier, are too big for ANOVA analysis to be adequately used.

The next step is to analyse if ROA/ROE mean difference between firms that have no female management board members and those who do is statistically significant, as correlation matrix results indicated. MB_D1 is a dichotomous variable with 0 values if there are no female management board members and 1 otherwise, so the appropriate test to employ is independent samples t-test. Independent samples t-test is used to determine if the mean difference between two (independent) groups is statistically significant by comparing average values (means) of selected variables. A mean difference is more likely to be statistically significant; if the difference between group means is large, if the sample size is large (which

is not the case with our samples) and/or if the standard deviation is low (indicating responses are not widely spread out but rather consistently close to average values).

Table 3: Test of homogeneity of variances

	Levene Statistic	Sig.
ROA	4,067	0,023
ROE	4,857	0,012

As group statistics in Table 4 suggest, both ROA and ROE mean is negative (-2.38 and -5.99 respectively) for firms with no female management board members, while positive for others (0.53 and 3.04 respectively).

Table 4: t- test group Statistics

Dummy MB		N	Mean	Std. Deviation	Std. Error Mean
ROA	none	14	-2,384	9,54796	2,5518
	else	36	0,535	2,7117	0,45195
ROE	none	14	-5,988	18,25913	4,87996
	else	36	3,042	9,44465	1,57411

Independent samples t-test results indicate that mean difference for ROA is not statistically significant, while for ROE it is, but at the 10% level. Such results are primarily a consequence of: high variances (high standard deviations) indicating widely spread ROA and ROE values around mean values, as well as rather modest sample size.

Table 5: t-test for Equality of Means

	t	df	Significance (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval	
						Lower	Upper
ROA	-1,126	13,823	0,279	-2,91876	2,59151	-8,48368	2,64616
ROE	-1,761	15,783	0,098	-9,02999	5,12755	-19,9121	1,85212

Finally, we turn to OLS regression analysis. It is important to point out that the expected predictor values of regression coefficients will not be interpreted in the traditional sense. As we have already proven, our data on ROA and ROE show high variability. Also, the sample, though covering almost entire banking and insurance market, is quite small; therefore making predictions about future ROE/ROA values based on gender diversity variables and/or control variable values would be imprudent. The reason we do continue with regression analysis is to double check our previous results, i.e. prove that the share of women on management boards positively influences bank/insurance company performance.

We employed 3 different regression models as presented earlier, or 6 to be precise, for each of them was computed with ROA and ROE as independent variable. The results of our regression analysis, namely regression coefficients (t values in brackets), are given in Table 6, with r squared and model significance data in the bottom of the table.

It should be noted that all of the models have rather low r-square values which is quite expected; in general, the higher the r-squared values are, the better the model fits the data. However, if r-squared value is low but predictors are statistically significant, we can still draw important conclusions about the nature of the connection between the predictor (gender diversity) value and the response value (ROA and ROE). Regardless of the low r-squared, the significant coefficients still indicate the mean change in the response of ROA or ROE for one unit of change in the gender diversity predictor while holding other predictors in the model constant, which is extremely valuable information.

Table 6: Regression analysis summary

Variables	Model 1		Model 2		Model 3	
	ROA	ROE	ROA	ROE	ROA	ROE
Constant	-11,754	-24,467	-6,112	-11,802	-7,585	-15,245
	(-1,624)	(-1,448)	(-0,835)	(-0,686)	(-1,010)	(-0,855)
Number of employees (ln)	-0,754	-0,665	-0,609	-0,245	-0,762	-0,656
	(-0,848)	(-0,320)	(-0,670)	(-0,115)	(-0,817)	(-0,297)
Size (ln assets)	0,550	1,222	-0,023	-0,380	0,250	0,345
	(0,651)	(0,620)	(-0,025)	(-0,179)	(0,272)	(0,158)
Number of years operating in the market (ln)	2,262	2,50	2,885	4,786	2,636	4,136
	(1,299)	(0,615)	(1,612)	(1,138)	(1,422)	(0,941)
Share of women on supervisory boards (%)	-0,190	-0,077				
	(-0,453)	(-0,781)				
Share of women on management boards (%)	0,057*	0,171**				
	(1,906)	(2,444)				
Management board female members dummy			3,469*	10,00**		
			(1,828)	(2,242)		
Supervisory board female members dummy			-1,498	-1,909		
			(-0,888)	(-0,481)		
Supervisory board Blau index					-2,571	-2,828
					(-0,545)	(-0,253)
Management board Blau index					4,238	12,732
					(1,067)	(1,352)
R-squared	0,172	0,167	0,169	0,152	0,127	0,093
Significance	0,127	0,147	0,136	0,186	0,292	0,490

** , * , coefficient is significant at; 5%, 10%, respectively

In all estimated models our control variables (number of employees, size and number of years operating in the market) turned out to be statistically insignificant. Model 1 results double checked our previous results regarding the importance of share of women on management boards. β_5 coefficient estimates indicate a statistically positive relationship between share of women on management boards and company performance (ROA and ROE). Model 2 indicated management board female members dummy as statistically significant for both ROA and ROE. Lastly, model 3 showed Blau index, a measure of gender diversity, as not being relevant to ROA and ROE variability.

To sum up, a few key conclusions can be drawn from our research results:

- ⇒ t-test group statistics suggest that both ROA and ROE means are negative for firms with no female management board members,
- ⇒ independent samples t-test results indicate that mean difference only for ROE is statistically significant, at the 10% level,
- ⇒ regression analysis coefficient estimates indicate a statistically positive relationship between share of women on management boards and company performance (ROA and ROE),
- ⇒ management board female members dummy is statistically significant for both ROA and ROE indicating that financial institutions with at least one or more female members perform better.

6. Concluding remarks

The paper deals with board composition in terms of gender diversity in financial institutions including both banks and insurance companies. Despite the attention it attracts, this issue remains largely unexplored. The authors focus on Croatian banking and insurance industry and investigate whether share of women on supervisory and management boards (%), female representation in supervisory and management board introduced as dummy variable as well as supervisory and management board diversity measured by Blau index influence corporate performance in terms of profitability.

The results of the analysis proved the importance of female participation on management boards in positively influencing financial performance of banks and insurance companies, measured by accounting indicators (both ROA and ROE). However, women are underrepresented in both management and supervisory boards with the problem of gender inequality being most evident in supervisory boards, in banks in particular.

The reasons behind female board underrepresentation are rather complex and range from traditional gender roles to prevalent political and corporate cultures, to name just a few. So the issue of gender equality should be addressed at national level. Unlike some EU members, Croatia has not yet imposed any quotas on the subject.

Given the importance and relevance of the topic under investigation, it might be interesting to extend this research taking into account other financial institutions operating in the Croatian market such as housing savings banks, leasing companies etc.

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Appendix I: The number of insurance companies and banks with N female board members

Management board female members			
N	Insurance companies (% of total)	Banks (% of total)	All (%of total)
0	9 (36%)	5 (20%)	14 (28%)
1	11 (44%)	15(60%)	26 (52%)
2	5 (20%)	5 (20%)	10 (20%)
Total	25 (100%)	25 (100%)	50 (100%)
Supervisory board female members			
N	Insurance companies	Banks	
0	8 (32%)	13 (52%)	21 (42%)
1	11 (44%)	8 (32%)	19 (38%)
2	4 (16%)	3 (12%)	7 (14%)
3	1 (4%)	1 (4%)	2 (4%)
4	1 (4%)	0 (0%)	1 (2%)
Total	25 (100%)	25 (100%)	50 (100%)

The Concept of Economic Efficiency Gains in Assessing the Mergers in the Financial Market

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Abstract. Mergers in the financial market may create premises to increase the efficiency in the sector by improving the quality of the products and services provided, thus reducing production and distribution costs, ensuring risk diversification and improving the quality of management. As a result of efficiency gains, the main beneficiaries are the final consumers. In assessing the merger, a great deal of attention is given to the features of economic efficiency as a result of corporate restructuring, because they can be used as arguments in favor of diminishing the anticompetitive effects on consumers caused by the merger. In this paper, we intend to analyze the concept of economic efficiency in assessing the mergers in the financial market, the methods used to evaluate the economic efficiency gains by the competition authorities, the results of empirical research, and the international practice in this field.

Key words: *competition, efficiency gains, financial market, data envelopment analysis.*

1. Introduction

Competition requires financial institutions to streamline the service delivery and improve the quality of financial products provided. The phenomenon of globalization has been a catalyst for the increasing number of mergers in the financial markets. Among the reasons for financial institutions to merge is to increase efficiency, especially through achieving the synergy effects. If there is a financial synergy, cost of capital should be reduced. Financial economies of scale will take the form of lower transaction costs, better access to financial market and lower capital costs. Another advantage of mergers is linked to the benefits of economies of scope, so inputs can be shared in order to provide a broader spectrum of services. Also, another form of efficiency gains are from the combination of back-office operations, information systems and administrative functions.

Mergers on the financial market that lead to the creation/strengthen of a dominant position are subject to the provisions of competition law and controlled in order to avoid instances of anticompetitive practices. Arguments on efficiency are often claimed in order to authorize an economic concentration. Thus, the analysis of the efficiency gains is an integral part of the merger assessment process in the financial market. In this paper, we intend to analyze the concept of efficiency gains covered by the competition law, methods of efficiency gains analysis in assessing economic concentrations, international practice in this area and assessment of the Moldovan banking system efficiency using Data envelopment analysis.

2. Approaches about efficiency concept in the merger analysis

The goal of the competition law is to protect competition through the most appropriate methods in order to ensure an efficient allocation of resources, which will help to increase market efficiency in a free market economy (Kolasky & Dick, 2003). If there is competition in the market, which is not affected by anti-competitive practices, economic entities initiatives to overcome rivals by offering low prices, high quality and new products, inevitably will streamline the economic activity. According to these statements, efficiency, not competition, is the ultimate goal of the legislation. In this context, economic theory outlined several core objectives of the economic concentrations regulation (Röller et. al., 2000):

- i) Consumer surplus - in this case, the consumer's gain is the central point in the assessment of mergers and it is closely linked to price development, especially if the merger would reduce the price of goods.
- ii) Total surplus - refers to the consumer and producer surplus and address the effects of the merger on the economy as a whole. Even if the merger leads to higher prices, which would harm consumers, the merger may be authorized due to the surplus of producers.
- iii) Other objectives: promoting European integration; regional balance; employment; the competitiveness of the national firms on international arena, etc.

The concept of efficiency refers to an event that increases the total value of all economic measurable assets in a society. There are several ways to classify the efficiency gains generated by a merger, but the most important categories are: allocative efficiency; productive efficiency; dynamic and transactional efficiency (Lindsay, 2006).

Allocative efficiency occurs when manufacturers produce goods and services that satisfy consumer's needs and the last pay a certain amount of money. According to the theory, in case of allocative efficiency, the value of a good to consumers at the margin is equal to the value of resources expended in supplying the product. For example, when the price could not be reduced and output could not be increased without producers making economic losses.

Productive efficiency is achieved when goods and services are produced at the lowest possible cost. Productive efficiency occurs when input could not be reorganized to increase output by at least one unit and keep the output of all other products constant. Mergers may increase efficiency through more productive ways, including promoting economies of scale, economies of scope and synergies.

Dynamic efficiency includes technological changes that lead to the improvement over time in products and production techniques, and learning-by-doing when the unit cost is decreasing because the manufacturer has more experience in the production process.

Transactional efficiency shows to what extent the cost of purchasing can be reduced. Transactional costs tend to be higher when it is likely the opportunistic behavior or extensive coordination is required among producers to achieve a cooperative agreement. Transactional efficiency is the most extensive of all types of efficiency and usually facilitates companies' efforts to achieve allocative, productive and dynamic efficiencies.

Another approach of the efficiency classification is based on the production function. Thus, there are five categories of efficiency (Röller et. al., 2000):

- i) Rationalization of production, which refers to the cost savings from reallocation of production between firms without increasing technological capacity;
- ii) Economies of scale, namely the average cost savings associated with increases in the total output;

- iii) Technological progress, which can be achieved through R&D investment and know-how;
- iv) Purchasing economies or savings in factor prices such as intermediate goods or cost of capital;
- v) Reduction of slack (managerial and X-efficiency).

Also, efficiency gains can be classified into: i) real cost-savings, which refers to economies of productive resources (ex.: economies of scale, rationalization, technological progress); ii) redistributive cost-savings, which refers to cost savings that companies may obtain in the form of lower taxes (Röller et. al., 2000).

3. Efficiency gains in economic concentration legislation

In Moldova, by the adoption of the new law on competition in 2012 was launched the competitive environment reform in accordance with the European Union practices and experience. The new law transposes the art. 101-106 of the Treaty on the Functioning of the European Union signed on 25 March 1957, the Council Regulation on the implementation of the rules on competition laid down in Articles 81 and 82 and partially the Council Regulation on the control of concentrations between undertakings. Also, the assessment of the economic concentrations in the country is done under the Merger Regulation approved in 2013 by the Competition Council. In assessing mergers, the authority responsible for supervising the competition examines the efficiencies that result from the merger of economic entities. According to the regulation, the economic concentrations susceptible to raise significant barriers to effective competition on the market or in a substantial part may be authorized if the parties to the concentration demonstrate the fulfillment of the following conditions: i) the concentration shall contribute to increasing the economic efficiency, improving the quality of production, distribution or technical progress or to increasing export competitiveness; ii) favorable effects of concentration shall compensate the negative effects of restricting competition; iii) consumers benefit to a reasonable extent from resulted advantages (Regulation on economic concentrations of 2013).

Within the European Union, efficiency analysis in the context of mergers was included in the draft regulation on mergers in 1989, which specifies that a merger would be approved if it contributed to achieving the objectives of the Treaty, so that the economic benefits will prevail over dangers on competition. However, these provisions were excluded from the final version of the regulation because the Council of Europe was unable to resolve the differences between Member States that are in favor of social, regional and industrial policy considerations (ex.: Spain, Portugal, France) and Member States that support a competition analysis system similar to the US (ex.: Germany, UK). Some Member States didn't agree on including provisions on the efficiency in the regulation because they would be used as a complement to industrial policy. Thus, it was considered that EU industrial policy, which aimed to protect and ensure the competitiveness of the industry would be supported by efficiency provisions and would contribute to the creation of industrial champions that would dominate the market and impede effective competition in the market (Butorac Malnar, 2008).

Subsequently, the economic efficiency analysis of the mergers returned to the attention of the European Commission as a result of blocking a merger amounting to 42.0 billion USD of General Electronics and Honeywell, after it was approved by the US Department of Justice (Butorac Malnar, 2008). Thus, it was initiated the Merger Regulation review. Article 4 of the EU Merger Regulation states that reorganisations are encouraged to the extent that they are in line with the requirements of dynamic competition and capable of increasing the competitiveness of European industry, improving the conditions of growth and raising the standards of living in the Community. Also, article 29 states that in determining the impact of

a concentration on competition in the common market, it is necessary to take into account any substantiated and likely efficiencies put forward by the undertakings concerned. It is considered that the merger will not raise significant obstacles to effective competition where the efficiencies generated by the merger counteract the anticompetitive effects on competition, in particular the potential harm to consumers, as a result of the creation or strengthening of a dominant position (Council Regulation on the control of concentrations between undertakings, 2004). These provisions changed radically the Commission's view on efficiency gains. Thus, a merger leading to major efficiency gains shall be authorized, even if there is a risk of rising significant obstacles to effective competition in the market. Also, among the reforms was the introduction of a new chapter on efficiency analysis in the Merger Guidelines.

The efficiency gains issue is addressed differently in the law worldwide. Thus, many countries in the world have followed the example of the United States approving provisions of the merger assessment based on the US model. In the United States the debate on the role of efficiency in merger assessment began in 1968 when Oliver Williamson argued that the cost savings generated by the merger of two institutions could justify anti-competitive effects. After, US law has changed consecutively, and currently the model applied in the analysis of the relationship between efficiency and market competition is a hybrid, aiming at both consumer surplus, as well as total surplus (Butorac Malnar, 2008). Practice and experience of the United States in integrating the analysis of efficiency gains in competition law were adopted widely by the other states, according to their economic characteristics.

In Canada were promoted advanced policies in the analysis of the link between ensuring market competition and efficiency gains. Thus, the Competition Court approved a merger based on economic efficiencies, even if it led to the monopolization of the market. Among the basic arguments of the Court where the small size of the Canadian economy, compared to the US and thus a high level of market concentration may be necessary to achieve the results economies of scale and increasing economic efficiency (Kolasky & Dick, 2003).

4. Mechanism of efficiency gains analysis in the assessment of economic concentration

According to the legislation, economic concentration includes all those operations that result in lasting change in the control of undertakings involved and market structure. The change of control on a lasting basis results from: i) the merger of two or more previously independent undertakings or parts of undertakings; ii) the acquisition, by one or more persons already controlling at least one undertaking, or by one or more undertakings, whether by purchase of securities (social shares) or assets, by contract or by any other means, of direct or indirect control of the whole or parts of one or more other undertakings (Regulation on economic concentrations, 2013).

Moldovan law on competition stipulates the incompatibility of the competitive environment with economic concentrations that could raise significant obstacles on the effective competition in the market or in a substantial part of it, especially as a result of the creation or strengthening of a dominant position. A dominant position means holding a relevant market share that exceeds 50%. However, mergers that could raise significant obstacles to effective competition on the market or in a substantial part of it would be authorized if the parties involved in the concentration demonstrate that: i) the concentration shall contribute to increasing the economic efficiency, improving the quality of production, distribution or technical progress or to increasing export competitiveness; ii) favorable effects of concentration shall compensate the negative effects of restricting competition; iii) consumers benefit to a reasonable extent from resulted advantages.

Thus, the merger that raise obstacles in the competitive environment will be authorized by the relevant authority only if efficiency gains will compensate the anti-competitive effects and these benefits will be passed on to consumers. The evaluation of the efficiency gains, as well as anti-competitive effects resulting from the merger of financial institutions are carried out by the merging entities and it is part of the notification form of economic concentrations.

In order to facilitate the evaluation process of the efficiency gains and anti-competitive effects resulting from a merger it is proposed to complete 3 steps: 1. screening the economic concentration; 2. measuring efficiency gains and anti-competitive effects; 3. balancing the efficiency gains and anti-competitive effects (Kastberg Nielsen et. al., 2006).

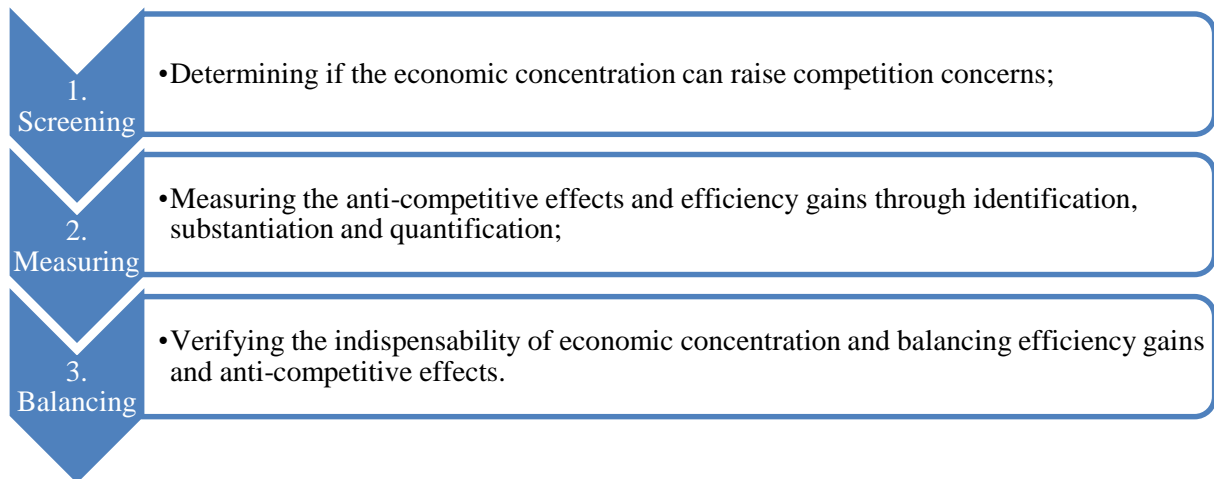


Figure 1 Mechanism of efficiency gains and anti-competitive effects assessment in the evaluation of economic concentration

The starting point in the efficiency gains analysis is to determine whether it is necessary to initiate proceedings in this regard. The regulation on the control of economic concentrations developed based on the EU legislation contains certain conditions that establish what types of merger fall under the law and what conditions should be met in order to get the authorization from the relevant authority.

The first step in the assessment of efficiency gains is screening, which aims to clarify the probability of rising barriers to competition in the market as a result of the merger. If the merger does not present any harm to the competitive environment, it is excluded the relevance of efficiency gains and anticompetitive effects assessment. Screening consists of 3 stages. First, the assessor should verify if the merger will result in the emergence of obstacles to effective competition in the market or it is automatically exempt from control. In this context, the legislation sets certain thresholds as turnover. Once the thresholds are exceeded, the participants to the concentration are obliged to get the approval of the competition authority. Afterwards, the assessor should verify if the merger does not generate unacceptable restrictions, which have a particularly negative impact on competition. Unacceptable restriction means strengthening or creation of a dominant position and it is considered a dominant position, holding a market share exceeding 50% of the relevant market. If the merger doesn't have a particularly negative impact on market competition, the assessor may initiate the procedures for determining the efficiencies and anti-competitive effects in order to balance them.

Once the assessor has finished the screening process and identified the need for determining the efficiency gains and anti-competitive effects, he should initiate the measurement. This stage aims to measure the size of anticompetitive effects and the efficiency gains by

identification, substantiation and quantification. The identification has the aim to conclude a list of all anti-competitive effects and efficiency gains.

According to the EU experience, in merger evaluation, the competition authority will take into account the efficiency gains only if they are in favor of consumers, merger-specific, verifiable and timely. The efficiency gains are merger-specific if they are a direct consequence of it, unable to be obtained at a similar level through less anti-competitive alternative procedures. Also, the competition authority should ensure that the alleged efficiencies could materialize and are significant enough to counteract the possible harm to consumers (Guidelines on the assessment of horizontal mergers, 2004).

Substantiation refers to determining whether the anti-competitive and efficiency gains are large or small, and quantification determines the magnitude of the concentration impact. The measurement is a complex and expensive process, involving the use of advanced techniques, as well as comprehensive statistical information on the market. Among the most popular methods of determining the size of the anticompetitive effects and efficiency gains are: diversion ratio; market simulation; event study analysis; engineering studies; regression analysis; Data Envelopment Analysis (Kastberg Nielsen et. al., 2006).

The diversion ratio measures the lost share of sales if the price will rise. This indicator can be calculated as the share of price-elasticity and cross-price elasticity estimates. More particularly a diversion ratio would be used to assess the extent to which an increase in price of one brand of 5 to 10 percent would lead the consumers to switch to the second brand. The calculation of the ratio involves holding reliable data on price and quantity of products/services on the market, which constitute a significant barrier in using this indicator.

Market simulation is a mathematical model showing the real market, where anti-competitive effects of market changes can be simulated and calculated. They are usually developed for oligopolistic markets and are used to quantify the effect of horizontal mergers on the price. Market simulation models are complicated and require the construction and interpretation of complex data about the market. A simulation market includes 3 steps: estimating the elasticity; building the model and merger simulation.

Event studies aim to determine how asset prices would change as a result of the company's merger announcement. The price difference before and after the announcement is interpreted as efficiency gains or losses. However, it is a tool for calculating indirect efficiency gains.

Engineering studies are studies that analyze the variation in costs depending on the volume of production, studying the economies of scale in the enterprise and show the implications of economies of scale on industry structure. Based on these studies, it is possible to calculate the minimum efficient scale, elasticity of scale, the average cost, marginal cost, variable costs, fixed costs and particularly the cost function, using internal company data.

Regression studies are econometric analysis of production or cost functions for a particular industry. The aim is to identify the average level of production costs at a certain level of quantity for all companies in the sector and this type of analysis shows how efficient is a particular company against the industry average. Regression studies can provide information on the estimated size of cost savings and identify some cases where it is possible to make these savings.

Data Envelopment Analysis is a tool used to estimate the relative level of efficiency for different companies. Unlike regression studies, which compare companies at a hypothetical average of the industry, this method compares the company with the most efficient enterprise on the market.

Once the evaluator measured the value of efficiency gains and anti-competitive effects, he should initiate the balancing phase, which aims to determine whether the efficiency gains

compensate the anti-competitive effects. In consequence, the assessor concludes one of the following statements: i) efficiency gains are greater than anti-competitive effects, and the merger would be submitted for approval to the competent authority; ii) suggestions to amend the economic concentration in order to mitigate the impact on competition in the market; iii) the merger would raise significant obstacles on competitors in the market.

Also, at this phase the assessor should verify if the merger is necessary and its results cannot be obtained by other way. Simultaneously, the assessor should check whether the merger will not create a significant impediment of effective competition in a substantial part of the market and if the efficiency gains are transferred to a sufficient degree to consumers.

5. Analysis of the banking system efficiency of Moldova using the Data Envelopment Analysis

The banking sector contributes to the growth and welfare of the society. In circumstances where the private sector is facing the lack of financial resources for development and the public sector is characterized by a high level of public debt, ensuring an effective banking system will create prerequisites for sustainable economic development.

The Moldovan banking system has the tendency for instability and fragility. At the end of 2015, the banking sector consisted of 11 commercial banks, including 4 branches of foreign banks and financial groups. During 2015 was initiated the liquidation proceedings for 3 commercial banks. Moreover, the banking sector is characterized by a moderate level of competition. Thus, in 2015 the share of five commercial bank's assets in total banking sector assets was equal to 83.96%, increasing by 8.11 pp compared to 2014.

Table 1 Moldovan banking sector indicators for 2013-2015

Name	2013	2014	2015
Assets, million MDL	76190,12	93909,15	69095,55
Liabilities, millions MDL	64753,21	81545,14	57330,03
Loans, million MDL	42177,28	40841,98	38187,61
Deposits, million MDL	51889,94	65462,51	50201,51
Total banking system assets / GDP, %	76,28	84,03	57,68
Assets of the 5 largest banks / Total assets, %	70,43	75,85	83,96
Nonperforming loans ratio, %	11,56	11,73	9,95
Total number of bank employees	10933	10231	7621
Number of bank subdivisions	1287	1339	814

Source: developed by the authors based on the reports of the National Bank of Moldova

The Moldovan banking sector is facing the tendency for deposit reduction and the risk of worsening the loan portfolio quality. During 2015, the National Bank of Moldova promoted a tough monetary policy, due to the acceleration in inflation, which at the end of the third quarter of 2015 was equal to 11.1%. In these circumstances, the central bank has taken steps to combat inflationary pressures and currency depreciation by increasing the basic rate applied to the main short-term monetary policy operations by 5 pp and required reserves in MDL by 2 pp. Increased rates on the monetary policy instruments did not have an impact on bank deposits in national currency. In 2015, deposits decreased by 23.3% compared to 2014. This decrease was due to the reduction of deposits in foreign currency by 11.8% and in national currency by 11.5%. Moreover, total loans recorded a downward trend, which in 2015 decreased by 9.5% compared to 2013. The population reluctance on placement of funds as deposits in MDL and reduced access to credit was due to the depreciation of national currency against the USD by 25%, harsh monetary policy promoted by the central bank and economic uncertainty.

The bank efficiency analysis continues to be an extensively discussed topic by the economic researchers. Given the lack of data on bank mergers in Moldova, which makes it impossible to assess their impact on the efficiency of the banking system, we intend to analyze the efficiency of each bank in the banking sector, using the non-parametric methodology "Data Envelopment Analysis".

The concept of Data Envelopment Analysis was first used by Charnes, Cooper and Rhodes in 1978 to measure the efficiency of each decision-making unit. They defined the methodology of data envelopment analysis as a nonlinear programming model that provides a new definition of efficiency for use and a new way for estimating external relations from observational data (Charnes et. al., 1978).

DEA provides a comprehensive analysis of the relative efficiency for situations with multi-input, multi-output in order to assess and measure the performance of each company compared to its envelope surface determined by other companies. Companies that belong to this area or draw it in DEA terminology are cited as being effective and those that are not placed on the surface are named as inefficient. DEA methodology can measure the efficiency depending on the input or output. Measuring the technical efficiency by input-oriented approach tends to answer to the question: "How much input can be reduced without changing the amount of produced outputs?". In case of measuring efficiency by output-oriented approach the tool will answer to the question: "How much the output can increase keeping the same amount of inputs?" (Roman, 2003).

Data envelopment analysis addresses two types of returns to scale, either constant returns to scale (CRS) or variable returns to scale (VRS). In this paper, we used DEA with variable returns to scale, which is an extension of the DEA model with constant returns to scale. The assumption of constant returns to scale is possible only when companies operate at an optimal scale. Imperfect competition, financial constraints may influence a company not to operate at an optimal scale. The use of constant returns to scale specification when not all companies operate at an optimal scale, result in measuring technological efficiency (TE) that can be confused with scale efficiency (SE) (Roman, 2003).

DEA assesses N firms; each firm uses K inputs to produce M - different outputs. The company i is represented by the column vectors of inputs x_i , and outputs y_i , and X and Y are input and output matrices. Thus, the model will take the following form:

$$\left\{ \begin{array}{l} \min_{\theta, \lambda} \theta \\ -y_i + Y\lambda \geq 0 \\ \theta x_i - X\lambda \geq 0 \\ N_I \lambda = 1 \\ \lambda \geq 0 \end{array} \right. \quad (1)$$

In the model, θ is a scalar, λ is a constant vector of dimension $N \times 1$, and N_I is a vector of elements equal to 1 for the dimension $N \times 1$. The program should be solved N times for each firm and get a θ value for each company.

This model doesn't specify whether the company operates in an area where returns to scale are increasing or decreasing. For this reason the restriction $N_I \lambda = 1$ was replaced with $N_I \lambda \leq 1$, whereby was added the non-increasing returns to scale (NIRS).

$$\left\{ \begin{array}{l} \min_{\theta, \lambda} \theta \\ -y_i + Y\lambda \geq 0 \\ \theta x_i - X\lambda \geq 0 \\ N_i \lambda \leq 1 \\ \lambda \geq 0 \end{array} \right. \quad (2)$$

The nature of inefficiency for a given company, due to increasing or decreasing returns to scale, can be determined by comparing the technical efficiency in case of non-increasing returns to scale with variable returns to scale. If they are not equal, the company operates in conditions of increasing returns to scale, and if the conditions are equal, then the firm operates under decreasing returns to scale (Roman, 2003).

The DEA model shown above is an input-oriented model, which aims to identify technical inefficiency as a proportional reduction in input use, maintaining the output level constant. Also, it is also possible to measure the technical inefficiency as a proportional increase in output, maintaining the level of input. The technical inefficiency must be equal under constant returns to scale, but different in case of variable returns to scale.

In the DEA Model used for the analysis of the Moldovan banking system efficiency, we used two inputs and three outputs, namely: Y1: total loans; Y2: interest income; Y3: non-interest income; X1: total deposits; X2: share capital. The descriptive statistics for the variables are shown in the table below.

Table 2 Descriptive statistics of the variables used in DEA model

Name	2013	2014	2015
Total loans, million MDL			
Min	161,49	174,79	191,30
Max	9184,87	10826,03	11225,70
Mean	3134,45	3329,04	3471,60
Standard deviation	3048,44	3468,08	3658,51
Interest income, million MDL			
Min	22,98	22,10	35,90
Max	922,13	1062,31	1464,02
Mean	352,96	375,27	497,11
Standard deviation	323,45	363,03	491,43
Non-interest income, million MDL			
Min	11,38	12,31	14,14
Max	205,76	234,65	305,20
Mean	78,37	88,64	106,26
Standard deviation	70,38	83,26	104,97
Total deposits, million MDL			
Min	90,41	99,57	254,82
Max	9517,40	11487,72	14022,84
Mean	3499,99	3804,54	4563,77
Standard deviation	3705,22	3974,98	4670,76
Share capital, million MDL			
Min	100,00	100,00	100,00
Max	1000,00	1250,00	1250,00
Mean	323,39	359,59	359,59
Standard deviation	272,63	339,24	339,24

Source: developed by the authors based on the reports of the National Bank of Moldova

In the analysis of the banking system efficiency based on data envelopment analysis, we used the DEAP program (Coelli, 1996). The estimates of banking technical efficiency have been calculated using the input-orientation and variable returns to scale. The data has been entered into the DEAP program for three years and the results are shown in the table 3.

In the table below are reflected data for the 11 banks, which function in Moldova. Moreover, the abbreviation “OE” stands for overall efficiency, “TE” is the abbreviation for technical efficiency and “SE” means scale efficiency. According to calculations, the most efficient commercial banks in the banking system received an indicator value equal to 1,000.

Table 3 Summary of mean efficiency levels of Moldovan banks

Name	2013			2014			2015		
	OE	TE	SE	OE	TE	SE	OE	TE	SE
BC „MOLDOVA - AGROINDBANK” S.A.	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
B.C. „COMERTBANK” S.A.	0,619	0,794	0,779	0,654	0,888	0,736	0,730	0,920	0,794
BC „EuroCreditBank” S.A.	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
B.C. „ENERGBANK” S.A.	0,900	1,000	0,900	0,994	1,000	0,994	0,976	1,000	0,976
B.C. „EXIMBANK - Gruppo Veneto Banca” S.A.	0,990	1,000	0,990	0,778	1,000	0,778	0,760	0,885	0,859
B.C. „FinComBank” S.A.	1,000	1,000	1,000	0,966	1,000	0,966	1,000	1,000	1,000
BC „MOBIASBANCA - Groupe Societe Generale” S.A.	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
BC „Moldindconbank” S.A.	0,830	0,957	0,867	1,000	1,000	1,000	0,992	1,000	0,992
B.C. „ProCredit Bank” S.A.	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
BCR Chisinau S.A.	0,586	0,685	0,855	0,653	0,742	0,880	0,963	0,982	0,981
B.C. „VICTORIABANK” S.A.	0,881	1,000	0,881	0,855	1,000	0,855	1,000	1,000	1,000
Mean	0,891	0,949	0,934	0,900	0,966	0,928	0,947	0,981	0,964

Source: elaborated by the authors using the DEAP Program

According to the results, the overall efficiency of the Moldovan banking system has improved in 2015 compared to 2013. The banking sector recorded an overall efficiency level of 89.1% in 2013, 90.0% in 2014 and 94.7% in 2015. The analysis of overall efficiency suggests that the improvement in 2015 compared to 2013 was due to the increase of both the technical efficiency and scale efficiency. During 2013-2015, the scale inefficiency was bigger than technical inefficiency, which suggests that although banks have effectively controlled its costs, they operated on a wrong scale.

The results of DEA analysis showed that during 2013-2015, four commercial banks operated efficiently. In 2013 and 2014, this number was equal to 5, and 6 commercial banks operated efficiently in 2015.

During 2013-2014 the bank BCR “Chisinau” S.A obtained the lowest ratio of overall efficiency compared with other banks in the sector. According to the results in 2013, BCR “Chisinau” SA could reduce inputs by 41.4% and 34.7% in 2014 to achieve the same level of output. In 2015, it increased its efficiency up to 96.3%, the waste of input being equal to 3.7%.

In 2015 the overall efficiency of the banks ranged between 73.0% and 100%, suggesting that banks worked relatively efficient in performing the basic functions, the waste of resources being equal to 5.3%. Also, the decomposition of the total efficiency in technical efficiency

and scale efficiency suggests that inefficiency in the banking sector is mainly due to the inefficiency of scale (3.6%) compared to technical inefficiency (1.9%).

6. Conclusions

Competition law aims to protect the competition by ensuring the efficient allocation of resources, which will help to increase the market efficiency. Thus, efficiency, not competition, is the ultimate goal of the legislation. Furthermore, according to economic theory, the expected results of mergers are the increase in consumer or producer surplus. In this context, the efficiency generated by the mergers in the financial market could contribute to financial sector development, given that they provide better access to the financial markets and will contribute to lower costs of capital and transactions. However, the economic concentration legislation provides the incompatibility of the competitive environment with mergers that could significantly impede the effective competition in the market or in a substantial part of it, especially as a result of the creation or strengthening of a dominant position. Thus, in order to allow a merger that could have a significant impact on market competition, the efficiency gains should be greater than anticompetitive effects and the beneficiaries should be the consumers. There are a lot of ways to classify the efficiency and the most used is allocative, productive, dynamic and transactional efficiency.

The evaluation mechanism of efficiency gains is complex and costly. In the assessment of efficiency gains should be undertaken 3 steps: 1. Screening the economic concentration; 2. Measuring the efficiency gains and anti-competitive effects; 3. Balancing the efficiency gains and anti-competitive effects. The first step in assessing the efficiency gains is screening, which aims to clarify the probability of rising barriers to competition in the market. Measuring aims to quantify the anticompetitive effects and efficiency gains and balancing to determine whether efficiency gains will compensate the negative impact of anti-competitive effects. The competition authority will take into account the efficiency gains only if the gains are: consumer-oriented, substantial, merger-specific, verifiable and timely.

There is a multitude of methods to quantify the efficiency gains, but they are quite costly and involve the use of advanced techniques, as well as comprehensive statistical information on the market. Among the most popular methods of determining the size of the anti-competitive effects and efficiency gains are: diversion ratio; market simulation; event studies; engineering studies; regression studies; data envelopment analysis.

Given the lack of data on bank mergers in Moldova, which makes it impossible to assess their impact on the efficiency of the banking sector, we applied the "Data Envelopment Analysis" tool to assess the Moldovan banking sector efficiency. According to the results, the banking sector's performance has improved during 2013-2015. The banking sector recorded an overall efficiency of 89.1% in 2013, 90.0% in 2014 and 94.7% in 2015, loss of resources being equal to 10.9% in 2013, 10.0% - 2014 and 5.3% in 2015. Also, in 2015 six commercial banks have worked efficiently of 11 banks. Also, if we decompose the overall efficiency in technical efficiency and scale efficiency, we conclude that inefficiency in the banking sector is mainly due to the scale inefficiency. This suggests that although banks have effectively controlled its costs, they operated on a wrong scale.

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IMPROVING CAPITAL STRUCTURE

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Abstract. In the analysis of financial statements, the amount and structure of equity is an extremely important category that stakeholders use in the process of evaluating the going concern assumption sustainability. The existence of fair value in accounting regulation is conceived as a corrective to fluctuations in the value of certain assets. However, when considering its characteristics, fair value has inherent inability of establishing stable measures which would contribute to the standardization of this category. It is precisely this mentioned inability that paves the way for manipulation using asset revaluation. Therefore, when conducting a financial analysis of the business operations of a company, share of revaluation reserves and other positions in the capital structure of the company should be explored. Statistical analysis of financial data will be carried out on the sample of companies that are listed on the Zagreb Stock Exchange.

Keywords: *capital structure, revaluation reserves, public limited company, statistical analysis, Republic of Croatia*

1. Introduction

Fair value has always occupied the attention because of its subjectivity. It is a necessary compromise between subjectivity of valuation and objective statement of asset value because there is no other way to continuously adjust actual state of property with the accounting records. Since these are the items of equity, their value can have a significant impact on capital structure. Because of that, it will also be analyzed whether investors evaluate capital structure using aggregate values or also pay attention to its structure in detail. The research will include analysis of share price movements which are mainly determined by relation of supply and demand in the market. Financial analysis of annual reports is one of the most influential factors that contribute to the demand for a certain share.

2. Capital structure and fair value

From historical point of view, definition of capital is not unambiguously defined. Its interpretation varied among different authors. Considering different capital theories, Schumpeter gave an explanation that is still actual. He has explained term equity as "sum of money or its counter value, which the partners have invested in company, the total amount of assets etc. It is essentially a monetary term which means real money or a claim in money or goods estimated in cash"¹. Lubhan and Frankenberg, the authors of the German professional

¹ Brkanić, V: *Optimalizacija bilančne strukture*, RRI plus, Zagreb, 2002., p. 7.

literature, express accounting concept of capital as part of funding sources: "The account of capital serves for demonstration of own funds, own equity of a company. When there are multiple owners, individual accounts of capital which provide information on property relations must exist in bookkeeping for each owner of the company."²

Modern economic theory confirms that authors are not unique in defining capital. One part of them relate capital to assets. From accounting perspective, capital is residual value of total assets which remains after deducting liabilities. In the Croatian economic thought, definition of capital is less frequent. Veselica, V. explains how equity represents an owner of a company who is entitled to the profit of a company and earnings from its sales.³ Numerous authors in the field of financial science identify capital with the funds disposable for investment.

Companies use a variety of sources in financing their business. Basic structure of funding sources can be viewed from aspect of ownership (owner's and borrowed) and aspect of maturity (long-term and short-term). Combination of different, long-term and short-term sources, which companies use to finance their operations, are called financial structure. Financial structure shows, therefore, a way of financing entire assets of a company.

Capital structure policy determines which proportion and type of debt to combine with equity. Structure of long-term capital, i.e. total equity and long-term sources borrowed from banks and other creditors and investors who are not owners or shareholders, as well as obligations for issued long-term securities, is usually called capital structure. In other words, the policy of capital structure includes management of owner's and borrowed long – term capital.

There are numerous ways in which companies achieve improvements in capital structure, for example, by equity issuance, borrowing from banks or issuing corporate bonds and selling them to various institutional and individual customers. There is an increasing number of financial instruments which companies use to raise capital (funds) and finance its operations.

Economic theory, in a certain way, has set theoretic relations of capital structure which are considered optimal. Optimum is a goal and purpose of a number of procedures that should lead activities of a company to effective economic positions of assets, including the capital structure.

In a struggle of achieving competitive edge, companies have possibility of adopting new standards of efficiency regarding capital structure management. Considering the global cash flows, value creation and requirements that fundamental positions of corporate financial reporting should demonstrate fair value, accounting and financial science and profession introduces new models of assets and liabilities valuation. The consequence of abovementioned has resulted in introduction of fair value as the model for evaluation of assets and liabilities in companies. This has led to new capital structure positions.

In the capital structure different positions appear such as share capital, capital reserves, reserves from retained earnings, revaluation reserves and profit or loss. Revaluation reserves are part of the equity which is consequence of asset reassessment that exceeded purchasing costs (of tangible and intangible assets). Asset measured at fair value is an amount at which an asset could be exchanged between informed unrelated parties that are willing to carry out a transaction. Liability measured at fair value is the amount for settlement of the liability between informed, unrelated parties that are willing to carry out a transaction.

Thus, the application of revaluation model introduces fair value in measurement of fundamental tangible assets positions, so companies have an opportunity to change capital structure.

² *Ibidem*, p. 8.

³ Veselica, V.: *Financijski sustav u ekonomiji*, Inženjerski biro d.d., Zagreb, 1995., p. 61.

3. Data, methodology and hypotheses

Data used for calculating financial ratios was obtained from Zagreb Stock Exchange's (ZSE) official website and consists of 75 companies listed on ZSE's regulated market in 2013. Only requirement which had to be fulfilled was that share of a certain company was traded on ZSE in last month of two years included in research.

Revaluation reserves to equity ratio and provisions to total assets ratio were used to represent two frequently assessed accounting positions – revaluation and provisions. Accounting standards are flexible regarding these categories and they provide broad opportunities for creative accounting which consequentially results in embellishment of financial statement's "bottom line" which can be misleading to investors. High relative values of these categories are often considered as "red flag" and reason to perform a deeper and more focused financial analysis. Footnotes can be very abundant source of information in analysis of structure and values of these positions.

Other two categories included in research are retained earnings and net profit of the period. Net profit is one of the key categories which investors on stock market expect to be high because it is more likely that the profitable company will perform dividend payout to their shareholders. Also, company retains better position in negotiations with creditors as well as improved public opinion and increased public interest. Downside of this category is that it can be misleading if creative accounting techniques are applied. Retained earnings are part of annual profit which is kept in company instead of allocating it to shareholders. It is logical that this position is not popular by the vast majority of shareholders who prefer dividend payout. If this category is negative it means that there are accumulated losses instead of retained earnings for observed financial year.

Table 1. Abbreviations used in analysis

Abbrev.	Ratio
RR/EQ	Revaluation Reserves to Equity
P/TA	Provisions to Total Assets
RE/TA	Retained Earnings to Total Assets
NP/TA	Net Profit to Total Assets

The aim of this research is to analyse relationship between aforementioned positions which are reported in balance sheet and market valuation of a company, i.e. price of a company on stock exchange. Statistical techniques will be applied in order to reach conclusions on research hypotheses which are established as follows:

Hypothesis 1 – there is statistically significant negative relationship between revaluation reserves to equity ratio and change of market price of a company,

Hypothesis 2 – there is statistically significant negative relationship between provisions to total assets ratio and change of market price of a company,

Hypothesis 3 – there is statistically significant negative relationship between retained earnings to total assets ratio and change of market price of a company,

Hypothesis 4 – there is statistically significant positive relationship between net profit of the period to total assets ratio and change of market price of a company.

4. Research results

Table 1. presents descriptive statistics for all analyzed ratios (mean and standard deviation). Every activity has it's own specificity regarding these financial positions. "Agriculture", Forestry and Fishing", "Manufacturing", "Construction" and "Professional, Scientific and Technical Activities" have very high revaluation reserves to equity indicators due to a fact that they are capitally intensive activities and need significant investment in non-current

assets. When comparing provisions to total assets, “Manufacturing”, “Construction”, “Accommodation and Food Service and Arts”, “Entertainment and Recreation” are above average.

Table 2. Descriptive statistics

	Revaluation reserves to equity (RR/EQ)			Provisions to total assets (P/TA)			Retained earnings to total assets (RE/TA)			Net profit of the period to total assets (NP/TA)		
	N	Mean	S.D.*	N	Mean	S.D.*	N	Mean	S.D.*	N	Mean	S.D.*
Agriculture, Forestry and Fishing	3	0,35	0,2781	3	0,002	0,003	4	-0,025	0,152	4	-0,038	0,029
Manufacturing	26	0,46	1,7645	26	0,025	0,060	23	-0,475	2,263	23	0,022	0,140
Construction	4	0,48	0,5558	4	0,020	0,019	3	-0,068	0,068	3	-0,019	0,070
Retail and Wholesale Trade	4	0,12	0,1210	4	0,005	0,005	5	0,001	0,229	5	0,014	0,045
Transport and Storage	8	0,002	0,0275	8	0,007	0,007	8	-0,115	0,307	8	0,001	0,142
Accommodation and Food Service	19	-0,05	0,9110	19	0,022	0,063	22	-0,018	0,314	22	0,005	0,073
Information and Communication	2	-0,0001	0,0001	2	0,007	0,004	1	0,050		1	0,008	
Real Estate	1	0,0000		1	0,000		1	0,254		1	0,033	
Professional, Scientific and Technical Activities	7	0,7002	1,4470	7	0,018	0,015	6	-0,254	0,548	6	-0,001	0,029
Arts, Entertainment and Recreation	1	0,0000		1	0,034		1	0,013		1	0,040	
Total	75	0,2574	1,2294	75	0,019	0,048	74	-0,186	1,284	74	0,008	0,100

* S.D. - Standard Deviation

It is notable that average net profit values of all analysed activities do not go over 4 percent (there are no activities that are, on average, extremely profitable in relative terms), and some are (on average) even unprofitable. Regarding retained earnings, highest average values are in „Real Estate“ activity (25,4 percent), while highest average loss was achieved in „Manufacturing“ activity (47,5 percent).

Table 3. Correlation table

		P_delta	RR/EQ	P/EQ	RE/TA	NP/TA
P_delta	Pearson Correlation	1	-0,087	0,012	-0,441**	0,486**
	Sig. (2-tailed)		0,463	0,921	0,000	0,000
	N	74	74	74	74	74
RR/EQ	Pearson Correlation	-0,087	1	-0,003	0,016	-0,177
	Sig. (2-tailed)	0,463		0,978	0,893	0,130
	N	74	74	74	74	74
P/EQ	Pearson Correlation	0,012	-0,003	1	0,014	0,200
	Sig. (2-tailed)	0,921	0,978		0,904	0,088

	N	74	74	74	74	74
RE/TA	Pearson Correlation	-0,441**	0,016	0,014	1	-0,406**
	Sig. (2-tailed)	0,000	0,893	0,904		0,000
	N	74	74	74	74	74
NP/TA	Pearson Correlation	0,486**	-0,177	0,200	-0,406**	1
	Sig. (2-tailed)	0,000	0,130	0,088	0,000	
	N	74	74	74	74	74

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Correlation analysis (Table 2) indicates that there isn't statistically significant relationship between change of company's market price and revaluation reserves to equity ratio. Same can be applied to relationship between change of company's market price and provisions to total assets ratio. On the other side, retained earnings to total assets ratio and change of market price of a company as well as net profit of the period to total assets ratio and change of market price of a company are significantly correlated. Retained earnings to total assets ratio has moderate negative correlation with market price change, while net profit of the period to total assets ratio has moderate positive correlation with the same variable.

Table 4. Model Summary

a. Predictors:	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
(Constant), RR/EQ	1	0,087	0,008	-0,006	0,490
(Constant), P/TA	1	0,012	0,0001	-0,014	0,492
(Constant), RE/TA	1	0,441	0,195	0,184	0,441
(Constant), NP/TA	1	0,486	0,236	0,226	0,430

Table 5. ANOVA

Dependent Variable:	Predictors:	Model		Sum of Squares	df	Mean Square	F	Sig.
P_delta	(Constant), RR/EQ	1	Regression	0,131	1	0,131	0,545	0,463
			Residual	17,290	72	0,240		
			Total	17,421	73			
P_delta	(Constant), P/TA	1	Regression	0,002	1	0,002	0,010	0,921
			Residual	17,418	72	0,242		
			Total	17,421	73			
P_delta	(Constant), RE/TA	1	Regression	3,393	1	3,393	17,412	0,0001
			Residual	14,028	72	0,195		
			Total	17,421	73			
P_delta	(Constant), NP/TA	1	Regression	4,119	1	4,119	22,296	0,0001
			Residual	13,302	72	0,185		
			Total	17,421	73			

Table 4 shows how much variation is explained by certain regression model. Linear regression model which includes the retained earnings to total assets ratio, and a model which

includes the net profit to total assets ratio are statistically significant, while linear regression models for the revaluation reserves to equity ratio and the provisions to total assets ratio were not statistically significant (Table 5).

Table 6. Independent Variables Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Dependent Variable: P_delta		B	Std. Error	Beta		
1	(Constant)	0,101	0,058		1,735	0,087
	RR/EQ	-0,034	0,046	-0,087	-0,738	0,463
1	(Constant)	0,090	0,061		1,463	0,148
	P/TA	0,120	1,203	0,012	0,100	0,921
1	(Constant)	0,061	0,052		1,175	0,244
	RE/TA	-0,168	0,040	-0,441	-4,173	0,0001
1	(Constant)	0,074	0,050		1,480	0,143
	NP/TA	2,381	0,504	0,486	4,722	0,0001

The independent variables coefficients of linear regression models are positive for the provisions to total assets ratio and the net profit to total assets ratio, which means that the increase in these ratios will be accompanied by an increase in the dependent variable (changes in market price of share), while the coefficients are negative for revaluation reserves to equity ratio and the retained earnings to total assets ratio, which means that the increase in these ratios will be accompanied by a decrease in the dependent variable (Table 6). The coefficients for provisions to total assets ratio and the revaluation reserves to equity ratio are not statistically significant at the statistical significance level of 5 percent, while the net profit to total assets ratio and the retained earnings to total assets ratio is statistically significant at the statistical significance level of 5 percent.

5. Hypothesis acceptance

Table 7 summarizes the overall results of research in form of hypothesis acceptance or rejection. It was confirmed that the revaluation reserves to equity ratio and the provisions to total assets ratio compared to the price movements in the market were not statistically significant in terms of correlation as well as independent variable coefficients in regression, so their algebraic signs will not even be considered. According to the mentioned facts, hypotheses 1 and 2 are not accepted.

Table 7. Hypothesis status

No	Hypothesis	Status
1.	There is statistically significant negative relationship between revaluation reserves to equity ratio and change of market price of a company.	NOT ACCEPTED
2.	There is statistically significant negative relationship between provisions to total assets ratio and change of market price of a company.	NOT ACCEPTED
3.	There is statistically significant negative relationship between retained earnings to total assets ratio and change of market price of a company.	ACCEPTED
4.	There is statistically significant positive relationship between net profit of the period to total assets ratio and change of market price of a company.	ACCEPTED

Source: Author's creation

On the other hand, the retained earnings to total assets ratio and the net profit to total assets ratio were significantly correlated in relation to the price movements of company's shares,

and coefficients of independent variables in regression are also statistically significant. Direction of the relationship corresponds to that predicted in the hypotheses so hypotheses 3 and 4 are accepted.

6. Conclusion

Capital management model should be adapted to current conditions in which companies operate. It can be assumed that managers bring decisions in sphere of capital management determined by the current situation in capital markets, as well as the efficiency standards of existing capital structure, and the adoption of new asset pricing models with application of fair value. However, efficient capital management should be the goal of managers and company owners for a series of reasons such as the achievement of investment optimum, strategic decisions for future operations (business continuity, acquisition of another company, selling company, merger with another company), maximizing the value of quoted companies and achievements of business efficiency standards in order to increase competitiveness of a company for entering a meaningful economic integration. Furthermore, the application of the fair value can embellish the image of capital structure, but will not significantly affect the change in the market price of the company. Improvements of capital structure are related to more efficient resource management, because a significant impact on market price changes of a company is established on that basis.

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SMA usage in (post) transitional economy's public sector organizations – A Field Study

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Abstract. The concept of Strategic Management Accounting, is still vague and undefined idea after more than 30 years of development, and has a number of development areas lacking valuable researches. One of these areas is the public sector, which many authors believe has been overlooked in SMA researches and literature, and is thus viewed as an important future research direction. Given the fact that the public sector has been increasingly concerned with the issues of strategy and accounting, the usage of SMA core ideas and approaches should not be something completely new to organizations in this sector. Therefore, the main purpose of this paper is to analyze the characteristics of the SMA treatment and implementation in public sector organizations in a (post) transitional economy, such as the understanding of the SMA concept - its ideas, scope and importance, SMA concept adoption, SMA usage process, SMA techniques usage. The field study research was carried out in several major public sector organizations in Croatia, and the results presented in this paper are an attempt to carry out the above-mentioned overlooked and valuable researches that are absent from the area of SMA usage in public sector organizations.

Key words: *strategic management accounting, strategic management accounting process, strategic management techniques, public sector organization, field study research*

1. Introduction

Today, after more than 30 years of development and growing literature, strategic management accounting (SMA) is still concept modestly developed, having number of deficiencies and gaps, which is why some authors are prepared to see its development as a paradox (Juras, 2014, p. 76). Once a young star with bright future, at this point of time the SMA concept is yet to fulfil the expectations of accounting academics and practitioners. In doing so, there are different streams of research which need to be pursued, with the ultimate goal of clear definition and positioning of SMA concept, establishing its primary methods, techniques, and processes and clarifying the linkages with other, closely related concepts and disciplines. In this sense, Nixon & Burns (2012, p. 240) are suggesting desirable future SMA research streams as being focused on filling the gaps between SMA literature and (1) strategic management literature, (2) practice, (3) cognate strategic-oriented literatures, and (4) the lack of consistency, cohesion and coherence among techniques attributed to SMA. In addition, existing SMA literature and conducted empirical researches have overlooked the important characteristics of public sector, which is increasingly concerned with issues of strategy and accounting (Cuganesan et al., 2012, p. 247).

On the other hand, in the last 20 years the term 'new public sector' marks the movement and concrete pressures in advanced (Western) economies to make their public sectors more efficient and effective (Brignall & Modell, 2000, p. 281). According to the same authors, this led to introduction of various 'private sector' management techniques and the frequent adoption of some form of neo-market system in which the purchasers and providers of public services have been split and are frequently required to contract with each other (p. 281). Mentioned 'new public sector' movement and introduction of 'private sector' management

techniques, by definition, should be most expressed in economies going through large and fundamental transitions from government controlled to market controlled economies. In this sense, accounting practices, especially managerial accounting practices, are typical 'private sector' management techniques that are, among many others, crucial in mentioned reducing costs and increasing effectiveness. According to Vašiček (2009, p. 417) in the Republic of Croatia, a typical (post) transition economy, the growing constraints of available assets, growing public expenditure and even stronger public criticism are constantly pressuring public management to reduce costs and increase effectiveness, wherein appropriate and somewhat customized cost and managerial accounting methods, techniques, instruments, cost concepts and implementation processes play crucial role. Besides just mentioned, the 'end of monopolistic power' and 'giving' concessions to private sector subjects, has led to vast number of public sector organizations now being faced with real competition, a situation completely new for these organizations and for which they now need methods and techniques that are more strategic, market and future oriented.

All previously mentioned contributes to the curiosity and the importance of researches conducted and insights being gained about SMA treatment and usage in public sector organizations, especially having in mind the fact that SMA literature has overlooked public sector and its characteristics in its researches. Therefore, this paper is an attempt to provide valuable insights into SMA usage and treatment, as state of the art discipline of accounting profession (Shah et al., 2011, p. 1), in public sector organizations in (post) transition economy, for which Republic of Croatia is typical example.

2. Theoretical background

2.1 Strategic Management Accounting

The concept of strategic management accounting (SMA), as an approach that tried to give more strategic role for management accounting (Cadez & Guilding, 2008, p. 836), emerged in the beginning of 1980s, due to the general dissatisfaction with current accounting systems and practices on one side and growing awareness of crucial role of accounting information for strategic management processes on the other (Brouthers & Roozen, 1999, p. 311). In this sense SMA concept is seen as an approach that lies at the interface between strategic management and accounting, with accounting techniques and information aimed to support strategic perspective (Tayles, 2011, p. 22).

The concept was first introduced in the literature by Simmons whose definition of SMA concept is still one of the most influential. According to this author SMA refers to:

the provision and analysis of management accounting data about a business and its competition for the use in developing and monitoring the business strategy, particularly relating levels and trends in real costs and prices, volume, market share, cash flow and proportion demanded of a firm total resources (Simmons, 1981 in: Dixon, 1998, p. 273).

Besides just listed SMA definition, there are numerous others, according to the author's starting point, which only further contributes to overall confusion about what SMA concept represents. The purpose of this paper is not to pursue various attitudes in defining SMA, rather to take mainstream approach. In this sense one more influential definition of SMA concept is that it is 'generic approach to accounting for strategic positioning, defined by an attempt to integrate insights from management accounting and marketing management within a strategic management framework' (Roslender & Hart, 2003, p. 255).

During the 30 years of development the concept evolve in various directions, from which two are regarded as literature's essential. These two main research traditions are: (1) the research

that uses label SMA to investigate management accounting that is strategically oriented, and (2) research that examines inter-relationships between strategy and management control systems (MCS) (Cuganesan et al., 2012, p. 245). Depending on the research stream(s) taken, Simmons' cost management approach, Bromwich's approach or some other, less influential approach, the conceptualizations and listings/propositions of SMA techniques differs from author to author. SMA techniques can be described as (management) accounting techniques with clear strategic focus, future oriented stance, explicit external focus, drawing heavily on non-financial measures (Ma & Tayles, 2009, p. 474). Mentioned propositions vary from almost a single-digit number of techniques to 14 or 16 techniques. These techniques are used in various stages of strategic management process, according to the need for and suitability of every SMA technique. In this sense SMA techniques are used in (1) monitoring, (2) decision-making and planning, and (3) controlling (Brouthers & Roozen, 1999, p. 314); or more concretely in (1) collecting information related to the competitors, (2) using accounting for strategic decisions, (3) cutting costs on the basis of strategic decisions and (4) gaining competitive advantage through it (Lord, 1996 in: Shah et al., 2011, p. 3). Subsequently Cadez & Guilding (2008, p. 838-839) state that SMA techniques generally in majority of classifications can be classified in five broad categories: 1) costing, (2) planning, control and performance measurement, (3) strategic decision making, (4) competitor accounting and (5) customer accounting (Table 1).

Table 1 Essential techniques in strategic management accounting toolbox (Juras, 2014, p. 80)

SMA techniques categories	SMA techniques	Guilding et al. (2000)	Cravens & Guilding (2001)	Cinquini & Tenucci (2007)	Cadez & Guilding (2008)	Shah et al. (2011)	Fowzia (2011)
Costing	Attribute costing	✓	✓	✓	✓	✓	✓
	ABC/M		✓	✓		✓	✓
	Life-cycling costing	✓	✓	✓	✓		✓
	Quality costing	✓	✓	✓	✓		✓
	Target costing	✓	✓	✓	✓		✓
	Value-chain costing	✓	✓	✓	✓	✓	✓
Planning, control and performance measurement	Benchmarking		✓	✓	✓		✓
	Integrated performance measurement/BSC		✓	✓	✓	✓	✓
Strategic decision-making	Strategic costing (strategic cost management)	✓	✓	✓	✓	✓	✓
	Strategic pricing	✓	✓	✓	✓		✓
	Brand valuation (budgeting and monitoring)	✓			✓	✓	
Competitor accounting	Competitor cost assessment	✓	✓	✓	✓	✓	✓
	Competitor position monitoring	✓	✓	✓	✓		✓
	Competitor performance appraisal	✓	✓	✓	✓	✓	✓
Customer accounting	Customer profitability/cost analysis		✓	✓	✓		✓
	Lifetime customer profitability analysis				✓		
	Valuation of customers as assets				✓	✓	

The techniques shown in Table 1 are usually used in empirical researches of SMA treatment and usage in companies – the researches shown in Table 1 are among most influential in recent SMA literature. Therefore, listing of SMA techniques in Table 1 also serves as a basis for analysis of SMA technique usage in (post) transition economy's public sector organizations, conducted in this paper.

2.2 Public sector organizations in (post) transition economy and accounting practices

Transition economy by definition refers to an economy that is changing from being one under government control to being a market economy, i.e. one in which companies are not controlled by the government (Cambridge Dictionaries Online, 2015). It is the process which almost all Central and Eastern Europe countries, especially post-socialist ones, went through or are still facing with. Croatia, as typical post-socialist country and a new member of EU, is in number of aspects still transition economy, even though its major transition efforts are behind it. Being pressured by EU Accession Negotiations, global economic crisis and preparing for fierce competition on EU's open-market, Croatia underwent substantial efforts and changes trying to make its public sector to be more efficient and effective.

Public sector structure in Croatia is in accordance with IMF's and UN's definitions (Figure 1). UN's SNA definition of public sector divides public sector to general government and quasigovernment (or public) corporations, whereby public sector covers: (1) all institutional units which belong to central, state/regional or local government, (2) social security funds on all government levels, (3) all non-market non-profit institutions which are under government control and are predominantly finance by it, and (4) public corporations or quasigovernment corporations which are under government control (Bejaković et al., 2011, p. 104). Just listed public sector organizations, although considering and answering to a wider set of stakeholders, due to the need for fundraising bodies to be held accountable to taxpayers, are primarily focused on financial information, despite a long history of calls for use of more non-financial information dating back to Mayston (1985) and Politt (1986) (Brignall & Modell, 2000, p. 282). Public sector units and corporations, for the purpose of this paper called organizations, in carrying out accounting tasks on the individual level (micro level of accounting), are primarily oriented on reporting, budgeting, control, safeguarding public treasury by preventing and detecting graft and corruption and on facilitating sound financial management (Chadwick, 1993). In doing so, they follow national regulations which are harmonized with *International Accounting Standards*, especially *International Public Sector Accounting Standards* (Dimitrić, 2007, p. 1). In this sense, accounting for internal, especially strategic purposes, is highly overlooked, and in some organizations there are only a traces of these practices.

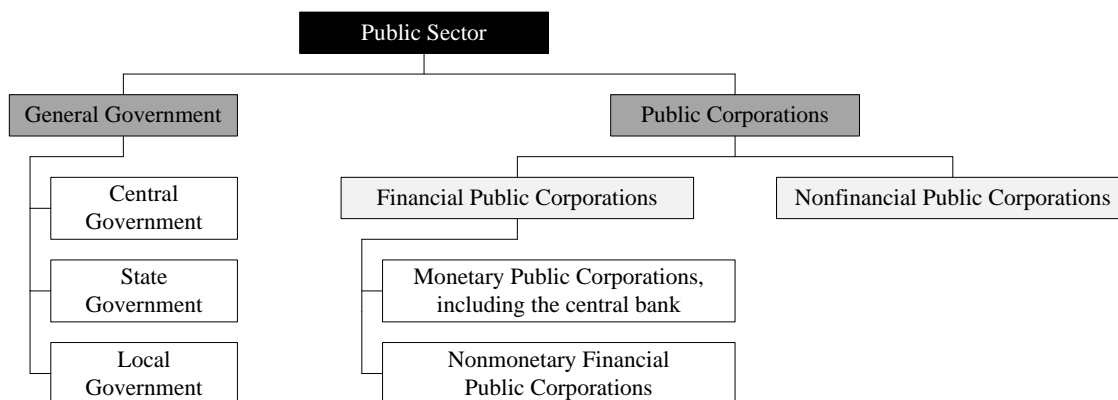


Figure 1 Public sector according to IMF's GFs (Government Finance Statistics) (GFS, 2001, p. 15)

Clearly, despite the fact that pressures and reforms, labelled under the term ‘new public management’, have increased the importance of strategy in public sector, specifics of the public sector context indicate that techniques and processes developed for private sector organizations cannot be simply transplanted into public sector organizations (Cuganesan et al., 2012, p. 246). In this sense, it would be interesting to investigate whether and to what extent do public sector organizations ‘think strategically’ and are they familiar with and do they use SMA techniques and practices, as some of these may or may not be applied to public sector organizations. More concretely the usage of SMA techniques and practices can be for example somewhat expected in public sector corporations, while the same cannot be said for government units (local, state/regional, central), where the expectations for SMA usage are pretty slim, especially in (post) transition economy like Croatia.

3. Methodology

According to Roslender & Hart (2010), Ma & Tayles (2009) and Dixon (1998), a case study methodology is most appropriate in building knowledge of actual business practices, i.e. strategic management practices, and has a comparative advantage in doing so in relation to other empirical research methods like wide ranging questionnaire, etc. Having in mind just mentioned, in order to accomplish stated purpose of the paper, i.e. to investigate the characteristics of SMA treatment and implementation in (post) transition economy’s public sector organizations, field study, a variation of case study methodology, was conducted. Field study, as a research design that embraces a relatively small number of companies or organizations (Roslender & Hart, p. 262) was chosen due to its ability to gain insights into practitioner’s views on and applications of the concept of strategic management accounting (Dixon, p. 274).

The study was carried out in 10 public sector organizations during December of 2015 and January of 2016, and was mainly descriptive in nature, focusing on descriptive characteristics of accounting practices in mentioned organizations, aimed for strategic purposes. As a means of study, interviews and questionnaire, accompanied with detailed written explanation of each SMA practice and technique, were combined to get better picture of SMA usage. Respondents were financial/accounting director in these organizations or theirs deputies. The basis for the interview and questionnaire structuration was the work of Guilding et al. (2000), Cravens & Guilding (2001), Cinquini & Tenucci (2007) and Cadez & Guilding (2008). As a part of consent agreement, no actual names of the public organizations analyzed were to be mentioned in the paper. Therefore, studied public organizations are labeled in the paper with numbers 1-10. Table 2 shows basic information of public sector organizations which constituted research sample.

Not shown in Table 2, all analyzed public sector organizations were in state ownership solely and have been in existence for more than 20 years. The sample was constituted of 5 public companies and 5 general government units (4 local, 1 regional). Organizations’ activities represented in the sample were transportation, health care and public administration. Number of employees ranged from several dozen (local government) to nearly 500 employees in some public companies, while these organizations predominantly have middle-aged employees’ structure. Respondents’ judgement of employees’ qualifications and competence ranged from high to very high, while results (business) accomplished were evaluated from good (only 1 organization) to mostly very good and excellent. Respondents’ evaluation of employees’ qualifications and achieved results in studied public sector organizations were very positive, moreover too positive, implicating somewhat optimistic and subjective perception of own organization’s employees and results. This was somewhat expected, having in mind public pressures for efficiency and effectiveness these organizations are up against and the need their employees have to present better their organizations and results accomplished.

Table 2 Research sample characteristics (field study, N=10)

Public sector organization	Type	Activity	Number of employees	Predominant employees' age (years)	Evaluation of employees' qualifications and competence	Evaluation of achieved (business) results
1	PC	transportation	391	over 50	very high	excellent
2	PC	health care	210	34-49	very high	very good
3	LGU	public administration	under 100	over 50	high	very good
4	LGU	public administration	under 100	34-49	very high	excellent
5	PC	transportation	438	34-49	high	excellent
6	PC	health care	under 100	34-49	very high	excellent
7	LGU	public administration	17	34-49	high	very good
8	LGU	public administration	under 100	34-49	high	very good
9	PC	transportation	100-250	34-49	high	good
10	RGU	public administration	100-250	34-49	high	very good

Legend: PC – public company; LGU – local government unit; RGU – regional government unit

4. Findings

Questionnaire and interviews in the study were combined in a manner that questionnaire was used to collect appropriate quantitative data, while semi-structured interviews were used to gain deeper insights into SMA treatment and usage.

4.1 Strategy treatment in public sector organizations

When it comes to strategy and strategic management in public sector organizations, overall attention given to this aspect of public management can be described as being somewhere between moderate to high. As expected, this attention is higher in PCs than in L/RGUs, i.e. in PCs this attention is high while in L/RGUs is lower and closer to moderate. This difference in strategy treatment is most obvious in an approach to performing various tasks related to strategy. Namely, In PCs this approach is significantly more systematic and comprehensive than in L/RGUs, i.e. in PCs tasks related to strategy are being performed systematically and frequently, while in L/RGUs these tasks are approached systematically only in some aspects, while being performed ad-hoc and improvised in other. Consequently, in L/RGUs these tasks were not being performed so often and constantly as in PCs. Mentioned strategy related tasks in public sector organizations are in domain of their leading officer or director and his/her closest associates, while only in the biggest PC in the researched sample there is a specific department/office or team of people which are responsible for performing majority of strategy related tasks. Finally, no matter who is responsible for performing these tasks, accounting information are highly used during these activities and the accounting department works very closely with person(s) who is dealing with strategy issues. It is interesting that two of three big PCs are seeing accounting information only as (significant) part of overall information needed by strategic management; while in other public sector organizations accounting information are regarded as almost the only information needed.

Just mentioned insights are as expected, having in mind that public sector organizations in Croatia are only just beginning to see strategy as integral and crucial part of their functioning and existence in their environments. This especially stands for L/RGU where years of a specific way of functioning made it difficult now to introduce changes and to see strategy as it is, despite the fact that, for example, all of these organizations need to develop strategic approach for tourism development as they are public administration units which are located in touristic regions.

4.2 Accounting treatment in public sector organizations

Generally, accounting in public sector organizations is being done through specific work places within a bigger administrative department or service or within specific finance and accounting department. Only in the largest PC and the largest LG the accounting work places are organized in specific accounting department. The number of people performing solely accounting tasks varies from 1 to 15 people from organization to organization or in relative terms around 2-5% of total working force in public sector organizations are accountants. According to respondents' opinions, accounting tasks are being performed in appropriate or good manner, and accounting personnel occasionally attends seminars and to some extent follows professional literature about new accounting trends and developments. When comparing PCs and L/RGUs, there is no difference in opinions of respondents regarding the quality of accounting performed. The significance of accounting jobs and information for overall functioning of public sector organizations is very high, as it is considered a very valuable source of information which is being produced in quality manner. Thus, it needs to be emphasized that PCs regard their accounting as much more important for overall company functioning and achieving desired goals than L/RGU, i.e. PCs place lot of attention on accounting and strive to make it even better or excellent, with high quality processes and information, while L/RGUs are satisfied with their accounting being in accordance with law and accounting standards. In doing so, PCs, apart from law and standards' requirements, are performing 'own' analysis and calculations for internal purposes, while this kind of practice can only be found in traces in L/RGUs, and only in two largest ones.

Findings about general accounting practices in public sector organizations reveal different perceptions of respondents about what accounting needs to represent in public sector organization. On one side there are PCs' respondents which are closer to state of mind of private sector accountants and managers, which see accounting as a valuable information service aimed not just for fulfilling external (legal) requirements, but also to be crucial supporting department/office for strategic analysis, formulation, decision making, implementation and control. Quite differently, L/RGUs' respondents see accounting as being information service covering mainly costs and transactions and reporting them to external stakeholders. In this way, both groups in their perception of the quality of accounting practices in their organization mutually do not differ in large extent, but the underlying logic and perception of what accounting needs to represent puts them in opposite side of accounting treatment. This insight is definitely a reason for concern, giving the fact that in transition economy L/RGUs need to be more active and propulsive in creating promised/obligated or desirable outcomes, where good strategic management and accounting information are indispensable prerequisites. This is more than obvious in case of L/RGUs from the sample, as they compete between themselves in number of areas such as touristic attractiveness, withdrawal of EU funds, etc.

4.3 SMA treatment and usage in public sector organizations

The crucial part of the study was to gain deeper insights into accounting practices aimed for strategic purposes. In this sense, respondents were asked to pinpoint accounting practices that are being carried out for strategic purposes and to assess their relative importance and frequency of usage. For start, respondents were unanimous in emphasizing that in their organizations (both OCs and L/RGUs) accounting practices aimed for management's purposes were primarily internally oriented and in some extent related to strategy and strategic management. Thus said, in PCs the preparation and usage of accounting information for strategic decision making is the most important and subsequently most frequent accounting practice followed by exploitation of cost-reduction opportunities. Cutting cost on the basis of strategic decisions is less important and frequent in PCs, while collecting

information related to competitors and gaining competitive advantage through all mentioned practices are present in this manner in significantly lesser degree. In L/RGUs overall importance and frequency of usage of accounting information for strategic purposes is on lower level than in PCs, where mentioned practices are more dominant than others in the same order as in the PCs. Additional questions also revealed that mentioned accounting practices aimed for strategic purposes are being used in larger extent for strategic monitoring and control, compared with usage of the same practices for strategic decision making. The time spent on performing both of these groups of accounting practices is, by respondents' opinion, approximately the same.

Respondents were then confronted with the usage and treatment of specific SMA techniques or their approximate variation, having in mind that public sector organizations have distinct accounting practices when compared to private sector. Both groups of respondents (PCs and L/RGUs) have demonstrated certain level of knowledge about SMA as a field and SMA techniques. They also confessed that there are blind areas when it comes to SMA and SMA techniques. In this sense they admitted that SMA techniques, as presented in the Table 1, were being carried out in some, smaller extent in their organizations, and that those employees who are responsible for SMA techniques usage are familiar with them.

When going through SMA techniques one by one, the results were more and more 'realistic', i.e. pessimistic from the SMA literature point of view. Detailed data and results processed on the basis of this part of study (conversation/observation) are shown on Figure 2. From the results shown it is obvious that the usage of SMA techniques in public sector organizations is, optimistically speaking, on very low level. Namely, for L/RGUs it is difficult even to discuss about SMA techniques usage, having in mind that three of five respondents from these units confessed that them and their associates are not familiar with the listed techniques, while in the fourth unit (RGU) the knowledge about SMA techniques is related to mainly costing techniques, which are not being used or if used, then in rare occasions. Only in last LGU the SMA techniques are not *terra incognita*, but this certainly does not mean that there is a systematic usage of mentioned techniques present. In this LGU, competitor accounting SMA techniques, together with strategic costing, are being used often, while benchmarking and BSC are being used rarely. Average usage of SMA techniques in these public sector organizations is somewhere between non-using and not knowing about techniques at all, an insight which speaks for itself.

On the other hand, contrary to expectations, the usage of SMA techniques in PCs is not much better than in L/RGUs. Four of five respondents from these companies are familiar with all SMA techniques, while for one respondent the SMA techniques are something unknown and by his opinion unnecessary. The usage of SMA techniques in four PCs ranges from never being used to constant usage, depending on SMA technique and particular company. On average, target costing, strategic costing and customer profitability/cost analysis are being used occasionally; value chain costing, BSC and valuation of customers as assets have never been used, while the rest of SMA techniques are being used rarely. These results, similar to L/RGU results, indicate the orientation to costing and pricing techniques.

When analyzed according to the groups of SMA techniques (Figure 3), there are small differences in usage of SMA techniques in public sector organizations. None of the groups of SMA techniques, when considering in average, is being used predominately in public sector organizations. For L/RGUs this usage of groups of SMA techniques is in the zone of unknown, while in PCs mentioned usage varies from non-using to rarely using. In this sense group of planning, control and performance measurement techniques are less used than other groups of techniques, and are on the verge of being unknown to the respondents. Being unknown is the undesirable state of all groups of SMA techniques in L/RGUs. Only in PCs

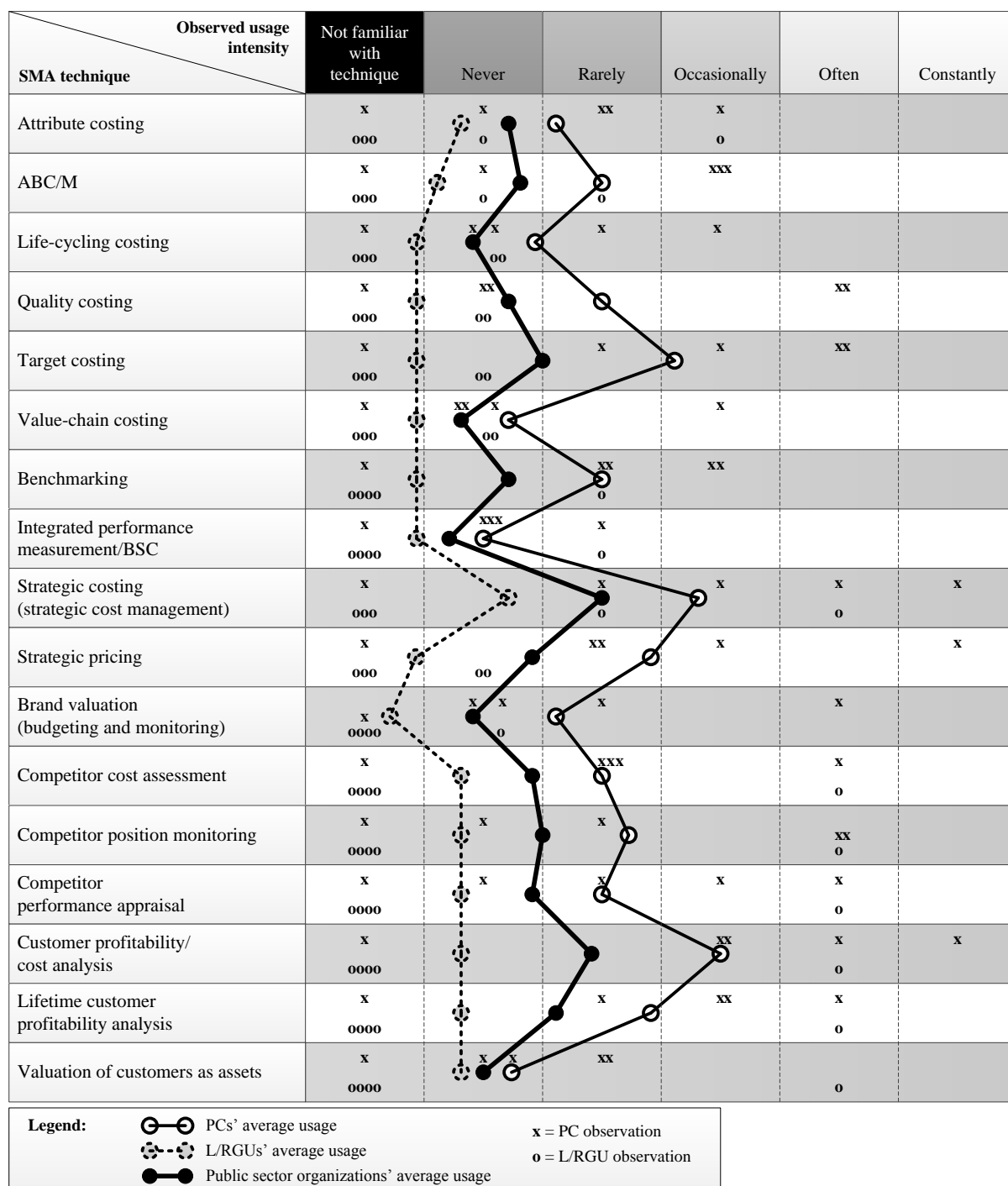


Figure 2 SMA techniques' usage intensity in studied public sector organizations (field study, N=10)

there is a usage of groups of SMA techniques. This usage is closer to non-using for costing and planning, control and performance measurement, while strategic decision-making, competitor accounting and customer accounting are used on rarely basis. From all groups of SMA techniques, the situation is the least unenviable for strategic decision-making techniques, i.e. strategic costing and pricing, and customer accounting techniques, especially in PCs.

Further, respondents were asked to give their additional opinions regarding the various issues of SMA usage. In this sense they think that little is being invested (money, working hours, education) in SMA usage. PCs are investing a bit more than L/RGUs, being closer to

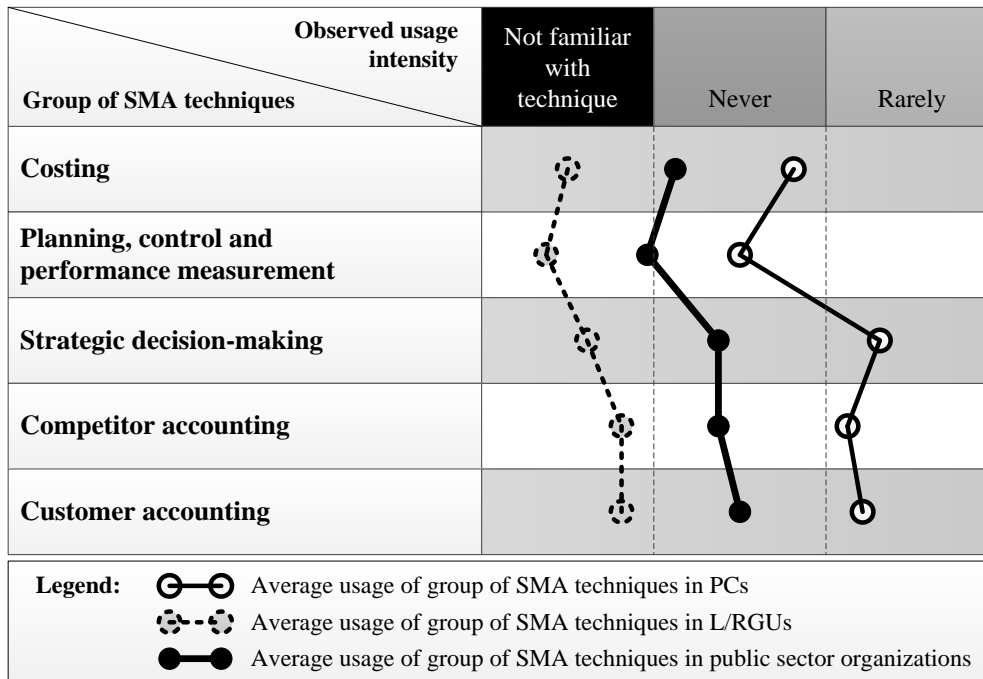


Figure 3 Average usage of groups of SMA techniques in studied public sector organizations (field study, N=10)

moderate degree of investment in SMA usage. When considering who gives incentive for SMA usage and who is carrying out usage itself, the Board of director is the body which usually requests some kind of analysis within the frame of SMA usage and accounting staff carries out required tasks. In other words, there is no autonomous initiative of accounting staff for carrying out some of SMA techniques and no external company or institution is being hired to perform this tasks.

Besides the issues of investment in and incentive for SMA usage, respondents also ranked the importance of particular SMA techniques for business and strategic purposes, and also commented the time needed to use the technique, as well as the systematic and quality of usage itself (Table 3). In this regard, strategic costing is most important SMA technique for business and strategic purposes, followed by target costing, attribute costing and benchmarking. When it comes to L/RGUs, for them attribute costing and ABC/M are more important than strategic costing. Some techniques, like target costing, is considered by L/RGUs important for business and strategic purposes, but their usage still lacks in these units. As for time needed for technique usage, moderate amount of time is usually needed, whereas L/RGU's are less time-efficient than PCs in SMA usage. Similar conclusion can be drawn for the degree of systematic and quality usage, where this degree varies from predominantly moderate to low, again emphasizing the more systematic and quality usage within PCs, when compared to L/RGUs.

Finally, when asked to evaluate the usefulness of used SMA techniques, respondents evaluated them with moderate usefulness, being slightly more useful in PCs than in L/RGUs. One more important insight regarding the SMA usage, which offers a light at the end of the tunnel, is the opinion which respondents had regarding the future usage of various SMA practices, especially the usage of SMA techniques. They are almost unanimous that the mentioned usage needs to be significantly strengthened in their organizations. Again, there is a slightly more proactive opinion within the PCs' respondents, which see SMA usage as high necessity for future strategic and overall functioning of their companies.

Table 3 SMA techniques' usage characteristics (field study, N=10)

SMA technique	Importance for business and strategic purposes (rank)			Amount of time spend for usage			Degree of systematic and quality usage		
	Overall	PCs	L/RGUs	Overall	PCs	L/RGUs	Overall	PCs	L/RGUs
Strategic costing	1	1	3	moderate	small/moderate	moderate	moderate/low	moderate/low	moderate/low
Target costing	2	2	3		small/moderate				
Attribute costing	3		1	moderate/large	moderate	large	low	low	low
Benchmarking	3	3	4	moderate	moderate	moderate	moderate/high	moderate/high	moderate
ABC/M	4		2	small/moderate	small/moderate	small/moderate	moderate/low	moderate	low
Competitor position monitoring	4	2		moderate	moderate	moderate	moderate/low	moderate	low
Competitor performance appraisal	4	2		moderate	moderate	moderate	moderate/low	moderate	low
Competitor profitability/cost assessment		3		moderate	moderate	moderate	low	low	low
Strategic pricing		4			moderate			moderate	

5. Conclusion

The conducted field study, aimed to provide detailed insights regarding the SMA treatment and usage in public sector organizations, offered gloomy picture of the mentioned usage. The respondents from 10 public sector organizations (5 public companies, 5 local/regional government units) were confronted with various questions in the form of interviews and supporting questionnaire. These questioning were more general regarding the overall strategy and accounting treatment in their organizations, and more concrete and detailed regarding the SMA treatment and usage within the same organizations. Naturally, the investigation of SMA usage and treatment, especially specific SMA techniques, was being in significant manner adapted to fit the circumstances and requirements of public sector organizations functioning and conducting strategy and accounting practices.

Findings from the study, as mentioned, are very disappointing from the SMA advocates' and literature's point of view. As for the strategy and strategy treatment in public sector organizations, these findings are not that poor, indicating moderate to high attention being paid to strategy and strategy issues. These tasks are in the domain of leading officer or director, which tries to perform them systematically and frequently, highly using accounting information during these activities. Thus said, situation is better in public companies then in local or regional government units, which was expected, due to the fact that the market pressures are far stronger in case of public companies. When considering treatment of accounting as a whole in public sector organizations, these tasks are being done in appropriate or good manner within some bigger department; the accounting personnel occasionally attends some kind of education and accounting jobs and information are considered as very important for organization. Again, respondents from public companies are closer to the state of mind of managers from private sector, considering their higher attention to accounting practices and information, efforts to make them even better, and attempts to push accounting practices beyond just legal requirements and obligations, i.e. performing various analysis and calculation for internal (strategic) purposes of organization.

Public companies use accounting information for strategic purposes, especially for strategic decision-making and cost-reduction opportunities more frequently than local/regional government units. Within this, strategic monitor and control are primarily purposes for these information usages. Regarding the usage of concrete SMA techniques, the field study revealed the most disappointing insights, dominated by the lack of information and knowledge of respondents about these techniques in local/regional government units. The poor SMA techniques usage that does exist in local or regional government units is primarily oriented to costs. The situation is somewhat better in public companies, but not in a far greater extent, which would be expected, due to the fact that these companies have competition and effectiveness and efficiency requirements as a consequence of competing on the more or less free market. In these companies the usage of majority of techniques is in the zone of rarely using, with some exceptions of occasional or not using at all. In this sense, costing techniques dominate the mentioned usage and are regarded as most important, followed by techniques oriented on competitors and customers. Namely, strategic costing, target costing and customer profitability/cost analysis are SMA techniques most frequently used and are also, together with competitor position monitoring and benchmarking, regarded as most important for business and strategic purposes.

Investment in SMA usage is on low level, being slightly higher in public companies. Director or board of directors usually gives incentive for particular SMA technique usage, which accounting staff carries out. The usage of particular SMA techniques takes moderate time and is being performed in moderate to low degree of systematic and quality. Again, situation is somewhat better in public companies, which are more time efficient and more systematic and which put more quality in using SMA techniques.

Insights from the conducted field study suggest that the SMA treatment and usage in (post) transition economy's public sector organizations is in its initial usage stages. The concept, its practices and especially techniques are largely unknown to government units, while in public companies usage is present, but on a relatively low level, i.e. rare intensity of usage. These results definitely are not optimistic and promising, having in mind the effectiveness and efficiency pressures which are everyday higher on public sector organizations, forcing them to pursue more and more private sector's business and management practices, including SMA practices. Potential ray of light in dark tunnel is the last insight from the study, which suggests that respondents are aware that accounting practices for strategic purposes in their organizations are not on the level on which they should be. It remains to be seen if they will try to improve this situation of largely neglected accounting practices for strategic purposes, especially when the context and circumstances for public sector organizations in (post) transition economies demand more and more systematic and grounded strategic management with each new day.

Finally, insights from the field study conducted in this paper need to be considered with the amount of caution for several reasons. First, conducted field study covered only 10 public sector organizations, i.e. a very small sample having in mind overall amount of public sector organizations in the Republic of Croatia. Also, in the sample there were local/regional government units and public companies, while some types of the public sector organizations were not included. Second, study is significantly based on the subjective opinions of respondents, leading to the problem of subjectivity. Third, having in mind the specificity of public sector accounting and accounting practices, adjustments are necessary in investigated, theoretically proposed SMA practices, especially techniques. However, all this does not decrease the importance of the research aimed and conducted in this manner. Empirical contributions, focused on SMA literature's highly overlooked SMA usage in public sector organizations, with their smaller or bigger shortcomings, are still very important and welcome, due to the lack of empirical researches in this area.

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General public and investment strategies

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Abstract. General public sector in Croatia has various possibilities for the choice of investment strategies. Due to lack of financial literacy, tradition or lack of trust in financial institutions, it seems that Croatian citizens do not use all the possibilities that they have in terms of diversification of their personal portfolio. As in most transitional countries in Croatia, there is the problem of financial literacy of the general public. The financial literacy of the general public is becoming increasingly important due to dynamic and complexity of the financial system, especially if we take in consideration that financial decision usually have long term implications on the financial situation of the individuals. Aim of this paper is to investigate how and where Croatian citizens invest their money and also to investigate performances of investment instruments available to Croatian citizens. The governing of personal finances in Croatia is process in which the citizens are left on their own, meaning that they are not equipped with sufficient skills and knowledge necessary for efficient governing. Based on findings conclusions will be provided with recommendations.

Key words: *personal finance management, investment strategy, general public*

1. Introduction

Since the contemporary banking system, has one main goal, which is of maximization of the profit, this neglects the social responsibility as a goal to achieve. It seems that in such conditions the worst consequences are on general public sector. Social responsibility represents a futuristic concept for all post-communistic countries. During 90-ies of the last century in Croatia, as in majority of post-communistic countries, it was almost embarrassing mentioning of terms such as social responsibility. It was felt that the term itself was tied to the political environment of old times-communism. At a time when creation of new principles of market regulation was carried out there was also very bloody war going on in Croatia and there was a review of terminology and postulates from the former system. Perhaps it is precisely in this period that Croatia lost a unique opportunity of integrating the concept of real social responsibility through adequate legislation frame in order to implement social responsibility into the core businesses of all market operators operating in Croatia. There are some concepts that have only recently infiltrated into the terminology of social sciences in Croatia, and were unjustly expelled because of the existence of the term "social", such term and concept is social capital. (Baker W., 2004) The lack of social responsibility in all segments of modern society becomes very important issue. Many contemporary studies have shown how devastating is the impact of exclusively

profit driven business philosophy. Corporate social responsibility is in the focus of the progress of the wider community through the use of appropriate business policies and investment of corporate resources.(Buljan Barbača D., 2007) In fact, corporate social responsibility is a deliberate inclusion of public interest in the decision making process and respect for the concept of tripartite (3P): People, Planet and Profit.(Kotler P., Lee N., 2005) With a low level of financial literacy that Croatian citizens possess they do not know which are the main advantages and disadvantages of financial instruments that they are using.

In Croatia is still present opinion that the state is obliged to take care of the social status of its citizens in retirement. However, due to the unsustainability of the current pension system, caused mainly by unfavorable demographic trends (increased life expectancy, decreasing fertility rates), responsibility for social status of the individuals in retirement is to be completely transferred to individuals. In the conditions of unfavorable demographic trends, small number of workers bear the high costs of financing pension system with high number of retired persons, and it is visible that this negative trends are only increasing in last two decades. (Buljan Barbača D., Matošević Radić M., 2011)

Making decision on use of a particular financial product depends on the personal preferences, especially risk attitude, of each individual. Risk aversion is very often underestimated in analyzes of investment habits of Croatian citizens, but lot of studies performed in United Kingdom, United States of America, New Zealand and Australia, show that undoubtedly, risk attitude have a lot to do with a choice of investment strategies. The results of the analysis sections suggest risk aversion is time varying, and that a key driver in the change over time is likely driven by changes in future market expectations of investors. If changes in risk aversion affect investing behaviors, time-varying risk aversion could affect the demand for risky assets over time. For example, if investors have positive (negative) expectations about the future return of stocks, the demand for risk assets may increase (decrease). (Blanchett D., Finke M., Guillemette M., 2014)

In order to invest in efficient way investor need to know and understand financial instruments in investors portfolio. In addition, investor needs to be able to determine personal needs, goals and desires. For high quality governing of personal finances, control of the household budget and regulation of costs need to make a part of a clear financial plan. After considering the personal preference and defining financial plan, it is necessary to get informed, from relevant source of information, about financial products and compare them with each other. For doing this kind of analyzes investors in Croatia have a huge possibilities in number of sources of information, such as banks, financial consultants, the Internet, magazines, newspapers, books, people around them and so on. But question of the relevance of the source if usually left unanswered.

In this paper we will investigate which investment financial instruments are available to Croatian citizens and what are the performances of these instruments. Analyzes of financial behavior of our citizens will be performed in order to create relevant data on which conclusions and recommendations will be given.

2. Financial products for Croatian citizens

The problems of personal finances can not be analyzed without analysis of wider environment and parameters that influence level of income in different life stages. One of the most delicate stages in person's life, when it comes to personal finances, is a life stage of individuals that have gone to pension. From statistics we can red that decrees of previous income can be very substantial and sometimes goes beyond 50% of previous salary. Reasons are various but we can underline two most important reasons that lead to this situation and is even getting worst. One group of reasons is negative demographic trends in Croatia and other group of reasons is

increased unemployment in whole population, but particularly in older ages. (Buljan Barbača D., Matošević Radić M., 2011.) Croatian pension reform was conducted in 2002 because of the unsustainability of the current situation within the pension system. Although there are a number of reasons for the implementation of pension reform as the main reason, unfavourable demographical trends, were detected. Unfavourable demographical trends, in terms of efficiency in pension system, are related to the increase of life expectancy and decrease of natality rate Aging becomes a problem because pension funds are financed by working population and exploited by pensioned ones. If we have a situation of continues aging we can predict that our problem of collecting a money for the pension funds will be even greater in the future.(Buljan Barbača D., Matošević Radić M., 2011.) Ratio of the number of insured and retirees of the 90ies of the last century to the present day in constant decline.

Table 1 The ratio of insured and pensioners in Croatia

Year	Insured persons	Retired persons	Ratio
1990	1.968.737	655.788	3 : 1
1995	1.567.981	865.769	1,81 : 1
2000	1.380.510	1.018.504	1,36 : 1
2005	1.498.877	1.080.571	1,39 : 1
2010	1.475.363	1.200.386	1,23 : 1
2013	1.400.631	1.190.815	1,18 : 1
2014	1.411.197	1.130.855	1,25 : 1
2015	1.413.637	1.135.166	1,25 : 1

Source: own work according to the CPIA

From the data presented in Table 1 we can see that the ratio of the number of insured persons and retired from the 90ies up to today is in constant decline. Although the ratio of the last two years shows slight improvement (1.25: 1), we cannot say that problems with lack of efficiency in pension system are solved.

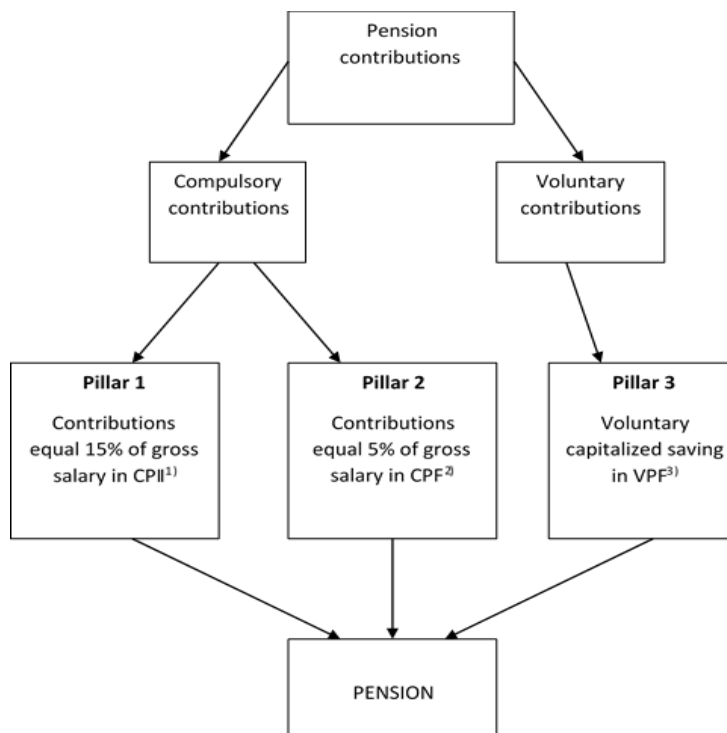


Figure 1 Croatia's pension scheme

Notes: 1) Croatian Pension Insurance Institute, 2) Compulsory pension fund, 3) Voluntary pension fund

Contemporary Croatian pension system consists of three pillars, which represent a combination of compulsory and voluntary pension funds. While the first pillar existed before, and all financial contributions were allocated in this pillar, the second and third pillar are implemented as a part of the pension reform in 2002. The structure of today's Croatian pension system is shown in Figure 1.

From Figure 1 it is clearly visible that the pension contributions are divided into compulsory and voluntary pension contributions. Compulsory pension contributions are allocated in first two pillars. The first pillar is based on intergenerational solidarity and is financed with 15% of employees' gross salaries. The second pillar is the pillar for the individual capitalized savings and amounts of the 5% of employees' gross salaries is to be allocated in it. Voluntary pension contributions are to be allocated in the third pillar which is also based on individual capitalized savings. The projection is that once a person becomes retired, pension will be paid out from all three pillars.

In Croatia is still present paradigm that the state is obliged to take care of the social status of the population. However, due to the changes in social system and problems of the current pension system it is realistic to expect that in the future responsibility for social status of the individuals in retirement age is to be completely transferred to individuals. This means that individuals will have to make decisions on which additional financial instruments will they invest if they want to ensure the social status in retirement. On the Croatian financial market there are is a number of financial instruments available for investment.

The most common financial instruments for investment present on the financial market in Croatia are:

- Current and / or giro account, foreign currency account
- Housing savings
- Bank savings
- Life insurance policies
- Life insurance policies linked with units of investment funds
- Pension funds
- Investment funds
- Shares
- Bonds

If we consider that, the individuals will have to take care of their financial situation in the future it is very important which financial decisions they take today. Individuals are usually uninformed about financial products, and also unaware of financial performances of this products and therefore are not able to take the best investment decision in particular moment. Problem of financial literacy of the Croatian citizens should be approached as a major social challenge that can prevent poverty in the future.

2.1 Performances of investment product

Aim of this sub chapter is to analyse efficiency of financial product in terms of their performances. For some products, like life insurance policy, this task becomes impossible because each policy is individualised. Financial products accessible to Croatian citizens will be displayed with corresponding yield for each year in last ten years.

In table 2 we are displaying data on yields on investment in voluntary pension funds. It is very important to emphasize that this is data on performance of open voluntary funds. Presented data are average yields calculated on the basis of relevant data published on official page of Croatian Agency for Supervision of Financial Services (CFSSA).

Table 2 Yields of voluntary pension funds by years

Year	Yields (%)
2006	8,90
2007	9,69
2008	-10,88
2009	10,70
2010	8,54
2011	-1,16
2012	14,60
2013	3,02
2014	9,78
2015	5,17

Source: own work according to data from the CFSSA-e

From presented data it is clearly visible that performances of this financial product are characterised with volatility.

For the purpose of having continuous data in this paper in table 3, table 4, table 5 and table 6 we have chosen to present relevant data on funds present at Croatian market for at least 10 years.

Table 3 Average yields of equity funds last 10 years

Year	HI Growth (%)	ZB euroaktiv (%)	FIMA Equity (%)	Average
2006	33,36	14,49	63,23	37,03
2007	32,39	-6,42	16,96	14,31
2008	-54,05	-36,77	-61,73	-50,85
2009	13,81	21,04	-17,43	5,81
2010	3,50	2,68	-16,21	-3,43
2011	-8,41	-4,94	-11,68	-8,34
2012	6,37	15,21	-24,25	-2,67
2013	4,85	13,34	13,36	10,52
2014	15,28	-1,00	27,48	12,16
2015	10,00	7,91	21,93	13,28
Average	5,71	2,55	1,17	

Source: own work according to data from the hrportfolio.hr

Table 4 Average yields of balanced funds last 10 years

Year	HI Balanced (%)	ZB Global (%)	PBZ Global fund (%)	Average
2006	24,14	15,25	32,05	23,81
2007	18,53	27,35	24,71	23,53
2008	-33,49	-38,59	-50,88	-40,99
2009	11,16	13,94	9,57	11,56
2010	4,76	7,64	3,98	5,46
2011	-5,50	-14,12	-9,78	-9,8
2012	5,51	7,38	-2,18	3,57
2013	3,73	0,07	0,56	1,45
2014	12,64	7,00	12,49	10,71

2015	7,14	9,26	5,11	7,17
Average	4,86	3,52	2,56	

Source: own work according to data from the hrportfolio.hr

Table 5 Average yields of bond funds last 10 years

Year	HI Conservative (%)	ZB Bond (%)	Raiffeisen Bond (%)	Average
2006	8,72	0,36	1,26	3,45
2007	7,77	2,87	1,05	4,00
2008	-1,46	4,04	0,32	2,90
2009	0,31	11,09	12,31	7,90
2010	5,84	4,75	8,42	6,34
2011	-0,61	2,23	0,76	2,38
2012	5,48	7,41	-6,87	2,01
2013	5,87	-3,58	-5,62	-1,11
2014	7,33	7,21	5,85	6,80
2015	2,19	3,73	2,64	2,85
Average	4,14	4,01	2,01	

Source: own work according to data from the hrportfolio.hr

Table 6 Average yields of cash funds last 10 years

Year	HI Cash (%)	ZB Plus (%)	PBZ Dollar Fund (%)	Average
2006	3,37	3,23	4,59	3,73
2007	4,04	4,13	4,07	4,08
2008	5,39	5,61	6,65	5,88
2009	6,47	8,75	3,55	6,26
2010	2,50	2,33	2,60	2,48
2011	2,76	2,48	1,15	2,13
2012	2,29	2,70	1,17	2,05
2013	1,78	0,95	0,25	0,99
2014	1,39	0,74	1,44	1,90
2015	0,92	0,57	1,10	0,86
Average	3,09	3,15	2,66	

Source: own work according to data from the hrportfolio.hr

The financial instruments presented in table 3, table 4, table 5 and table 6 show volatility in last decade. Equity funds and balanced funds in terms of performances show wider amplitude in yields. Cash funds and bond funds have narrower amplitude in terms of yields.

In table 7 data on interest rates on different kinds of deposits is presented. Relevant data is collected published on official page of Croatian National Bank (CNB).

Table 7 Interest rates on deposits without a currency clause and deposits with currency clause

Year	Short-term deposits (in domestic currency)	Long-term deposits (in domestic currency)	Short-term deposits (with currency clause)	Long-term deposits (with currency clause)
2006	4,00	4,93	3,66	4,67
2007	4,23	5,23	3,76	4,48
2008	4,79	5,51	3,93	4,71
2009	5,28	6,07	3,48	4,09
2010	4,16	5,25	2,78	3,75
2011	3,48	4,59	2,80	3,33
2012	3,47	4,55	2,99	2,91
2013	2,99	4,02	2,53	2,86
2014	2,92	3,53	2,71	3,10
2015	2,55	3,13	1,62	3,02

Source: own work according to data from the CNB

Presented data show as that changes in interest rates in deposits was not so dynamic as in previously analysed data for different funds in focus of our observations. Long term deposits show higher interest true whole period of observation. Deposits with currency clause during last decade have been less awarding than deposits in domestic currency.

In table 8 we are displaying yield on two relevant indexes CROBEX and CROBIS. When selecting stocks that will become part of index CROBEX, are taken into account only shares listed on a regulated market traded more than 90% of the total number of trading days in the six-month period preceding the audit. (The Zagreb Stock Exchange, 2011.) The index CROBIS includes government bonds and bonds government agencies that are listed on the Zagreb Stock Exchange under the following conditions: minimum nominal value of 75 million €, maturity of the bonds is greater than 18 months and bonds have a fixed interest rate, with payment of principal annually. (The Zagreb Stock Exchange, 2002.)

Table 8 The movement of the index CROBEX and CROBIS

Year	Change of the CROBEX (%)	Change of the CROBIS (%)
2006	60,70	-4,50
2007	63,20	-4,50
2008	-67,10	-6,10
2009	16,40	5,80
2010	5,30	-0,20
2011	-17,60	-4,50
2012	0,00	13,70
2013	3,10	-4,42
2014	-2,70	5,80
2015	-2,70	5,80

Source: own work according to data from the web site of the Zagreb Stock Exchange

Deficiency of this two indexes lays in the fact that we can not establish with precision how many investments were made on national stock market by citizens.

2.2 Changes in financial habits of Croatian citizens

In table 9 are presented data on changes in financial habits of Croatian citizens regarding consumption of insurance product. Investigation is performed on data on gross policy income collected by all Croatian insurance companies.

Table 9 Gross insurance premium - insurance companies (in 000)

Year	Life insurance	Non life insurance
2005	1.895.769	5.454.304
2006	2.165.061	6.015.094
2007	2.482.743	6.582.189
2008	2.545.775	7.140.327
2009	2.488.675	6.922.661
2010	2.443.127	6.787.860
2011	2.431.268	6.713.977
2012	2.461.154	6.577.321
2013	2.538.414	6.538.186
2014	2.637.784	5.923.573

Source: own work according to data from the CFSSA-e

Since life insurance policy represents mean of our interest it is appropriate to state that citizens of Croatia have almost constant slow growth of consumption of this financial instrument.

Bank deposits made by general public will be presented in table 10.

Table 10 Bank deposits by years (in millions of kuna)

Year	Deposits on transaction accounts	Savings deposits	Term deposits	Total
2005	29.175,20	26.124,50	116.442,20	171.741,90
2006	37.696,60	26.601,50	138.651,00	202.949,10
2007	45.283,60	26.874,10	160.964,30	233.122,00
2008	41.313,10	25.640,10	180.860,70	247.813,90
2009	34.526,90	24.531,30	197.751,70	256.809,90
2010	37.258,10	26.705,50	205.219,20	269.182,80
2011	39.628,40	26.376,20	215.386,00	281.390,60
2012	47.466,30	21.229,80	207.147,90	275.844,00
2013	54.245,10	21.785,70	206.774,80	282.805,60
2014	67.549,20	18.052,40	200.474,10	286.075,70

Source: own work according to data from the CNB

From presented data is visible that citizens increase investment in deposits on transaction accounts and term deposits, while in same time decrease on saving deposits is visible.

Data of our interest is also data on short-term and long term deposits without and with currency clause. This data are displayed at table 11 and table 12.

Table 11 The amounts of short-term and long-term deposits without a currency clause (in millions of kuna)

Year	Short-term deposits	Long-term deposits	Total
2011	150.809,00	62.857,4	213.666,40
2012	162.383,94	66.899,24	229.283,18
2013	170.401,83	82.716,48	253.118,31
2014	170.352,64	100.837,41	271.190,04
2015	157.834,26	109.385,48	267.219,75

Source: own work according to data from the CNB

Table 12 The amounts of short-term and long-term deposits with a currency clause (in millions of kuna)

Year	Short-term deposits	Long-term deposits	Total
2011	4.328,59	81.511,80	85.840,39
2012	4.097,29	79.720,99	83.818,28
2013	3.318,46	79.096,38	82.414,84
2014	3.335,86	80.414,77	83.750,63
2015	2.348,44	80.207,16	82.555,60

Source: own work according to data from the CNB

From presented data it is visible that our citizens show some changes in saving habits especially when it comes to short-term deposits.

Voluntary pension funds represent opportunity of investment for Croatian citizens since 2002. In table 16 gross contributions collected in voluntary funds will be presented.

Table 13 Gross contributions of voluntary pension funds by years (in 000)

Year	Gross contributions
2006	184.300
2007	261.533
2008	249.457
2009	286.965
2010	289.350
2011	303.814
2012	282.658
2013	292.058
2014	357.339
2015	450.996

Source: own work according to data from the CFSSA-e

In presented data is very clearly visible that Croatian citizens are starting to consider voluntary funds as interesting investment product. Last decade is characterized by continuous growth of investment in voluntary funds.

In table 14 we are analysing level of net assets of different investment funds. Deficiency of this data is in lack of precise data on the structure of investors, meaning that we do not know what is percentage of private investors.

Table 14 Net assets of open investment funds (in 000)

Year	Cash funds	Bond funds	Balanced funds	Equity funds
2006	4.274.744	1.138.589	5.994.698	4.311.043
2007	4.140.206	674.073	10.022.402	14.180.944
2008	3.907.382	510.977	2.150.291	2.753.595
2009	6.044.826	554.761	1.929.278	2.878.020
2010	6.859.559	1.180.904	1.945.398	3.021.862
2011	7.240.022	723.421	1.361.556	2.165.706
2012	9.124.521	446.683	1.107.755	1.936.657
2013	9.797.924	386.430	933.254	1.917.649
2014	9.180.308	934.891	749.768	1.696.259
2015	9.256.527	1.457.602	809.312	1.630.344

Source: own work according to data from the CFSSA-e

We can see that interest in different funds is changing in last decade. Very visible is dropdown of net assets in equity and balanced funds at the beginning of financial crisis.

From data displayed in this subchapter we can see that Croatian citizens show changes in financial habits in terms of change of the level of consumption of certain financial instruments.

3. Research methodology and results

On the basis of data presented in chapter 2 we will try to establish whether Croatian citizens in creating investment strategies follow performances of this financial instruments or they take random choices while selecting investment strategies.

We will try to establish what is correlation between investment in certain financial instruments and performances in these instruments. Because of great volatility before 2011 we will concentrate our research in last 5 years.

Pearson's correlation indexes are calculated on the basis of last 5 years. Correlation is calculated using data presented in subchapter 2.1 with data from subchapter 2.2 for following instruments; long-term deposits with currency clause (LTD-c), short-term deposits with currency clause (STD-c), long-term deposits without currency clause (LTD), short-term deposits without currency clause (STD), voluntary pension funds (VPF), cash funds (CF), bond funds (BOF), balanced funds (BF) and equity funds (EF).

Table 15 Value of Pearson's correlation index for chosen financial instruments

Financial instrument	Pearson's index
LTD-c	0,96
STD-c	0,97
LTD	-1,00
STD	0,22
VPF	-0,07
CF	-0,63
BOF	0,51
BF	-0,93
EF	-0,88

Source: own work according to data from the different relevant sources

Strong correlation exist as positive for both long and short term deposits with currency clause, strong negative correlation exists in investments in balanced funds and equity funds. Absolute, but negative correlation is found for long-term deposits without currency clause. Medium strong correlation exists in positive form for bond funds and as negative for cash funds. Correlation for short-term deposits without currency clause is relatively poor. When it comes to voluntary funds correlation is slight. The results must be observed with caution in terms of absolute relevance, because we based it on observation of data for just 5 years.

4. Conclusions and recommendations

From the results of performed research we can conclude that efficiency in creating a personal portfolio is not something that can describe financial behaviour of Croatian citizens. Lack of financial literacy has been proven by obtained results. Investment strategies used by Croatian citizens could be named random choice strategies with doubtful result.

Future with increase of the level of financial literacy could bring different results. Increase of financial literacy should be imposed as a number one aim for all institutions involved.

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Track 2

Entrepreneurship,
Tourism and Trade

Social entrepreneurship, benefits of networking from the perspective of Croatian NGOs

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Abstract: The concept of social entrepreneurship has attracted a lot of attention in Croatia over the past several years. However, judging by the available information, the implementation of the concept of social entrepreneurship is still not very widespread. Social networks can provide social enterprises with information, support and access to resources.

In this study we have tested the benefits of networking from the perspective of Croatian NGOs with a social component. The assumption was that presidents of NGOs in Croatia do not think that networking can help entrepreneurs to access resources that would otherwise be unavailable or costly to obtain. We also assumed a lack of knowledge about the advantages of networking such as certain legal benefits, facilitated lobbying with national institutions, and increased eligibility for government grants. Our research is based on the sample of 200 NGOs with a social component. The second purpose of this survey was to raise awareness of social entrepreneurship in Croatia and to show the importance of knowledge about network support in the process of developing social entrepreneurship.

Key words: *Non-governmental organization (NGO), social entrepreneurship, networking, entrepreneurship*

1. Introduction

Even if social entrepreneurship is a young term in social science and still lacks a consistent theory to define it, being seen as “a large tent” (Martin et al., 2007) for all kind of activities, the social phenomenon of social entrepreneurship is becoming wider and stronger as ever before. The same is happening with social networking. Social entrepreneurship can strongly benefit from a wise use of social network and networking.

The key difference between social entrepreneurship and commercial entrepreneurs is that in commercial entrepreneurship, the main focus is on the economic return, while in social entrepreneurship is in social return, which means that conventional entrepreneurs look essentially for economic profit (Kirzner, 1973), meaning that their performance is attached to financial return (Austin, Stevenson, & WeiSkillern, 2006). On the other hand, social entrepreneurs search, generally, to accomplish social goals based on the economic sustainability (Dorado, 2006). Leadbeater (1997) defends that many of the traits and behaviors of social entrepreneurs are the mirror of commercial entrepreneurs, including their

determination, ambition, charisma, leadership, ability to communicate their vision and inspire others and maximizing the use of resources; the key difference is that in business entrepreneurship, the main focus is the economic return while in social entrepreneurship is the social return. However, the creation of economic wealth is important for the social entrepreneur, so that he can ensure the sustainability of the organization and for it to become self-sustaining. Profit and wealth creation can be part of the model, but they are only means and not end in themselves (Dees, 1998).

Social entrepreneurship in Croatia is a rather new phenomenon and is still poorly developed. The term appeared in the public discourse rather late, in 2006, and since then has increased to the point where a strategy for social entrepreneurship has been initiated.

Social entrepreneurship refers to innovative and financially sustainable activities focused on solving social issues. A social enterprise's commercial activities do not necessarily have to be in accordance with the social mission; rather, its purpose is to create financial resources to implement social goals (Noya, 2009). Therefore, social entrepreneurship can encompass a rather wide range of organizations and enterprises – from those which generate profit by themselves, to those which procure resources for other organizations which pursue social mission.

The criteria used for classification of social enterprises are the following: (1) pursuit of social (or environmental) goals along with the economic ones; (2) availability of a profit generating strategy and its share in the organization's total profit; and element of innovation.

According to this classification, the first group is composed of traditional non-governmental organizations or associations. These are characterized by a large share of social goals and a non-profit status, and they represent the focus of this paper and the topic of our research.

The second category refers to nonprofit social enterprises. Unlike the classical NGOs, this category entails innovation, i.e. an innovative approach in the achievement of (social) goals.

The third group encompasses the so-called hybrid social enterprises which pursue social goals and whose profit generating strategy is in accordance with the social mission. Finally, the fourth category includes for-profit social enterprises which have a set of social goals, but whose profit generating strategy is not necessarily complementary with them. There is also a fifth category, which largely overlaps with commercial entrepreneurship and which is more closely related to socially responsible business practices (Vidović, 2012).

The aim of this paper is to explore the benefits of networking from the perspective of Croatian NGOs. As a starting point for this research, the assumption was that presidents of NGOs in Croatia do not think that networking can help entrepreneurs to access resources that would otherwise be unavailable or expensive to obtain. We also assumed a lack of knowledge about the advantages of networking such as certain legal benefits, facilitated lobbying with national institutions, and increased eligibility for government assistance.

This survey has been conducted on the sample of 200 associations in the Republic of Croatia in July/August 2015. Our respondents were Croatian NGOs which perceived the social component as an important one, and incorporated it in NGOs core activities.

By means of this research, we wanted to achieve the following objectives: (1) discover the benefit of networking among NGOs; (2) raise awareness of social entrepreneurship; (3) promote and spread the knowledge about social entrepreneurship among Croatian NGOs and the interested public.

In order to examine the aforementioned goals, the remainder of the paper is organized in four sections. The first section provides readers with an introduction into the topic and into the importance of this type of research. The second gives an overview of social entrepreneurship and benefits of networking for social entrepreneurs. In the third section of this paper, research

methodology and research results will be presented. And in the last section, the authors will offer research conclusions.

2. Social entrepreneurship and networking

Socio-entrepreneurship, in literally meaning, consists of two words, which are socio and entrepreneurship. They fuse and create a new word. So, socio-entrepreneurship is entrepreneurship that has social goal and method. Social entrepreneurship begins with a discussion of previous studies of Certo and Miller (2008), which pointed out that there are three ways to look at in social entrepreneurship. First, from the overall mission, social entrepreneurship has a mission to social value creation with profit as an indirect effect. Second, performance measurement is difficult to do because the difficulty of social value measurement. Third, resource utilization, that social entrepreneurship utilizes the resources voluntarily. Social entrepreneurship has profit as the goal and results oriented.

Certo and Miller (2008) define social entrepreneurship as a process that involves the recognition, evaluation and exploitation of opportunities that result in social value which involves the provision of basic needs such as food delivery, health services and education. Social entrepreneurship is an activity with community goals, which hopefully is profitable and the profit is used to reinvest in the organization itself (Steinerowski, Jack, & Farmer, 2008). It is more likely to occur in contexts where there are socio-economic, environmental and cultural issues (Dacin et al., 2010) and promotes a lasting, attractive and sustainable solution for social problems (Nga & Shamuganathan, 2010). Social entrepreneurs are people who identify a failure in society and transform it into a business opportunity; they recruit and motivate others to their cause and build networks with essential people at the same time. Also, they face the obstacles and challenges and introduce their own systems to manage their social business (Thompson, 2002).

Developing and successfully using the social network means to rationalise (Parsons, 1951) the necessity of networking (Blau, 1972). Social networks (that are generating trust – as in social capital) are working as a economic lubricant generating lower transactional costs, new ways of collaborating and business opportunities – prosperity, in general (Fukuyama, 1996), but it needs a sustainable effort in order to “establish or reproducing social networks that are going to be used on long term” (Bourdieu, 1985). The same rule of the “weak ties” that Granovetter (Granovetter, 1973) developed to explain how the way people find a job applies to organizations when it comes to raise funds for their activities, perform better, solve a task faster, find volunteers to involve and so on.

Networks have several useful properties for social entrepreneurs. The first is size. Social entrepreneurs can enlarge their networks to get crucial information and other resources from knowledgeable others. The next is positioning. Entrepreneurs position themselves within a social network to shorten the path to knowledgeable others to get what they need (Blau, 1997; Burt, 1992; Granovetter, 1973). Finally is relationship structure. Social contacts may be related to the entrepreneur or to each other through several types of relations or interactions. In single stranded relations, each person performs only one activity with the entrepreneur and is related to that person through only one type of relation. Multiplex ties, in contrast, have several layers of different content or types of relationships (Scott, 1991). They may play numerous roles in the entrepreneur's support group. Researchers pay special attention to the contribution of multiplex ties to entrepreneurship. They especially note that social network members can contact and organize themselves, expanding the opportunities they make available to the entrepreneur (Burt, 1992; Hansen, 2001).

3. Research methodology and findings

The purpose of this research was to meet research goals, explore the benefits of networking from the perspective of Croatian NGOs, understand and explore the motivations of networking for social entrepreneurs, and answer in research questions: What motivates individuals to network in a social context enterprise?

The structured questionnaire method was applied. In our research, we use closed type questions. The answers are easier to code and quicker to analyses in closed questions. With Google Docs, we created a form which represents the basis of our online survey. Having created the form we sent it as a direct mail to email addresses of members of our target group, leaders of Croatian NGOs¹. The target group of respondents who can best provide the information we need are NGOs in Croatia which also have a social component as a registered part of their activities.

Preparations for the analysis of NGOs also included desk research, and audio scripts that contained a large number of questions significant for the research also proved to be highly valuable for the analysis. Respondents were contacted by e-mail.

The structured questionnaires include 4 questions each. The measuring instrument (questionnaire) for this research consisted of a set of questions that the respondents (presidents or vice presidents of NGOs) were asked to answer and express their agreement/disagreement with the proposed statements, whereby the Likert measurement scale of five degrees was used (1- not at all; 2 – very little; 3 – some, 4 – much, 5 – completely).

The most sensitive part of any social sciences survey is the response rate, especially when the survey is not completely anonymous, as we targeted a specific group of NGOs, and contacted them directly. Also, our survey was conducted in a very sensitive period, between July and August 2015, while most of Croatians used their annual leaves, which we took into consideration, and adjusted our questionnaire to be easy fulfilled by mobile phone or tablet. Out of the total of 200 questionnaires which were sent, 42 were returned, representing a response rate of 21%, which can be accepted as relevant in social surveys (Fombrun and Rindova, 1998).

From the total number of participants, 34 were females (81%) and 9 were males (12.5%). The research was conducted on the entire territory of Croatia. Distribution of the respondents across Croatia was as follows: NGOs operating in Osijek-Baranja County (23.3%), the City of Zagreb (23.3%) and Split-Dalmatia County (20.9%), while the rest were from other counties.

Average age of a Croatian NGO is 13 years. According to the research, the largest proportion of NGOs, up to 40.5% were employers while only 11.9% of respondents were either employees or volunteers in the NGO sector.

The variable " Benefits of networking from the perspective of Croatian NGOs." is a product of a chosen question while the reliability of the measurement scales was analyzed by means of the Cronbach's alpha coefficient. Cronbach's alpha reliability coefficient normally ranges between 0 and 1. However, there is actually no lower limit to the coefficient. The closer Cronbach's alpha coefficient is to 1.0, the greater the internal consistency of the items in the scale George and Mallery (2003) provide the following rules of thumb: "<0.9 is excellent, <0.8 is good, <0.7 is acceptable, <0.6 is questionable, <0.5 is poor, and <0.4 is unacceptable". While increasing the value of alpha is partially dependent up on the number of items in the scale, it should be noted that this has diminishing returns. It should also be noted that the alpha of our survey is <0.7, which is acceptable.

¹ A data base of Croatian NGOs, with the relevant contact details is publicly available on the following link: <https://uprava.gov.hr/o-ministarstvu/ustrojstvo/uprava-za-opcu-upravu/registri/registar-udruga/826>.

Table 1 Benefits of networking for NGOs (mean and std. deviation for each question)

Item Statistics

	Mean	Std. Deviation	N
Networking can provide certain legal advantages	3,6905	,94966	42
Networking: makes it easily lobbying with national institutions	3,9762	1,04737	42
Networking: makes it easier to receive government assistance	3,7143	,99476	42
Networking: makes it easier to react strongly to the appearance of new social change in society	3,8333	,93487	42

Source: Research results

Table 2 Case Processing Summary

	N	%
Cases Valid	42	100,0
Excluded ^a	0	,0
Total	42	100,0

- a. Listwise deletion based on all variables in the procedure

Source: Research results

Table 3 Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,931	,931	4

Source: Research results

We can see that all (42) of our respondents answered this question. Alpha coefficient for the four items is 0.931, suggesting that the items have high internal consistency.

After a detailed analysis of all four areas of competitive advantage which social entrepreneurs can obtain as the result of networking, it has become clear that the perception of interviewed presidents of NGOs ranges from 3 and 4 in terms of ratings, i.e. from indifference to agreement, as demonstrated in Table 1. It is important to highlight that no presidents expressed complete agreement with any one of the statements, i.e. that no competitive advantage features received the rating 5, which certainly leaves enough room for further work on improving the role of NGOs, both by NGO presidents themselves, and by relevant institutions. Competitive advantage related to national institutions received a high average rating of 3.80. Namely, presidents of NGOs in Croatia mostly agree with the statement that networking can help in receiving government assistance (3,714), and most of them also believe that networking could offer certain legal benefits (3,690). Many interviewees also agreed with the statement that networking facilitates lobbying with national

institutions (3,976). According to our survey, it allows NGOs to respond more easily and more efficiently in the face of new social changes (3.833).

4. Conclusion

Networking of NGOs in the Republic of Croatia is one of the main driving forces of development of NGOs on the local, regional and national level. According to the results of the conducted research, we can see that the interviewed presidents of NGOs are aware of the importance of networking, because joint activities allow them to obtain certain legal benefits (e.g. tax reliefs). All interviewees agree that networking could facilitate lobbying with state institutions and make it more efficient, and that in this way they might receive state assistance more easily and more quickly. The interviewed presidents of NGOs in the Republic of Croatia believe that networking would allow them to respond more efficiently to all social changes that could occur in the global market. NGO networks are not sufficient to overcome all disadvantages NGOs are faced with in their business operations, but if networking becomes a part of their business strategy and policy, it could contribute significantly to the achievement of positive results which could not be achieved by means of NGOs' individual policies.

The conducted research speaks in favour of the claim that NGOs in the Republic of Croatia can obtain great benefits from networking, but there are also numerous areas which require further work so that those benefits could manifest themselves fully. NGO networks are necessary so that the joint contribution could be manifested through social development.

For a further development of this area, it is necessary to prompt research on social entrepreneurship and encourage networking among social entreprizes, which would allow dialogue and exchange of experience. Finally, further surveys should be conducted among all NGOs in the Republic of Croatia in order to obtain their view on all the benefits they might receive from networking.

To conclude, we would like to cite Drayton, one of the most quoted authors dealing with the topic of social entrepreneurship, who provided the best outline of what social entrepreneurs should represent: "...There are many creative, altruistic, ethically good people with innovative ideas; however, only one in many thousands of such good people also has the entrepreneurial quality necessary to engineer large-scale systemic social change..."

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Redefining the development policies of consumer cooperatives in Moldova under European priorities

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Abstract: The cooperative system in Moldova is passing a long and difficult period of transition from a statual economy in an economic system. This process may not be perfect, but it ensures a high rate of economic agents involved in competition, thus turning it into a cumulative process of economic and social growth. The strategies, policies, and priorities for the development of cooperatives in the EU member states adhere to high scientific and professional standards, demonstrated over time by obtaining notable performances from technical, scientific, economic and social areas. This article follows the logic and proper steps after the signing of the EU-Moldova Association agreement for the redefinition of the concept and policies of consumer cooperatives in Moldova in order to assimilate with European priorities and practices and use that as a basis for achieving the desired objectives. Rethinking the management system in Moldova's cooperation is a major condition for sustainable economic development.

Keywords: *statual economic system, market economy, economic mechanism, competition, consumer association agreement.*

1. Preface

Cooperative nowadays is a component of the European and global social economy having a significant contribution both in national economies and in local socio-economic development. The cooperation is not only a significant component of the economy, but also one of the main subjects of the social economy in Europe and the world. Being recognized as a legal entity and being treated equally with the other types of associations and foundations, having an autonomous character, democratic values, true cooperative principles relief, personal responsibility, human solidarity, mobilizing human, material and financial resources, organizing economic activity, creating jobs, training of local population or in proximity that prepares professional associates for jobs and then multiplying collective ownership is held together to solve the material needs of the participants. Cooperative enterprises contribute to the training of the unemployed, including the different social groups and disabled people, aging population, immigrants of both sexes, and then by integrating them in social life, and as a result, contribute to the eradication of poverty and hunger.

Cooperative enterprises play an important role in social and economic life because they operate on the basis of fundamental needs, such as job creation, organization of economic and marketing processes in the industry, construction, transportation, adjustment of banking and crediting system to people's needs, performing insurance, health and educational services. Basically, this means that person's needs, his socialization and not profit are put in the center of cooperative activities, because the values and the principles of cooperative business enterprises differ from the ones based on the market economic relations. Economic development of cooperative enterprises is carried out by employees and their basic needs and aspirations.

A key principle of the cooperative to its members is the school of life. Cooperative economic structure, based on the grounds of its founding members' needs and aspirations is not targeting the profit as a main goal. Prominence of a true economy is a social wealth, social relief and joint resolution of local problems, where the financial benefits and material income became instruments for achieving human socialization, development of local infrastructure, schooling of people in need, maintenance and preservation of the environment, eradication of poverty and hunger of native population and migrants.

Viability of millions of cooperative enterprises in the world has been proven by a successful combination of cooperative competition due to a valuable human potential, it has the doctrine that stimulates employees' participation in economic and social life. Implementation of legal responsibility at every stage of production, distribution, exchange and consumption of economic performance of all interested participants, training of new skills and values to meet the needs and solve the problems.

Cooperatives have a significant market share in basic economic sectors, particularly in the areas of agriculture, trade, transport, construction, health, education and insurance, lending and banking systems, pharmaceutical and social service. A wide range of types of cooperatives, cooperative European transnational activities are grouped into different jobs in construction, craft, design, trade, production and realization of bread and bakery products, confectionery, meat and meat products, milk and milk products, footwear, clothing, utilities, etc. This cooperative system as a whole has created millions of jobs, wages and services providing a significant segment of the population in Europe.

Only a few findings that confirm the above. According to United Nations 50% of the population of the planet depends significantly on the activity of cooperative enterprises. One million such businesses have employed over 100 million people and the number of cooperative members is around 1 billion people. Initial rankings of the International Cooperative Alliance for the top 300 cooperatives from 26 countries around the world, called "Global 300", showed great resilience to the global crisis and that the total turnover of these cooperative groups is 2.2057 trillion US dollars (with 11.6% more compared to the period between 2010-2012). Main areas were: insurance (41%), agriculture and food (27%), retail (20%), industry (5%), banking and financial services (4%), healthcare (1%).

The European region of the International Cooperative Alliance - Europe Cooperatives enlists 123 million cooperative members and 160 thousand cooperative enterprises, which employed 5.4 million people. By the number of cooperative enterprises, mainland leaders are Italy with 41 500 cooperatives, Spain with 24 300 cooperatives followed by France with 22 800 cooperatives (2012).

The cooperative movement in France consists of more than 24 million cooperative members, followed by Germany with 20.5 million members and Italy with more than 13 million. These three countries occupy the leading places in Europe by number of employees, therefore - Italy with over a million people, nearly a million France and Germany with a total of over 830

thousand people employed in cooperatives. Italian cooperative enterprises have committed nearly 5%, while the French ones only 3.5% of the working population of these countries. The most important sectors in working cooperatives are industrial services (41%) and agriculture (33%), consumption (3%) and pharmaceuticals (1%).¹

Consumer cooperation in Moldova has a rich experience. Founded 147 years ago, it has gone through various periods of beneficial ascension and hardship.

Since 1991 the cooperative system in Moldova caught in privatization of state property, agricultural collectives, price liberalization, began to lose its values, principles and functions, there were disparities between the social and the economic position, which once made this system most humane and attractive in the country.

Currently a promising market economy creates new processes and forms in the development of cooperatives which justify interest in cooperative enterprises activities experienced in EU countries in solving complex problems of social-economic changes.

The integration of Moldova to the European Union implies the need for comparative analysis of cooperative systems in the country with the European countries, the cooperative legislation that governs these systems form the organizational structure determines function areas of activity, quality management in these systems for continuous modernization of cooperative structures in the country, attracting investment, widening sectors of activity, diversified and dynamic adaptation to the requirements of the national and international market. However, it imperatively requires harmonizing national legislation of consumption cooperation system with the EU acquis, the gradual harmonization of the legislation with the multidimensional European Community of the cooperative system.

This article is one of such attempts. The topic covers a wide European experience on the development of cooperative legislation, given that EU has integrated countries with different cooperative traditions, determined various regulations on multidisciplinary and multidimensional complex issues and had limited space. The authors have proposed to draw a few key coordinates that characterize this topic.

2. Methodology

In order to collect the research data there were used various methods such as analysis and synthesis, normative inference, deductive and comparative study.

3. Systemic Transformation of National Economy in Transition period and their impact on cooperatives

The late 80's and early 90's not only marked as the last years of the XX century, **but also a historical return to a natural market economy** of a Central and Eastern Europe, as well as the union republics of the USSR, including Moldova.

Without giving any details, we point out that in the socialist economy of Moldova as well as of the other countries the monopoly of state property was dominating, but in the agricultural and cooperative system it was collective ownership. The mechanism of realization of the property was conducted through centrally planned development law, and not in accordance to market requirements. Politico-administrative and organizational structures corresponded to the relations of production, but their administration was performed by an oversized and overly politicized Government party. Planned allocation of financial resources created material and human disproportion to the oversized businesses and insufficient development of others.

¹ Revue des etudes cooperatives, mutualistes et Associatives Recma. Trimistriel, april 2015, pag.33

Commanded economy had a system of non-stimulating remuneration, egalitarian and non-convertible monetary system. Export was executed by only specialized state enterprises.

Consequently, socialism was not a natural product and the transition from planned economy to market was one necessary objective. Countries going through these processes are called transition economy countries, including the Republic of Moldova, whose basic components of economy are in a radical systemic transformation.

Social and economic cost supported by the population, the national economy, including the cooperative system in this period, and the implications of the country transition through the entire activity is a special topic. It's worth mentioning that along the distortions and disparities experienced by the Moldavian socialist cooperatives, in the 60's-90's period there were times when the system performed services and produced goods that exceeded domestic consumption, collected and acquisitioned commodities for export, performed activities that reached the volume of several billion dollars annually.

In the early 90s the country was studded by a difficult economic and political context, unpredictable and unstable economic and political context when the industrial and agricultural country entered into a process of decomposition, cooperative system created based on socialist principles could not remain intact. Certainty of consumer's cooperatives was the same as of the system that has undergone degeneration.

In the management report of MOLDCOOP in XI Congress of the consumer cooperative work held on February 4, 1994 stated that "... the economic crisis in the country, the sudden drop in production, reduction of national income, unemployment and poverty population substantially influenced economic activity of consumer cooperatives." There was a significant decrease in the number of retail trade and public food units, which led to a considerable reduction in the volume of sales of goods, procurement and production activity was stopped in most of the cooperatives. The share of their assets in their total volume decreased from 34% in 1989 to 12% in 1993.

As mentioned in the report to the congress, in this period it was characteristic the fact that **"many of the leaders were plunged into so-called market economy, to independence without the psychological, social, economic and legal training, without knowing the proper measure of what that is"**. Consumer cooperatives built on different principles could not cope with the first primitive accumulation of capital and distorted competition terms that appeared at that time in the national economy.

The second wave of economic decline of consumer cooperatives in 1995-2000 resulted in a substantial reduction in the size of the cooperative sector and macro indicators of economic activity. During this time the number of unemployed has reached a significant proportion size, the number of cooperatives and cooperative heritage volume has decreased. Real Estate located in beneficial places was alienated and the remaining Real Estate was only partially used. The number of cooperatives has reduced, and the economic activity has been steadily decreasing.

The beginning of the new millennium is characterized by stopping the fall in consumer cooperation activity. In 2002 came the first signs of recovery in the economic activity, although an overall loss was registered in this segment.

Along with the stable growth followed by an un-uniformed development, a consumer cooperatives since 2005 began working with relative efficiency, and as a result, the economic and financial system in recent years has entered a phase of recovery and economic ascent, even a slow start, but which allowed modernization of material and technical base of the system, expansion of cooperative infrastructure in rural locations that improved placement in accordance with the requirements of the population, upgrading the existing capacities of

ensuring quality services. Expanding commercial infrastructure for bread production in areas where these services are required, including in places where such services are not provided in the previous period of time by reopening commercial establishments and restoring the service, upgrading some of them technologically and in terms of image has allowed in recent years to find not only a revival in trade, public catering, but also a steady increase in economic activities, taken as a whole, and production - which permit an improvement overall.

Gradually the system began to operate profitably despite unfavorable business environment in the country that does not allow attracting foreign and domestic investments in consumer cooperation. Due to lack of financial means, decisive actions needed to renovate and reinstate the entire cooperative heritage; multiplication and diversification of production, provision of services and creation of innovative cooperative units could not take place.

4. Some economic issues on cooperative systems in Moldova, France and Germany

a) The dimensions of consumer cooperatives in Moldova

Systemic changes in the national economy, the emergence of competitive elements in the real economy and trade sectors have given rise to diversification of cooperative systems, and in this case, arose agricultural production cooperatives, entrepreneur's agricultural cooperatives, joint stock companies, limited liability companies. But the size of consumer cooperatives in Moldova remains the most significant in the country. Experienced agriculture corporate organizations increase slightly the number of active agricultural entities as well as the management of agricultural land surface but are only in the beginning. Therefore further reports focus back on the consumer cooperatives, because its dimensions remain the most significant.

In the period of 2012-2015 years, the cooperative system has become multidimensional, diversified economic activities, concentrating efforts in achieving the development program mapped out by the Congress number XV of consumer cooperatives in Moldova.

According to official documents presented and discussed at Congress XVI (February 2016) about the activities of consumer cooperatives in 2012-2015, organizations and enterprises contributed to reanimate the system and the development of traditional activities and new activities, extended coverage in rural activities, rural modernization and upgrading production processes of trade, diversification of the services, infrastructure modernization. In the reference period were reopened 31 commercial units in villages, were modernized commercial technologies in 200 stores, refurbished 54 units of catering. It opened 30 stores of CoopPlus and CoopPrim type. The amount of investment in improving the technical and material support is near 88.6 mln. lei.

All of this allowed the cooperatives at the beginning of 2016 to present the following statistics:

- co-operative members - 144 000;
- Companies - 161, including 98 consumer cooperatives;
- Number of employees - about 4700 people;
- The number of localities in which cooperative provided its services -770;
- markets - 32 with 10850 seats outlets;
- The manufacturing sector comprises 21 factories and bakeries, confectionery sections 14, slaughterhouses -16 and 29 processing units of agricultural products;
- educational institutions - 3.

During the years 2012-2015 there were:

- Marketed retail goods worth of 3.1 billion lei, or 108.4% compared to the previous four years;
- Manufactured goods wholesale total of 383.5 mln. lei indicating an increase of 52.1% compared to the previous period;
- Acquired agricultural products over 315.4 mln. lei compared to 278.6 mln. lei in the period 2008-2011;
- Industry goods, mainly bakeries - breads pastries, sausages, beverages;
- Provided services worth of 589.5 mln. lei or 131.1% compared to 2008-2011;
- Conducted exports worth of 64.8 mln. 19.1 million lei and for imports. lei².

With the support of the majority system entities have reached an economic growth and resulted in a consistent profit worth 30.2 mln. lei. Practically 70% of businesses have turned to profit. Simultaneously, it increased the contributions to the consolidated budget, as well as social and health insurance, representing the total amount of 431.8 mln. lei.

b) Cooperative enterprises in France (as of 2012)

- **Agricultural cooperatives** - 2 850 enterprises in relation with 12,400 companies with common interest in agriculture, the number of employees about 160 000, 83.7 billion euro business figure;
- **Co-operative enterprises using needlework crafts** - 425 enterprises, (partners, members, associates - 59 000), 3,500 employees, 1.2 billion euro business figure;
- **Transport cooperatives** - 46 (partners, members or associates - 816 transport companies), number of employees - 1,655 persons, business figure 0.165 billion euro.
- **Trade cooperatives** - 80 enterprises, (partners, members or associates - 30815 people), number of employees 510 800 people, the volume of achievements - 138.2 billion euro;
- **Marine cooperatives** - 134 enterprises (partners, members or associates – 1230 fishing companies), 1,800 people employed, business figure - 1.2 billion euro;
- **Consumer cooperative** - 35 enterprises, 750 thousand cooperative members, 9,500 employees, 2.65 billion euro turnover and business figure 800 mln. euro;
- **Housing cooperatives (low-cost)** - 171 companies, 56.3 thousand cooperative members, 999 persons employed, turnover - 182 mln. euro;
- **Agricultural Credit Group** includes 39 regional banks, 2523 local savings banks, 7013 branches, 700,000 shareholders, 150 thousand employees.
- **Groups of banks and cooperative credit group:**
 - a) Savings Banks - 136 regional savings banks, 8,600 thousand shareholders.
 - b) The system of popular banks - 19 popular banks, shareholders 8,600 thousand, 117 thousand employees.
 - c) cooperative group - 13 structured cooperatives with 115 branches, 65 thousand shareholders, employees - 2058
- Other types of cooperatives and companies

² Data used from Development strategy of consumers cooperation of Republic of Moldova for 2016-2019 ; Chişinău, 2016; pag. 6-9.

- **Total per country - 23 144 cooperative enterprises, (partners, members, associates - 24,397,196), 1,081,015 employees, 299,11 billions of Euro – business figure³.**

c) Some cooperative sectoral activities in Germany

- **Cooperative banks** - 1101 units, branches 13211 and 750 billion carrying amount. -2 Cooperative central bank with 503 billion carrying amount, 17.4 mln. shareholders and 30 mln. customers;
- **Agricultural cooperatives Raiffeisen** including 19 centers, 51.3 billion euro – equivalent of the amount of goods;
- **Trade cooperatives** - 1960 enterprises, 400 thousand cooperative members, 112.9 billion euro turnover;
- **Consumer cooperative** - 285 enterprises, 500 thousand cooperative members, 2 billion business figure;
- **Housing cooperatives** - 1931 enterprises, 2.8 mln. cooperative members, 2.2 million apartments build⁴.

In conclusion, we find out that cooperatives in these countries create an economic and social system, apolitical and non-government, autonomous and independent carrying out various fields of activities - trade, manufacturing, banking, transport, construction of houses, employment, etc. All these and many other properties, principles, rules, order, control and mutual support are common. The difference between the cooperative system in Moldova and the EU is determined to turn, pointing out that Moldova is at the beginning of the way to master a market economy. It explains the lack of national legal expertise influenced by its contradictions which can not ensure an efficient activity of cooperatives under competitive conditions. Also, we need to mention the management faulty of the taxes' system and the unattractive to foreign investors and domestic businesses corrupted environment. We will study some of this problems below.

5. The need to reassess the legal basis for the development of cooperative system during the transition period in the Republic of Moldova

Moldovan cooperative entities still lack basic and unique legal basis for cooperative development of all forms, coordinated with banking law, customs law, commercial law, tax law, the status of cooperatives (like the German one). Cooperative forms are not diverse and multiple as that of France, Germany or Italy (measured by relative indicators). Constraints arise not only from that cause (as discussed previously), but also from the lack of experience needed in conditions of market economy, competitive unfavorable business environment, chronic shortage of financial resources to organize and develop cooperative activities, competitive both domestically and externally.

During the period of the 90's, the transition of the national economy to market relations, the Parliament adopted the Law of Cooperatives [4], which proved to be the legal base necessary for the development of cooperative system under competitive conditions. New economic relationships based on the private property and directed towards changing imposed by the market have given a rise to economic diversification of this segment as it is the cooperative. In the economy have taken birth also other organizational forms (such as has been mentioned

³ Revue internationale de l'economie sociale RECMA. Cooperatives in France : Issue and challenges at the start of the 21 st century . April 2015, p.32

⁴Data from the Federal Ministry of Catering of Germany, march 2014

above), agricultural cooperative, for which there have been developed the appropriate laws. This is how there appeared the Law concerning cooperatives of production (5), the Law concerning entrepreneurship cooperatives (6) and, of course, the Law of consumers' cooperative (7) which provides the legal basis for the most significant cooperative systems in the country. In addition to these laws there are drawn up special stipulations in the Civil Code (Articles 171-178) (8)) supplementing and providing more legal basis for the structure and operating of the cooperatives' system under market conditions.

The first steps in the development of the piece of legislation have led to the legal, administrative and social basis of cooperatives, for instance the legal limits, appropriate political and economic conditions in the country of cooperative relations during the period of transition, then laws, special stipulations in the Civil Code, as well as other rules and regulations adopted on the setting up, structure and operation of various forms of cooperatives joined in the organization and essence of goods-money relations, which along the way have become more exciting and all-encompassing.

Development and adoption of a package of laws and stipulations in the Civil Code on the setting up and legal, economic and social organization, defining specific property type of a cooperative, its structure, establishing the principles of ruling bodies and association of the co-operatives, as well as the integration of this economic and social segment in the market economy must, on the one hand, match the values, the principles, as well as national and international cooperatives' customs, and the specific needs of the changing economy, on the other hand.

The principles and the values on the basis of constitution of a cooperative are in line with those of non-commercial organization, which does not have the benefit as an aim, but satisfying the needs of those who have in common this cooperative, whereas the requirements of the market economy require cooperatives to operate under competitive conditions corresponding to laws of supply and demand which means obtaining the benefit that provides vitality. The situations that come out require flexibility in management, organization, legislation.

It is necessary to emphasise that the laws governing the system of cooperatives in Moldova, in principle, are flexible and allow the changes necessary in the transition period in some structural problems. Starting with the law of the cooperative system adopted in 1992, then logically developed and other organic, general and special laws, stipulations, pieces of law have formed the legal basis of the current national cooperative system which, in principle, is up to the level of development of relations of production based on private property. Under appropriate legal support, cooperatives of different social, economic sizes and shapes are involved in solving problems and needs generated by the difficulties faced by national economy nowadays.

This does not mean that the system of law governing this socio-economical section is morally perfect and is according to internal and external challenges and is not free of continuity, integrity, rigidity, contradictions and constraints. Consumers' cooperative is a significant part of national economy and social life, which offers viable alternatives through the creation of a different type of economic assets in relation to the companies and organizations that stand at the base of private property and the market economy rules. This explains the fact that the enactment of the cooperative system practically ensures the framework for cooperatives of different shapes in the country, in order to contribute to institutional capacity and development as well as cooperatives association in an territorial union.

More than that, the stipulations of the Law of Consumers' cooperative in the Republic of Moldova regarding the setting up, structure and operating of Consumers' cooperative subscribes to the nowadays trends in the EU.

At the jubiliar congress of the International Cooperative Alliance in Manchester, in 1995, the cooperative identity has been defined as follows: "Cooperative is an an autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly owned and democratically controlled enterprise ' (9)

The definition determines the basic features of the co-operatives: (a) an autonomous association self-contained by the governmental institutions and the companies of capital, which operates in accordance with the laws of the market, as well as individuals ; and (b) created by free, voluntary association of members of their own free will without being subject to any constraints or restrictions; (c) based on the principle of democratic "one person - one vote" election of the members of their management and the adoption of main solutions from everyday activity and perspective; (d) with a system of remuneration that is right, unbiased and fair.

The definition of the Consumers' cooperative in the Republic of Moldova is given by the law of Consumers' cooperative in 2000 by referring to the following editorial: "Consumers' cooperative -an autonomous and independent association of individuals, created on the principle of free consent, through the cooperation of shares of its members, engaged in economic activities to meet their interests and needs of consumption."

By comparing these two definitions of the cooperatives we can conclude that the law of Consumers' cooperative addresses to the principles and values of the constitution and operation of the co-operatives similar or very close to those democratic principles of international cooperation adopted in Manchester, in 1995, at the Congress.

To confirm that has been written above, here are some of Cooperative's principles of the law of Consumers' cooperative in the Republic of Moldova:

- a) **Procedure for establishing consumers' co-operatives** can be carried out without great effort - cooperatives may be located in the area of one or more localities and/or in the same locality where can operate one or more consumers' owned cooperatives (Article 19 (1) and (2) The law C. C.);
- b) **Consumers' Cooperative shall be established by decision adopted by the constituent assembly which must be attended by at least 7 cooperative members.** In Civil Code the number of founding members is 5 (Article 171, paragraph (1));
- c) **Cooperative may be formed with a variable share capital.** The amount of a share shall be determined at a meeting of the constitution and may be amended in accordance with its statute. Without any difficulties, the members of the cooperative or the associated organization are able to withdraw their share (Law C. C. Article 89 (2), Article 90 (1) and (5));
- d) **Individuals may be associated in consumers' owned cooperatives and are able to get out of it voluntarily, freely.** Consumers' cooperative shall be open to all individuals that are capable of performing services and are responsible of their membership, that means they are equal in rights to be promoted within the governing bodies and of control, without there existing discrimination on political criteria, race, nationality, language, religion, sex, wealth (Law C. C. Article 6 (1) and (3), Article 9 (1) and (2));
- e) **Democratic nature of cooperative society** is confirmed by strict observance of the principle of "one member - one vote", regardless of how many shares subscribed and that all decisions shall be taken only in a collegiate way, there shall take part all cooperative members (Law C. C. Article 7 (1) and (2), Article 8 (2)). Regulations of the democratic governing structures operate within the Consumers' cooperative shall be carried out by ensuring the participation of members of the company's management and cooperative collective control activity;
- f) **Cooperative organization is a non-governmental and non-business organization** created in order to meet needs and interests of cooperative members, who participate on an equal foot

in the activity of the cooperative organization, to the formation of social capital, with the result being – the benefit from a fair and equitable distribution. Relations between the cooperative members and cooperative organizations shall be determined under mutually beneficial conditions. Cooperatives serve their members most effectively (Law C. C. Article 4 (4) (1) and (2), Article 11, Article 12). In accordance to the Article 15 of the law of CC, consumers' cooperative works **independently** on the basis of its own development programs;

g) **Cooperative members interests regarding the cooperative's property** is defended by the law of C. C. (Article 89 (1), (2) and (3)) that writes down that the property of the cooperative organization is private property, equally protected by the law, and shall consist of a divisible and indivisible part. The divisible part consists of shares, submitted by cooperative members, and the indivisible includes accumulated assets in the subsequent course of business, without the cooperative divisible part. Liquidation of the Consumers' cooperative provides from the divisible part the releasing accounts payable (if any) and shares - founding members, in accordance with statute, and the indivisible part goes to the territorial union from the area;

h) **In conclusion, consumers' cooperative formed on the basis of the principles referred above is a legal person governed by private law.** On the basis of Article 1 of the law of C. C. it is an autonomous and independent association of individuals, on the principles of free consent, through the cooperation of shares of its members engaged in economic activities to meet their interests and their needs of consumption.

This definition in Article 4 (referred above in paragraph (f) comes with an addition which states that the organization is non-governmental and non-commerce, and the Article 82 (1) specifies the legal forms of organization of consumers' cooperatives are consumers' cooperative, territorial union of consumers' cooperatives and central union of consumers' cooperatives. **Cooperative organizations may set up cooperative companies as independent legal entities with commercial character (Article 82 (2)).**

6. Some Ideas on Enacting of an entrepreneurial cooperatives in EU countries

According to the Document of the European Parliament, the legislation of the cooperative system in the Member States of the European Union is divided in the following way:

- Countries in which the legislative system of the cooperatives is divided into sectors, in accordance to that distinctive sector, as well as social aims (Belgium, Ireland);
- Countries in which cooperative legislation, which would be able to bring under regulation the set up and operation of cooperatives, has not been drawn up. Cooperative business shall be determined by the statute which outlines the nature of their cooperative (Denmark, Great Britain, Luxembourg);
- Countries in which has been drawn up a general cooperative law for the whole economy, which has a legal framework on the basis of which shall be constituted and work the coops of all forms (Germany, France, Italy, Spain, Austria).

The Rome Treaty, establishing the European Community, notes (Article 48) that cooperative entities are recognized as companies or firms, but this determination does not provide, in relation to other forms of businesses, equal and equitable relationships.

In order to facilitate cooperatives to achieve economic potential in compliance with the laws of the market economy, develop relations based on democratic cooperative system, growing social responsibility at European level, the European Council decided to create the **European cooperative societies with transnational character**. To do this, the Council of Europe has adopted Regulation No 1435/2003 of the Council of 22 July 2003 relating to the status of the European Cooperative Society (ECS). Regulation establishes a legal status of ECS and

guarantees equality of conditions of competition between cooperative companies and companies of capital. (10) Regulation provides:

A) Stipulations of ECS: ECS may be formed:

- By at least five individuals **and/or legal persons** residents in at least two Member States of the European Economic Area (EEA), formed in accordance with the law of a Member State of the European Union (EU) and governed by the law of at least two Member States of the EU;
- Through the merge **of cooperatives** formed in accordance with the law of a Member State, which have their registered office and the administration center in the State in question,
- By converting **a cooperative** formed in accordance with the law of a Member State of the EU which it has its registered office and the administration center in EEA, in case this cooperative has for at least two years a unit or a subsidiary company which is governed by the law of another Member State of the EU.

(B) capital of the ECS: share capital of the ECS is represented by the shares of its members. This capital must add at least 30 000 EUR. The laws of a Member State requiring a greater subscribed capital for legal persons who perform certain types of activities (such as banking, insurance, etc.) should apply to those ECSs which have their head office in the Member State concerned. Once a year, the general admission must satisfy itself, in a resolution, that the amount of capital is at the end of that financial year and its demarcations of the preceding year.

If the legislation of a Member State, in which its head office is, allows, ECS may have cooperative members as investors, with voting rights being limited.

(C) the ECS statute: founding members shall draw up the statute of the ECS, in accordance with the stipulations of the establishment of national cooperatives. The statute shall be drawn up in written form and signed by the founding members.

(D) principle of non-discrimination. Subject to these Regulations, an ECS shall be treated in each of the Member States as a national cooperative.

Registration and advertising. Any ECS shall be registered in the Member State in whose territory it has its registered office in a register designated by the law of the Member State in question. Registration and cancellation of registration shall be the subject of a notice published for informative purposes in the Official Journal of the European Union.

(E) structures of the ECS. In the structure of an ECS shall enter, on the one hand, **a general assembly**, and on the other hand:

- EITHER a **body of administration and** a supervisory body (two-tier system);
- EITHER a management (one-tier system), according to the choice referred to in the ECS statute.

In the general assembly, the members have, in principle, equal voting rights. Exceptions may occur in favor of big investors of cooperatives, in certain financial cooperatives.

The governing body or management body, depending on the type of structure chosen, ensure management of the ECS and may represent it in the justice system or third parties.

The statute of the ECS enlists the categories of transactions which require an authorization. This may be awarded to the management body or, administratively, by the supervisory body or by decision of the general assembly.

(F) audit and publication of accounts . ECS shall be subject to the legislation of the Member State in whose territory it is situated regarding the preparation, audit and publication of annual accounts and those consolidated.

(G) The winding up, liquidation, insolvency and cessation of payments. Dissolving ECS is pronounced: either by decision of the general assembly, in particular when it reaches the statute's deadline or when social capital is reduced below the minimum fixed value; or by legal proceedings, for example in case the headquarters of ECS have been transferred outside the EEA. ECS which is the subject of a winding-up proceedings, insolvency or cessation of payments shall be subject to the stipulations of the national legislation of the State in whose territory it is situated.

By drawing your attention and referring to this Regulation, we want to encourage the creation of transnational cooperative societies in the Republic of Moldova to promote an activity at the European level.

Improving legal framework in the field of the cooperative system by the Member States, as well as the European Community institutions consists of establishing the formation and functionality of cooperatives by ensuring compliance with cooperative characteristics in accordance with the principles and values set by International Cooperative Alliance (HERE- The Statement of cooperative Identity developed in 1995 and updated in 1996) and at the same time provides access for cooperatives to the capital market. Principles listed and recommended to all cooperative national systems by the declaration of identity are:

(A) voluntary association, free and open. Association is carried out by a body of people with the same sort of interests. This principle in the law of cooperatives in Germany (1990) is referred to as through free accession, unlimited number of members, as well as the admission of new members regardless of the date of lodging of cooperative. Worker cooperatives in France (1978) and the law of general cooperatives in Spain (1987) also require that the cooperative societies have a variable capital and a structure and democratic management, that assigns, in free accession and voluntary recall, people who have an interest or common socio-economic needs... this principle in Consumers' Cooperative law of Moldova are practically similar to those in Romania. In the notion of the consumers' cooperative, in Moldova as in France, there is no reference to the concept - "open" - which means that every person may join or leave cooperative regardless of the date of formation of the company.

B)democratic control of cooperative members exercised on decisions by the cooperative society. Cooperatives functioning democratically, as well as equal rights of cooperative members, in their management, with no discrimination, shall be carried out by the rules which determine the election procedures and the establishment of bodies to take decisions in the bodies at various levels. This principle is transposed in the laws operating in France, Germany, Italy, Spain, etc. Democratic principles are reflected by the fact that the activity of cooperatives is located under the control of its members.

C) The autonomy and independence in front of the state and public authorities, other individuals or legal persons. This principle is provided in the national law of the countries. It can be generalized in the following way: cooperative societies being autonomous, independent determine all the parameters of their activity, including production of goods, provision of services in order to satisfy the needs of cooperative members in accordance with the stipulations of the law without any interference or constraint from outside the cooperative society.

(D) **Fair economic activity for cooperative members through labor and capital.** This principle is practiced in the same way in all member-states and functions under national law. In addition to this, the Cooperative Law in Italy (1985) stipulates the establishment of funds through the National Bank of Labor which may be allocated to cooperatives in larger stakes than the social funds of the cooperatives.

(E) **cooperation and mutual aid between cooperatives and cooperative members** is an important principle, common to the cooperative system. It is regulated not only in Cooperative law stipulations in the Member States of the EU, but also in the various documents of unions, federations, Confederations, as well as Continental and world organizations, forums which have been associated with cooperative companies in order to protect and promote cooperative movement.

(F) **education, training and information of** cooperative members, employees regarding the essence and the type of the cooperative, awareness of the rights and their collective responsibility for the intended results.

In some countries by law there are provided funds for education.

(I) **concern for the community.** Cooperatives are the result of a free association of some people with the same interests, which may be satisfied most effectively by the cooperative system and this group of persons is a narrow space. Finding a solution for the needs of such cooperative members shall contribute to solving community problems - creating jobs , developing local infrastructure, preserving the environment. The amount of contribution of the cooperatives in solving the problems of community depends on the size and complexity of it. It must be mentioned that the cooperatives have started in England and Germany with such values as self-aid, equality, equity, democracy, and social responsibility and started the 3rd millenium with a real participation in Corporate Social Responsibility, which means maintaining the environment and sustainable development.

7. Conclusions

Solving contradictory issues concerning the path of development of the European cooperative system is viewed by some specialists through the working out of measures which emphasize an extended contribution to community policies through their inclusion on a much larger scale to community objectives. In this context, in various publications appear proposals to carry out reforms in order to shade or weaken the current restrictions on functioning and operating of the co-operatives and thus to widen their access to the capital market and to wider economic activities, including through participation in national community objectives. The followers of the development of the cooperative system, based on the classical principles, are pleading for the inclusion of cooperatives in solving community objectives and believe that shall be done only in accordance with the principles renewed and established by the International Cooperative Alliance. Beyond those discussions, we can highlight several suggestions:

- To allow third parties to participate in the formation of cooperative capital and as a result to provide some members more than one vote.
- To legislate the cooperative transformation into a capital company and issue bonds on the risk capital;
- To create cooperatives with widened economic positions that will gain access to the capital market and economic activities on a larger scale to the national community objectives as well as their contribution to these objectives;
- To reduce the minimum number of persons authorized to form a cooperative.

For the Republic of Moldova we mention :

- NON-commercial character of the consumers' cooperatives legislated is lacking financial support from the state in competitive economy conditions limits these economic entities as compared to other competitors and may lead to a crisis of the system;
- The law of Consumers' cooperatives shades the economic activity of the co-operatives, there are no functions, characteristics, and economic guidelines which may provide benefits, and cooperative members are not motivated to increase the company's share capital . One of solutions can be the given right of cooperatives to participate as a settler, or a shareholder or co-owner in different economic and social structures. This would keep the basic characteristic of the cooperative and the cooperative, at the same time, would have access to capital and development cooperation.
- The definition of a legal private property is expressed by possession, use and disposal. These 3 categories are interrelated and are mutually made use of and determine the legal content of the notion of private property. If the indivisible part of the property cannot be fairly mastered by the cooperative members (Article 89, paragraph (3) The law of C. C.), it means that this property is not private, for example, it may not be put as a mortgage to receive credits necessary for the development. Consumers' cooperative organization transfers to its companies, as a matter of possession and use the necessary property for their activity (Article 94 (1) A law C. C.). How there can be transmitted a property without having the right to dispose on it. Obviously, it is required to change the legal framework of the cooperative societies.
- The arrangements made by european specialists to transform some cooperatives into joint stock companies with issuance of the bonds representing specific risk capital, as well as minimum and the reduction of the number of persons authorized to form a cooperative is also good for the sake of our country.
- It is necessary to elaborate a legal statute (similar to the European Council Regulation N1435/2003 of 22 July 2003 on European cooperative societies) for the purpose of determining legal support, necessary for the establishment and operation of transnational cooperatives. Similar to the European regulations the state guarantees equal competitive conditions of cooperatives and capital societies.
- The Imperative need to strengthen communities by uniting cooperative members of the cooperative membership, Implementing mechanisms of incentive and motivation for economic and development entities.
- It is necessary to optimize the organizational structures of cooperatives by liquidation of economic entities that operate inefficiently and are not in conformity. At the same time, it is necessary to sustain effective cooperative structures by integrating them into specialized areas of cooperative activity and better management of the system at all levels⁵.

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The Analysis of Foreign Trade Activities of the Republic of Moldova and Their Impact on the Country's Economic Development

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Abstract: In the recent years, the Republic of Moldova has focused its trade activities, more to West than East. Lately there has been a decisive trend of external policy directed to the integration of the Republic of Moldova with EU.

In this paper foreign trade activities of the Republic of Moldova are analyzed. The authors explore the dynamics of foreign trade indicators, the commodity structure of exports and imports and the geography of trade flows, which show the tendency of the gradual shift from CIS market to EU market. Particular attention is also paid to the calculation of indicators for valuation of foreign trade activities, which allow estimating the impact of foreign trade on the country's economic development. In conclusion, the authors refer to possible negative effect of signing the DCFTA and offer a number of measures to minimize its unfavorable consequences.

The present research was realized on selected data and processed by the authors based on statistical yearbooks of the Republic of Moldova, National Bureau of Statistics, and other publications that have served as informational sources specific to researched theme.

Keywords: *foreign trade, export, import, foreign trade turnover, foreign trade balance*

1. Introduction

Topicality of the researched topic is determined by the fact that foreign trade significantly affects economic development of the country. Foreign trade relations contribute to economic growth, advancement of scientific and technical progress, formation of country's budget, balancing supply and demand in the domestic market. Presently foreign trade is one of the most developed forms of international economic relations. The goal of this research is to conduct a thorough analysis of foreign trade relations of Moldova and identify the main issues at the current stage.

Objectives of the research:

- analyze dynamics of foreign trade turnover in terms of value, calculate the trade balance, and indicators of valuation of foreign trade activity of the country;
- research commodity structure of exports and imports, and geographic directions of foreign trade flows;
- mark possible negative outcomes of signing the Agreement on Deep and Comprehensive Free Trade Area (DCFTA) and offer a number of actions in order not to allow negative consequences.

2. Dynamics of foreign trade indicators of the Republic of Moldova

The main indicators that reflect dynamics of Moldova's foreign trade development during 2001-2014, are presented in table 1, which shows that the development of foreign trade of Moldova

during the period under examination can be conventionally divided in two stages: I stage – from 2001 until 2008 and II stage – from 2009 until 2014.

Table 1: Dynamics of foreign trade indicators of the Republic of Moldova during 2001-2014 (million U.S. dollars)

Year	Foreign trade turnover	Exports	Imports	Foreign trade balance
2001	1,457.7	565.5	892.2	-326.7
2002	1,681.8	643.8	1,038.0	-394.2
2003	2,192.2	789.9	1,402.3	-612.4
2004	2,753.7	985.2	1,768.5	-783.4
2005	3,383.2	1,090.9	2,292.3	-1,201.4
2006	3,743.6	1,050.4	2,693.2	-1,642.8
2007	5,029.6	1,340.1	3,689.5	-2,349.5
2008	6,489.9	1,591.1	4,898.8	-3,307.6
2009	4,561.3	1,283.0	3,278.3	-1,995.3
2010	5,396.8	1,541.5	3,855.3	-2,313.8
2011	7,408.1	2,216.8	5,191.3	-2,974.5
2012	7,374.8	2,161.9	5,212.9	-3,051.0
2013	7,920.7	2,428.3	5,492.4	-3,064.1
2014	7,656.5	2,339.5	5,317.0	-2,977.4

Throughout the first stage we can see an increase in exports (average annual growth rate – 16.4%), and imports (average annual growth rate – 27.8%). Nonetheless, in spite of growing export deliveries, we have seen a gradual increase in trade deficit, which in 2008 made up 3,307.6 million U.S. dollars (the highest value for all years).

At the beginning of the second stage, in 2009 as a result of world financial crisis the volume of foreign trade turnover had slumped: by 29.7%. In the following years the volume of exports and imports gradually increased.

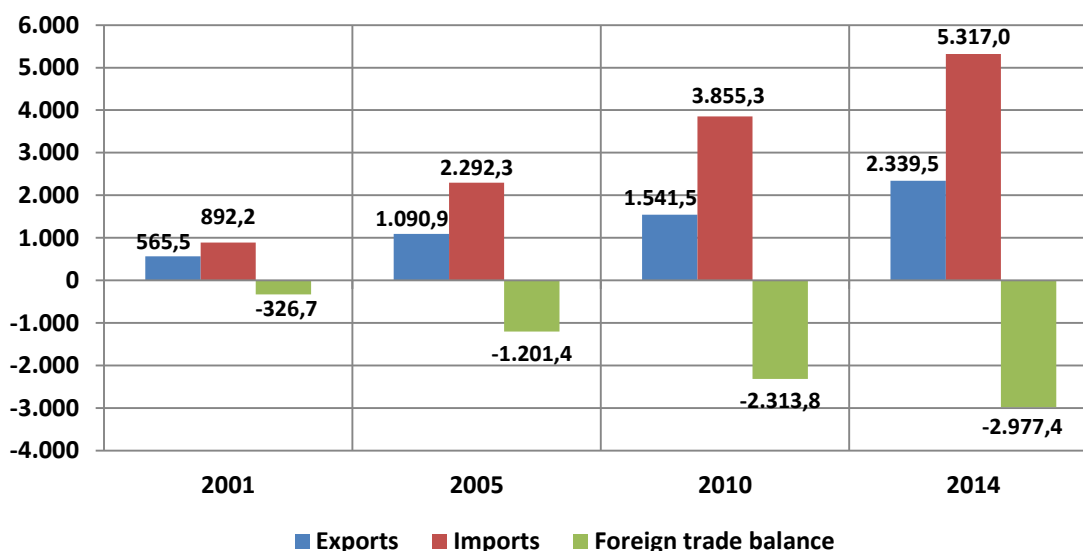


Figure 1: Dynamics of exports, imports and foreign trade balance of the Republic of Moldova (million U.S. dollars)

As can be seen from the data in figure 1, volume of imports by far exceeded the respective volume of exports. In 2014 foreign trade deficit made up 2,977.4 million U.S. dollars. It should be mentioned that often negative trade balance causes concern, because it shows that the demand for imported goods exceeds possibilities of import replacement industries. We believe that the deficit itself, naturally, is a negative factor, but not critical, except for cases when the reason behind growth is diminishing exports. Often growing imports are an indicator of strengthening of economic activity and consumption by producing companies. Growing imports are permitted for

strengthening of competition in domestic economy, are also an indicator of efforts put for participation in the world economy and consumption of more effective foreign technologies.

During the researched period the volume of Moldova's foreign trade in terms of value increased 5.3 times (exports volume – 4.1 times, imports volume – 6.0 times). Relatively fast growth of Moldova's foreign trade turnover to a great extent is determined by inflow of direct and portfolio foreign investments, as well financing (via grants and loans) of projects in key sectors of the Moldovan economy.

3. Basic indicators for valuation of foreign trade activity of the Republic of Moldova

The efficiency of development of foreign trade activity and successful integration of Moldova in the world economy directly depend on the level of development and utilization of foreign trade potential. In this connection, valuation becomes topical. It can be conducted using such indicators as provided in table 2.

Table 2: Basic indicators for valuation of foreign trade activity of a country

Indicator	Standard value	Characteristic	Calculation
Export quota (Q_E)	No standard value	It describes the importance of exports to the country's economy	$Q_E = \frac{E}{GDP} \times 100\%$
Import quota (Q_I)	No standard value	It describes the importance of imports to the country's economy	$Q_I = \frac{I}{GDP} \times 100\%$
Foreign trade quota (Q_{FT})	No standard value	It characterizes the ratio of foreign trade to gross domestic product	$Q_{FT} = \frac{E + I}{2 \times GDP} \times 100\%$
Export over import coverage ratio (R_{EI})	More than 1	It characterizes the level of self-sufficiency of the country's economy	$R_{EI} = \frac{E}{I}$
Rate of involvement of a country in the international system of labour division (RI)	No standard value	It characterizes the degree of involvement of a country in the international system of labour division	$RI = \frac{FT}{GDP}$
International competitiveness ratio (ICR)	More than 0	It characterizes the share of "pure" export in foreign trade turnover	$ICR = \frac{E - I}{FT}$
Exports per capita (E_C)	No standard value	It shows volume of exports per inhabitant of the country	$E_C = \frac{E}{P}$
Imports per capita (I_C)	No standard value	It shows volume of imports per inhabitant of the country	$I_C = \frac{I}{P}$
Foreign trade per capita (FT_C)	No standard value	It shows volume of foreign trade per inhabitant of the country	$FT_C = \frac{E + I}{P}$
Legend: <i>GDP</i> – gross domestic product, U.S. dollars; <i>E, I</i> – exports and imports of a country, respectively, U.S. dollars; <i>FT</i> – foreign trade of a country, U.S. dollars; <i>P</i> – population of a country, persons.			

Table 3 shows values of the basic indicators for valuation of Moldova's foreign trade activity during 2009-2014. The results of our calculations show that during this period indicators of foreign trade, export and import quotas in general had a dynamic growth, despite lower values in 2012-2014.

During the analyzed period shares of exports and imports in gross domestic product of Moldova were in average 28.5% and 68.0%, respectively. Such moderate values of indicators show openness of country's economy and importance of foreign trade activity.

The export over import coverage ratio representing exports in relation to imports in the region made up 0.44 in 2014. This value denotes a low level of self-sufficiency of the country, because exports do not cover imports. During the whole period under examination (from 2009 till 2014) falling negative values of international competitiveness ratio, which represents the difference between exports and imports in relation to foreign trade of the region, – from -0.44 to -0.39 – shows an increase in share of ‘net’ exports in foreign trade.

Table 3: Values of the basic indicators for valuation of foreign trade activity of the Republic of Moldova during 2009-2014

Year	Q_E	Q_I	Q_{FT}	R_{EI}	RI	ICR
2009	23,6%	60,3%	41,9%	0,39	0,84	-0,44
2010	26,5%	66,3%	46,4%	0,40	0,93	-0,43
2011	31,6%	74,0%	52,8%	0,43	1,06	-0,40
2012	29,7%	71,6%	50,6%	0,41	1,01	-0,41
2013	30,4%	68,8%	49,6%	0,44	0,99	-0,39
2014	29,4%	66,8%	48,1%	0,44	0,96	-0,39

The average annual rate of involvement of Moldova in the international system of labour division, calculated as the ratio of foreign trade of the country to GDP, is above 0.9; which means that the Republic of Moldova takes active part in international division of labour.

The dynamics of exports and imports per capita in 2009-2014 is shown in table 4.

Table 4: Dynamics of exports and imports per capita in the Republic of Moldova during 2009-2014

Indicator	Year					
	2009	2010	2011	2012	2013	2014
Average annual population, thousand persons	3565,6	3562,0	3560,0	3559,5	3558,6	3556,4
Exports per capita, U.S. dollars	359,82	432,76	622,70	607,35	682,38	657,84
Rate of increase of exports per capita, in % to the previous year	-	20,3	43,9	-2,5	12,4	-3,6
Imports per capita, U.S. dollars	919,42	1082,34	1458,22	1464,51	1543,41	1495,04
Rate of increase of imports per capita, in % to the previous year	-	17,7	34,7	0,4	5,4	-3,1
Foreign trade per capita, U.S. dollars	1279,24	1515,10	2080,92	2071,87	2225,79	2152,88
Rate of increase of foreign trade per capita, in % to the previous year	-	18,4	37,3	-0,4	7,4	-3,3

The volumes of exports and imports per one inhabitant of the country increased during 2009-2014. The indicator of exports per capita, calculated as a ratio of exports to population of the country, increased from 359.82 U.S. dollars in 2009 up to 657.84 U.S. dollars in 2014. The indicator of imports per capita also increased – from 919.42 U.S. dollars in 2009 up to 1495.04 U.S. dollars in 2014. It is determined by a 14 per cent average annual growth rate of exports and 11 per cent average annual growth rate of imports during the period under examination.

4. Dynamics of Moldovan exports and imports by commodity groups

Let's look at the dynamics of Moldovan exports by commodity groups during 2010-2014.

Table 5: Dynamics of Moldovan exports by commodity groups during 2010-2014, million U.S. dollars

COMMODITY GROUP	2010	2013	2014	2014 / 2010, %
Food products and raw materials	732.2	1,015.5	1,065.4	145.5%
Mineral products	9.4	14.8	11.8	125.5%
Fuels and energy	7.7	26.9	16.1	209.1%
Products of the chemical or allied industries; plastics and articles thereof	100.3	230.6	213.9	213.3%
Raw hides and skins, leather, furskins and articles thereof	24.7	33.4	34.7	140.5%
Wood and articles of wood; paper and	17.5	35.1	28.0	160.0%

COMMODITY GROUP	2010	2013	2014	2014 / 2010, %
paperboard and articles thereof				
Textiles and textile articles	267.7	330.5	330.1	123.3%
Footwear	30.4	35.7	33.5	110.2%
Articles of stone, plaster, cement, asbestos; glass and glassware	33.4	53.4	55.5	166.2%
Ceramic products	1.9	4.7	3.1	163.2%
Base metals and articles of base metal	58.6	124.4	56.6	96.6%
Machinery and transport equipment	192.8	362.8	337.2	174.9%
Other products	64.9	160.5	153.6	236.7%
TOTAL:	1,541.5	2,428.3	2,339.5	151.8%

The results of our calculations in table 5 show that the volume of export deliveries from Moldova increased 1.5 times in the last 5 years. The main reason for this is an increase in volume of exports of food products and raw materials – by 45.5%, machinery and transport equipment – by 74.9%, textiles and textile articles – by 23.3%, products of the chemical or allied industries and plastics – 2.1 times in 2014 as compared to 2010.

It should be noted that the agriculture holds a large share in sectoral structure of Moldovan economy. Agrarian nature of Moldovan economy also appears as a significant part of industry is involved in processing of agricultural raw materials. This is naturally reflected in export commodity structure (figure 2), where food products and raw materials hold the largest share (45.5%).

A fairly large share in the structure of export deliveries from Moldova is held by machinery and transport equipment (14.4%), textiles and textile articles (14.1%), as well as products of the chemical or allied industries and plastics (9.1%).

As compared with 2010 in Moldova's export commodity structure any serious changes did not occur: increase in share of products of the chemical or allied industries and plastics – by 2.6 p.p., machinery and transport equipment – by 1.9 p.p., decrease in share of textiles and textile articles – by 3.3 p.p., food products and raw materials – by 2.0 p.p., base metals and articles of base metal – by 1.4 p.p.

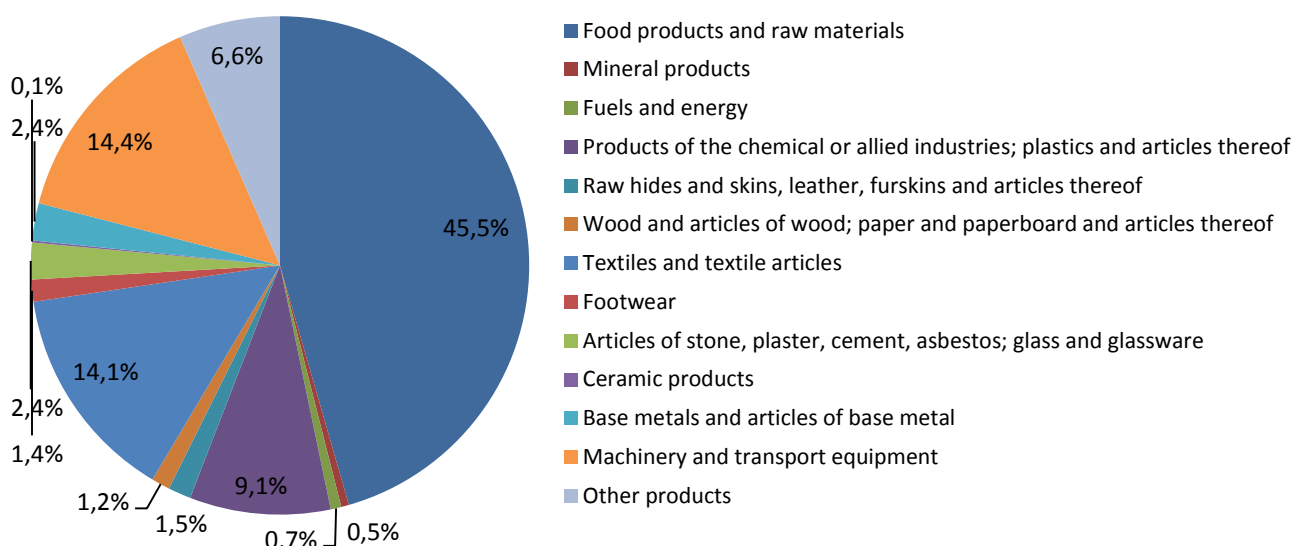


Figure 2: Commodity structure of Moldovan exports in 2014

Now let's look at dynamics of imports coming to Moldova during 2010-2014. The results of our calculations presented in table 6 show that import volume to Moldova increased by 37.9% in the last 5 years. The main reason for such an increase was growth of imports of fuels and energy – by 43.6%, products of the chemical or allied industries and plastics – by 1.5 times, machinery and transport equipment – by 38.9%, food and raw materials – by 21.6%, base metals and

articles of base metal – 42.8% in 2014 as compared with 2010. It should be mentioned that import volume was growing on all main commodity groups.

Table 6: Dynamics of Moldovan imports by commodity groups during 2010-2014, million U.S. dollars

COMMODITY GROUP	2010	2013	2014	2014 / 2010, %
Food products and raw materials	591.5	783.8	719.3	121.6%
Mineral products	16.0	21.1	17.7	110.6%
Fuels and energy	791.1	1,235.6	1,136.1	143.6%
Products of the chemical or allied industries; plastics and articles thereof	632.0	947.6	952.9	150.8%
Raw hides and skins, leather, furskins and articles thereof	27.4	34.2	42.9	156.6%
Wood and articles of wood; paper and paperboard and articles thereof	175.7	222.4	223.5	127.2%
Textiles and textile articles	282.3	386.9	357.0	126.5%
Footwear	20.5	31.2	27.3	133.2%
Articles of stone, plaster, cement, asbestos; glass and glassware	62.1	92.2	84.7	136.4%
Ceramic products	36.6	48.4	49.6	135.5%
Base metals and articles of base metal	248.5	331.3	354.9	142.8%
Machinery and transport equipment	814.4	1,140.1	1,130.9	138.9%
Other products	157.2	217.6	220.2	140.1%
TOTAL:	3,855.3	5,492.4	5,317.0	137.9%

In Moldova's import commodity structure in 2014 (figure 3) the biggest share is held by energy resources (fuel, electric power, coal). It constitutes 21.4% of total import volume. Significant shares are also held by machinery and transport equipment (21.3%), products of the chemical or allied industries and plastics (17.9%). So, an important share of imports includes goods or raw materials that are not produced in Moldova.

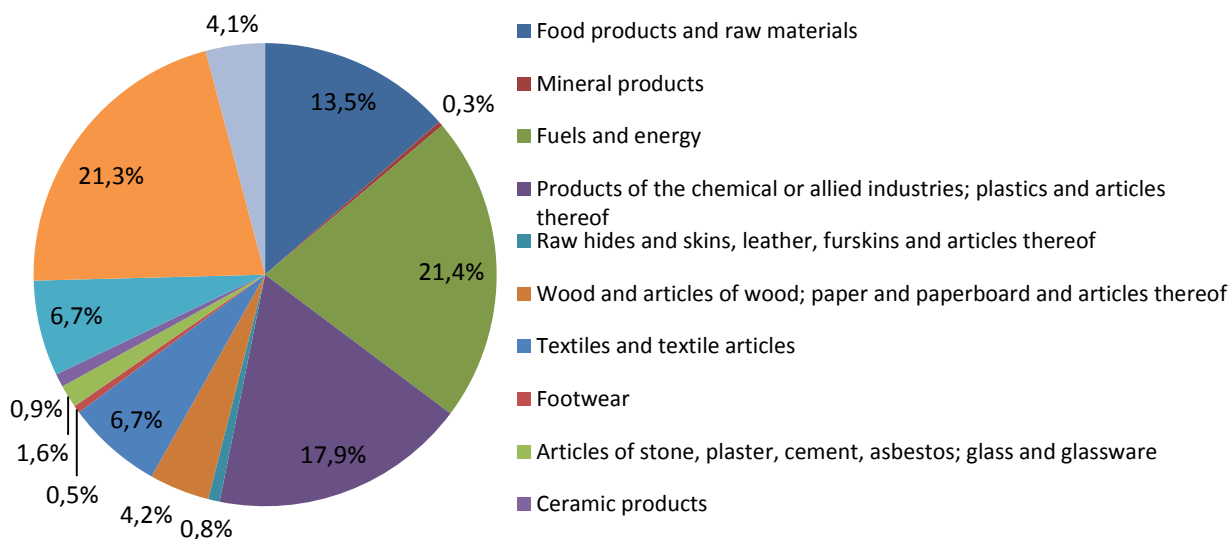


Figure 3: Commodity structure of Moldovan imports in 2014

As compared with 2010, in Moldova's import commodity structure no serious changes occurred: an increase or decrease in share of separate commodity groups did not exceed 1-2 p.p.

In 2014 the share of food products and raw materials in Moldovan imports made up 13.5%. If we compare imports (719.3 million U.S. dollars) and exports (1,065.4 million U.S. dollars) of this commodity group, then we can see positive trade balance. A number of Moldovan companies, however, are concerned about risks arising from Agreement on Deep and Comprehensive Free Trade Area (DCFTA) signed between the EU and Moldova. The thing is that presently Moldovan producers of agricultural products are in unequal conditions with their EU

competitors, considering the amount of subsidies and other aspects of activity. For this reason there were considered actions for protection of the domestic market and sector stimulation. If necessary two levels of protection measures can be used. If annual growth rate of imports of a certain product exceeds 15%, Moldova can on the basis of bilateral agreements promptly introduce protective duties. In case of continuing growth of deliveries from the EU, additional protective measures can be taken. But for this purpose it will be necessary to conduct a special research in accordance with European rules and prove the necessity of taking additional protective measures.

5. Geographical directions of foreign trade of the Republic of Moldova

Geographical directions of foreign trade of the Republic of Moldova present a particular interest. The diversification of markets, strengthening competitive position in traditional markets and establishment of trade and economic relations with new partners are the priority issues.

The directions of export flows from Moldova during 2001-2014 are shown in figure 4. One tendency is clearly visible: diminishing share of exports to CIS countries and growing share of exports to European Union countries. This fact shows that Moldovan exports shift gradually from CIS market to EU market. So, the share of Moldovan exports to CIS countries has decreased almost 2 times, while the share of exports to EU countries has increased more than 1.6 times in 2014 as compared with 2001.

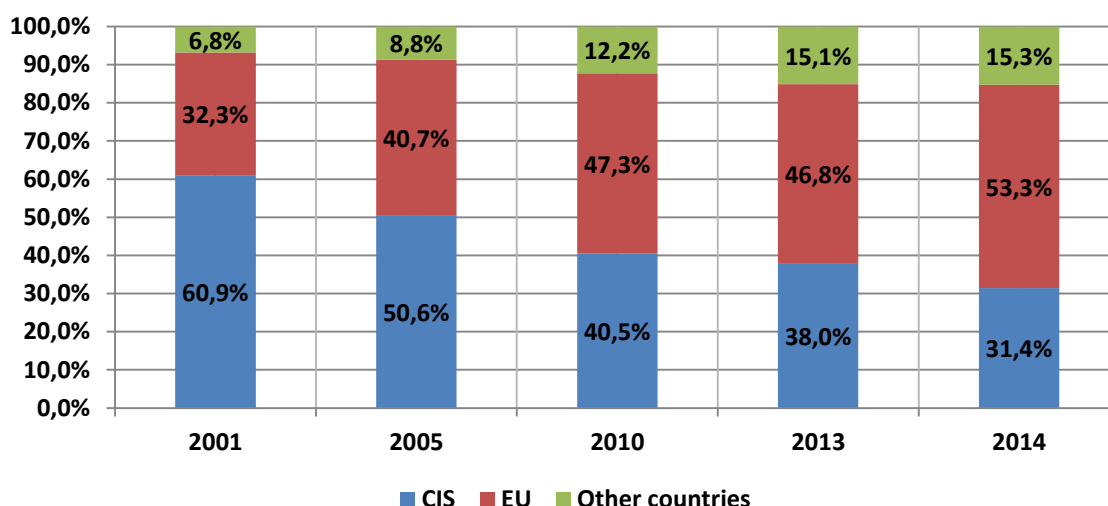


Figure 4: Dynamics of geographic structure of Moldovan exports during 2001-2014

Table 7 shows top 10 countries by imports of Moldovan products. The main buyers of Moldovan products are Romania, Russian Federation and Italy, which in 2014 imported 18.6%, 18.1% and 10.4% of the total Moldovan exports, accordingly.

Table 7: Top 10 countries by imports of Moldovan products in 2014

№	Importing country	Moldovan exports, million U.S. dollars	Share in total exports, %
1.	Romania	434.0	18.6
2.	Russian Federation	423.7	18.1
3.	Italy	243.4	10.4
4.	Germany	137.5	5.9
5.	Belarus	134.7	5.8
6.	Ukraine	109.2	4.7
7.	United Kingdom	108.2	4.6
8.	Turkey	104.7	4.5
9.	Poland	64.4	2.8
10.	Switzerland	49.2	2.1
TOP 10		1,809.1	77.3
TOTAL		2,339.5	100.0

Dynamics of geographic structure of Moldovan imports during 2001-2014 is shown in figure 5, from which one can observe a tendency to reduce import deliveries from CIS countries and increase share of imports from third countries, in particular, from China and Turkey. At the same time, the main group of countries from which Moldova imports products needed for the economy and people are EU countries. The share of imports from EU countries during the entire researched period is relatively stable – at 44-49%.

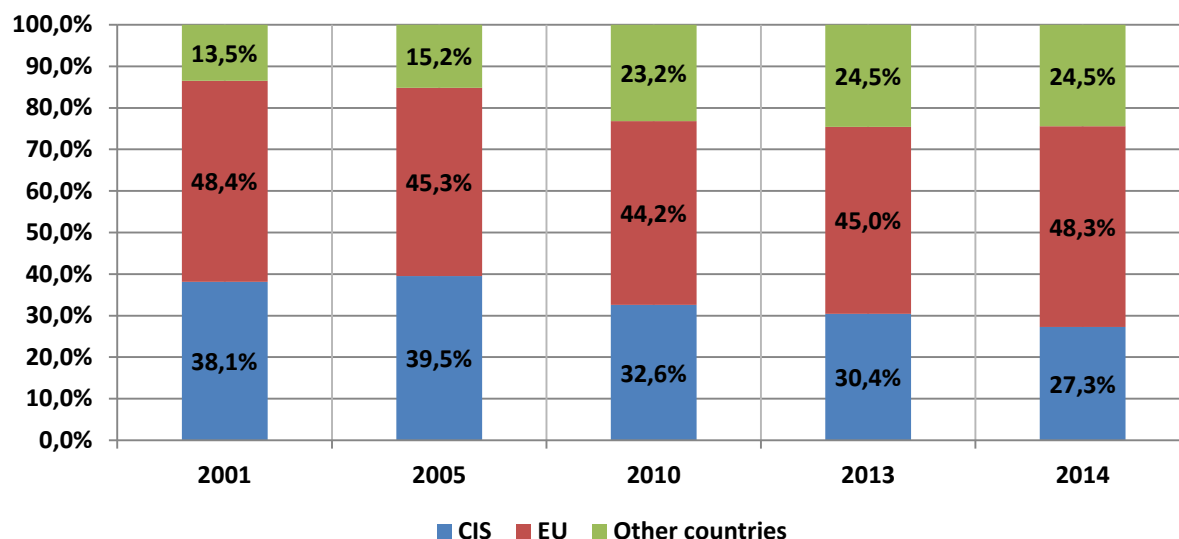


Figure 5: Dynamics of geographic structure of Moldovan imports during 2001-2014

Table 8 shows top 10 source countries of imports to Moldova.

Table 8: Top 10 source countries of imports to Moldova

№	Exporting country	Moldovan imports, million U.S. dollars	Share in total imports, %
1.	Romania	803.1	15.1
2.	Russian Federation	717.2	13.5
3.	Ukraine	546.4	10.3
4.	China	481.2	9.0
5.	Germany	427.0	8.0
6.	Italy	351.3	6.6
7.	Turkey	300.9	5.7
8.	Poland	155.8	2.9
9.	Belarus	142.0	2.7
10.	Austria	110.5	2.1
	TOP 10	4,035.2	75.9
	TOTAL	5,317.0	100.0

So, EU and CIS markets are strategically important for Moldova.

After signing Agreement on Deep and Comprehensive Free Trade Area (DCFTA) between Moldova and EU certain actual premises appeared for intensification of trade with European Union, which means expansion of markets. We believe, however, that in short-term any significant increase in export of Moldovan goods to European market will not occur. It is due to the fact that Moldovan exporters have high non-tariff barriers related to European quality standards, sanitary and phytosanitary norms, certification system and high entry costs to the European market (marketing, advertising, logistics, etc.). It will certainly hamper attempt to increase volume of Moldovan exports to the European market, while European exporters do not or will not have such obstacles in the Moldovan market, or will have much less obstacles.

Besides the aforementioned risks, the following risks should be mentioned:

1. Free trade conditions (no restrictions) cover 70% of imports from EU to Moldova and only 45% of imports from Moldova to EU.
2. Imports of European agricultural food products to Moldova free of customs duties can increase competition in the domestic market. In addition, there is a significant gap in technical and technological development between Moldovan and European production companies. State subsidies for agriculture in the EU countries may reach 40-45% of agricultural products cost, while in Moldova they may constitute only 2%.
3. Application of protective and restrictive measures by Eurasian Customs Union countries in regard to Moldovan products can lead and already causes gradual loss by Moldova of its positions in Eastern markets, which for a number of sectors of Moldovan economy are a priority, in particular, for agriculture, wine making industry and other economy sectors.

6. Conclusion

During the 2001-2014 period the volume of Moldova's foreign trade in terms of value increased 5.3 times. Relatively fast growth of Moldova's foreign trade turnover to a great extent is determined by inflow of direct and portfolio foreign investments, as well financing of projects in key sectors of the Moldovan economy.

The agriculture holds a large share in sectoral structure of Moldovan economy. Agrarian nature of Moldovan economy also appears as a significant part of industry is involved in processing of agricultural raw materials. This is naturally reflected in export commodity structure, where food products and raw materials hold the largest share.

Valuation of foreign trade activity of the Republic of Moldova through a number of basic indicators has allowed revealing the following tendencies: openness of Moldova's economy and importance of foreign trade activity, taking active part in international division of labour, growth of both exports and imports per capita, increase in share of 'net' exports and low level of self-sufficiency of the country.

The directions of Moldovan export and import flows show the tendency of the gradual shift from CIS market to EU market. We could expect that creation of free trade zone would facilitate higher volumes of foreign trade between the Republic of Moldova and EU countries. However, in our opinion EU countries will get the biggest benefits, not Moldova, who may face certain risks. Besides, losing Eurasian Customs Union countries markets cannot be compensated in full by higher exports to EU or other countries.

In order to avoid certain negative consequences of events, we believe that Moldovan companies must promptly take the following measures:

- Improve quality management system in companies in order to increase competitiveness of products in foreign markets, implement and provide a viable system for standardization, metrology and assessment of compliance;
- Carry out technological modernization of production in order to ensure high competitiveness of products based on "price-quality" ratio;
- Conduct a continuous markets diversification. Economic vector chosen by Moldova has focused recent discussions in general on partners from EU and CIS. However it is equally important to preserve and strengthen trade relations with other countries.

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Marketing and sustainable development: theoretical consideration and implications on the case study of JGL d.d. (Jadran Galenski Laboratorij)

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Abstract. Environmental and social problems still remain one of the main interests of theoreticians and practitioners. Air pollution, the greenhouse effect, ecological and social imbalance warn of the need for changes. Regarding this, significant effort is taken in order for progress to be achieved. Efforts in making business more sustainable will confront companies with both opportunities and threats. Companies need to be synchronized and develop a sustainability agenda to catch sight of and react to all challenges in implementing sustainable practices. Marketing as a discipline includes a broad theoretical and practical knowledge and has always been in line with socio-economic development, so this area is not an exception. Sustainability is becoming a growing issue in the current marketing theory and practice, so it is important for marketers to break their traditional frame of reference and reconsider their existing marketing policies. This paper provides a theoretical view of sustainable development from the marketing perspective and outlines concrete implications for creating sustainable marketing practices. Furthermore, as a positive example of managing sustainable marketing practices, the case of a Croatian company - Jadran Galenski Laboratorij - is elaborated, and potential directions for further research are discussed.

Key words: Sustainable development, Sustainability marketing, Sustainable marketing, Societal marketing, Environmental marketing,

1. Introduction

Mainly, marketing has been perceived as one of the principal drivers of consumption, and opposing to the concept of sustainability that originally encourages satisfying people basic needs and better quality of life without compromising the quality of life of future generations (Her Majesty's Government, 2005). Although, there is still much misunderstanding of marketing, the marketing thought has been developing continuously and the interest in the relationship between marketing and sustainability is growing. A growing number of companies are recognizing sustainability as an integral part of their business strategies. This can be explained as a consequence of growing volume of environmental and social legislation and regulation, concerns about the costs of scarcity of natural resources; greater public and shareholder awareness of the importance of socially responsible financial investments; the growing media coverage of the activities of a wide range of anti-corporate pressure groups; and more general changes in social attitudes and values within modern capitalist societies (Jones, P., Clarke-Hill, C., Comfort, D., & Hillier, D., 2008).

The objectives of this paper are, first, to review and understand concepts of sustainable development and interaction between marketing and sustainable development. Furthermore, discuss evolution of sustainability in marketing strategy and the future of sustainability in marketing strategy. The last part of the article gives a positive example of managing sustainable marketing practice, through the case of the Croatian company Jadran Galenski Laboratorij.

2. Sustainable development and sustainability

In the last 20 years attention on ethical, societal and environmental issues has risen dramatically. The term of sustainability has so far been covered by multiplicity definitions. Its core meaning is usually linked with the encouraging awareness about the negative effect of humans on their environment, but integrated concept in development of sustainability claims that is defined as 'A new era of economic growth that is forceful and at the same time socially and environmentally sustainable; an economy is sustainable if it meets the needs of the present without compromising the ability of the future generations to meet their own needs' (Brundtland Report, 1987). Sustainable development is development that is likely to achieve lasting satisfaction of human needs and improvement of the quality of human life." (Allen, 1980) One of the important objectives is reducing the absolute poverty of the world's poor through providing lasting and secure livelihoods that minimize resource depletion, environmental degradation, cultural disruption, and social instability"(Barbier, 1987)

Sustainability has oftentimes been associated with a triple bottom line framework developed by Elkington, which emphasizes the importance of balancing three parts: economic prosperity (i.e. profit), social equity (i.e. people), and environmental quality (i.e. planet) (Elkington, 1997). Nevertheless of the diversity of definitions of sustainability, three dimensions of sustainability can be isolated: economic, social and environmental dimension (Adams, 2006). Economic sustainability represents achievement of growth, efficiency and „fair“ distribution of wealth. An economically sustainable business uses resources in a way which allows the business to operate in the long term while generating profit (Reutlinger, 2012). Social sustainability is engaged with employees, communities and equality. Employees are supposed to be treated well and equally regardless of their race, gender or other characteristics. The working conditions should be in accordance with health and safety standards. It also implies participation in decision making process, mobility and cohesion, realization of social identity, institutional development and other. The companies should take care for local community in a way of minimizing negative impacts like air or sound pollution, but also can give positive contributions in a form of community based programs or donations. Environmental dimension honors the integrity of various ecosystems, their carrying capacity and protection of natural resources, including biological diversity. It incorporates responsibilities in reducing negative impacts on the environment in the whole product life-cycle, even after the purchase considering whether the product can be recycled or it ends up in a landfill (Reutlinger, 2012). All this therefore, indicates how the needs of the market economy and nature's economy are intertwined and economic sustainability must ground on ecological and social sustainability. Sustainable development therefore strives to balance and optimization between itself and with respect to the others areas.

3. Sustainability marketing

According to American marketing association, Marketing is the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large (American Marketing Association [AMA], 2015). Marketing can be defined both as a business philosophy and a collection of

management techniques, orientated towards providing value to consumers, organizations and society.

This definition represents a step forward in relation to traditional marketing. Traditional (transactional) marketing is the creation of and maintenance of consumers and profit. Key actors are profit oriented organizations and customers. Key value is commercial (from the perspective of an organization – selling products at defined prices and gaining profit, and for customers – purchasing products – value, at favorable – acceptable price). It is obvious that this concept is unable to cope with ecological, social and commercial challenges (Peattie & Belz, 2010 referenced in Rakic & Rakic, 2015).

Marketing aspects of sustainability involves the integration of sustainability elements in company's marketing strategies (Baker & Sinkula 2005; Fraj-Andrés, Martinez-Salinas & Matute-Vallejo, 2009), socially responsible purchasing and distribution policies (e.g., Drumwright, 1994; Salam, 2009), pricing tactics (e.g., Menon, Bharadwaj, Adidam, & Edison (1999), the design and development of new products (e.g., Pujari, 2006) and green advertising, promotional, and communication practices (e.g., Banerjee, Gulas, & Iyer, 1995); Maignan & Ferrell, 2004).

Due to the development of the different branches of marketing, there can be identified a few marketing concepts that are concerned with social and environmental issues and represent a step towards sustainable marketing. Societal marketing is one of them which strive to combine the wants and needs of consumers, long term interests of society and companies' profitability (Kotler, 2009). It encourages marketers to build social and ethical considerations into their marketing practices which is a very demanding task seeing that they must balance the often conflicting criteria of company profits, consumer want satisfaction and public interest.

Ecological marketing emerged 1970s (Henion & Kinnear, 1976.) and was oriented towards resolution of environmental problems and reduction of harmful products which have negative impact on the ecosystem. The purpose was to bring round the companies' impact on the environment, but the focus only on energy and resource industries resulted only in reacting on external pressures with no innovations (Emery, 2012). Ecological issues mainly concentrated on producer's will to become environmental friendly and these were not considering consumer demand at all (Dam & Apeldoorn, 1996).

Environmental and green marketing emerged due to increasing concerns of consumers for the environment with aim to make packaging and products more environmentally friendly. (Belz & Peattie, 2009). Green marketing therefore, strives to put all efforts to consume, produce, distribute, promote, package and reclaim products that are environmentally safe and responsive to ecological concerns (Dahlstrom, 2011). Profit of organizations and the survival of environment are the goals of environmental marketing, while the key actors are environment oriented organizations and consumers. Organizations strive to establish and maintain long-term relationships with consumers and environmental organizations.

Apart from environmental effects, consumers also put their concerns about the social impacts of products they buy, but only a minor part of them are ready to pay more for green products. However, consumers expect from the Companies more than just accomplishing legal regulations, yet to be socially responsible and operate environmentally friendly (Reutlinger, 2012). These challenges cannot be solved through conventional marketing practices. The solution could be in sustainable marketing as the last phase of the evolutionary process from conventional to ecological, environmental and green marketing. Sustainable marketing is intended not only towards the satisfaction of consumers and company profits, but also per the goals of the community as a whole.

According to Reutlinger (2012), sustainable marketing is a holistic approach within the aim of satisfying the wants and needs of the customers while putting equal emphasis on environmental and social issues, thus generating profit in a responsible way. It offers an extensive, approach in making products and services more sustainable in order to meet present and likewise new challenges at the same time. Fuller (1999) also gives the comprehensive definition of sustainable marketing defining it as a process of planning, implementing and controlling the development, pricing, promotion and distribution of products in a manner that satisfies the following criteria: 1) customer needs are met; 2) organizational goals are attained and 3) the process is compatible with ecosystems. (Marcel & Dragan, 2014) associates sustainable marketing as a certain form of relationship marketing, that stimulates the capacity of economic entities to provide the best value for consumers, but it also represents a practice of creating long-term satisfying relationships with key partners, customers, suppliers and distributors. It is also oriented towards efficient use of resources, thus /users and other stakeholders, while taking into account long-term interests of society and environment.

Although, the terms sustainable marketing and sustainability marketing are used as synonyms by different researches, Beltz & Peattie (2009) emphasize the differences between these two terms. According to these authors, sustainable marketing refers to something durable or lasting for a long period of time so, sustainable marketing can be understood as a kind of marketing, building long-lasting customer relationships in an effective manner, with no particular reference to sustainable development or issues that are banded to sustainability. On the other side, sustainability marketing more expressly relates to the sustainable development agenda while still building and maintaining sustainable relations not only with customers, but also with social environment and the natural environment (Kumar, Rahman & Kazmi, 2013). Belz and Peattie (2009) emphasize building and maintaining sustainable relationships with customers, the social environment and the natural environment. By creating social and environmental value, sustainability marketing tries to deliver and increase customer value. Also, as in the modern marketing concept, sustainability marketing analyses customer needs and wants, develops sustainable solutions that provide superior customer value, and prices, distributes and promotes them effectively to selected target groups. Hereinafter, the authors will use the term sustainability marketing.

Belz and Schmidt-Riediger (2010) identify five dimensions of strategic sustainability marketing: (1) ecological product quality, (2) social product quality, (3) market segmentation, (4) targeting, and (5) positioning. In accordance to this, sustainability marketing management is the process of development and maintenance of long term relationships (with consumers and other sustainability oriented stakeholders), creating, delivering and communicating sustainable value. It can be seen that sustainability marketing differs from conventional marketing in its holistic approach to decision making, monitoring and evaluating organizational actions and consequences. Further, sustainability marketing is committed to rendering organizational processes transparent to stakeholders; enlisting stakeholders in value creation and, in its concern with product life cycles and value chains wholesome, in their effects on natural and social environments. Finally, the term sustainability marketing applies when an organization operates in accordance with perspective of a finite resource system, and thus has a responsibility to its current and future stakeholders to make strategic decisions for the long term benefit of the entire system (Arnould & Press, 2011).

Marketing has experienced changes and sustainability became one of the key issues which have emerged in marketing strategy over the time. Ascending interest about the sustainability is rapidly transforming the competitive landscape and forcing companies to involve more attention to make their marketing strategies more sustainable.

Table 1 Characteristics of traditional, environmental, societal and sustainability marketing

	Traditional marketing	Environmental marketing	Societal marketing	Sustainability marketing
Goal	<ul style="list-style-type: none"> Survival of organization - profit 	<ul style="list-style-type: none"> Survival of organization - profit Survival of environment 	<ul style="list-style-type: none"> Survival of organization - profit Survival of society 	<ul style="list-style-type: none"> Sustainable development Survival of organization – profit (economic sustainability) Survival of environment (environment sustainability) Survival of society (society sustainability)
Key actors	<ul style="list-style-type: none"> Profit oriented organizations Consumers 	<ul style="list-style-type: none"> Environmental oriented Organizations Environmental oriented Consumers Environmental organizations (local, national, international, global) 	<ul style="list-style-type: none"> Societal oriented organizations Societal oriented consumers Societal oriented population 	<ul style="list-style-type: none"> Sustainability oriented organizations Sustainability oriented consumers
Relationships with consumers and other stakeholders	Transactions between organizations and consumers	Long-term relationships with environment oriented consumers and other stakeholders	Long-term relationships with societal oriented consumers and other stakeholders	Long-term relationships with sustainability oriented consumers and other stakeholders
Lifestyle	Consumption oriented lifestyle	Environmental oriented lifestyle	Societal oriented lifestyle	Sustainable lifestyle
Value	Commercial	Environmental	Societal	Sustainability

Source: Rakic, B., & Rakic, M. (2015). Holistic management of marketing sustainability in the process of sustainable development. *Environmental Engineering and Management Journal*, 14(4), 887-900.

The role of marketing in responding to sustainability will vary among companies depending on their industry, size, corporate culture and whether the style of marketing they practice is classically customer-led, technology (product) led or communication led (Charter, Peattie, Ottman & Polonsky, 2002). The company has to adopt sustainability in strategic marketing practices and marketing mix, and therefore, marketing strategies should be designed and implemented according to established sustainable values and objectives (Kumar, Rahman, Kazmi & Goyal, 2012).

The market is central to the way the world works, but sustainability needs to be understood as a fundamental cultural idea, hence it is necessary to plant a culture of sustainability. The planetary future depends on what kind of culture of consumerism is built, and according to that it is essential to redesign and engineer the global economy in a way that people can get more yet consume less (Adams, 2006). A major challenge for companies is to integrate and balance all aspects of sustainability in a way which enables financial stability and competitive while including ecological requirements and social demands (Belz & Karstens, 2005). Surely, sustainability marketing practice should not be measured as one more marketing approach, but need to give an intensive contribution to environmental, economic and social dimension.

Aforementioned is not easy because is necessary to formulate strategy in such a way, so that profits can still be earned even after reduced impact on environment and society (Charter, 2006). According to Varadarajan (2010), marketing strategy refers to an organization's integrated pattern of decisions that specify its crucial choices concerning products, markets, marketing activities and marketing resources in the creation, communication and/or delivery of products that offer value to customers in exchanges with the organization and thereby enables the organization to achieve specific objectives. The goal of a marketing strategy is to obtain a position that is desirable, different and defensible. Marketing is the process of satisfying consumers' wants and needs, so it is important that position is desirable, because firms compete in the marketplace to offer the most desirable products which will deliver the most satisfaction according to consumer desires. The position must be different in order to achieve competitive advantage, and defensible as well in order to maintain that advantage (Obermiller, Burke, & Atwood (2008).

Considering how to introduce sustainability into practice, it is very important not to fall into a trap of marketing myopia. Sustainability marketing myopia is a term that pertains to a distortion stemming from the overlooking of socio-environmental attributes of a sustainable product or service but prejudicial to customer benefits and values (Cuculeski, N., Mircevska, T. P., & Petrovska, I., 2016). The idea of sustainability marketing myopia is rooted into conventional marketing myopia theory, that is introduced by Theodore Levitt where he characterized the common pitfall of companies' tunnel vision, which focused on "managing products" (that is, product features, functions and efficient production) instead of "meeting customers' needs" (that is, adapting to consumer expectations and anticipation of future desires). Levitt warned that a corporate preoccupation on products rather than consumer needs leads to failure (Levitt, 1960). Sustainability marketing myopia can be avoided by identifying and highlighting the inherent consumer's values of the socio-ecological features of the product and the personal customer benefits that emanates from it or by aligning socio-ecological attributes with core benefits (functionality, performance, design, durability, taste, freshness, uniqueness, aesthetics, fashion) of the product to create "motive alliances" (Belz & Peattie, 2009). Therefore, it is exactly said that companies cannot stay for longer in the market if they will not become truly sustainable (Whiting, 2008).

The future objectives of sustainability marketing should be focused on segmentation, targeting and positioning customer on the basis of sustainability criteria beside with designing sustainability marketing mix for improved products and services, better prices, distribution and promotion. Sustainability in marketing strategy not only helps in competitive advantage, but also encourages ideas for cost savings and innovations (Whiting, 2008)

Taking into account all the previously mentioned, it can be concluded that sustainable marketing obtains a several benefits for companies like (Reutlinger, 2012):

- Cost savings which are achieved through energy, material and waste efficiencies and are often one of the main motivators for companies. Sustainable marketing provides many actions that lead to long-term savings and it is recommended to follow a step by step

approach starting with easily implement and low-cost actions before introducing more comprehensive and cost intensive solutions.

- Reputation: Being sustainable can provide a good reputation to a company and trust of their consumers.
- New markets: When company is renowned for being sustainable, new markets and customers can be open up. It can also be a point of differentiation from that can also arise some new products that will attract new customers who otherwise might not buy the company's products.
- Reduced risk: Switching to alternative energy sources, or becoming more resource efficient decreases the need of using possible scarce resources whose price will rise in a future and supply might become uncertain.
- Attracting and retaining employees: Working for sustainable company can enhance current employees' innovativeness, motivation and productivity.
- Leadership: Leadership can be gained or maintained through sustainable marketing, and the company can enhance their image and achieve a competitive advantage.

4. Case study of Jadran Galenski Laboratorij d.d.

JGL is a flexible, medium-sized, pharmaceutical company, producing primarily generics, developed from a central laboratory for manufacturing and controlling magistral and galenic preparations for the "JADRAN" Rijeka pharmacy. It was founded in 1991 as the first entirely private pharmaceutical joint stock company in Croatia. The company headquarter is in Rijeka. The transformation from a local laboratory into a powerful and fast-growing pharmaceutical company occurred exclusively through organic growth - development of new products and conquering new markets. The beginning of JGL market operation was characterized by an entrepreneurial spirit of its founders, who used the niche strategy with several pharmacologically essential drugs, produced on a small scale, recognizing the market potential for these products.

Systematic investments into employee knowledge and new product development, in addition to a close relationship with our customers and investments into modern technology for manufacturing and controlling drugs have resulted in JGL becoming the second pharmaceutical company in Croatia, developed from the initial small enterprise over a relatively short period of time. Today the JGL portfolio encompasses more than 540 products and in addition to its domestic market, it operates on the various markets in SEE, CIS (The Commonwealth of Independent States) and the rest of the world. JGL is an international pharmaceutical company aimed to developing and manufacturing drugs in target therapeutic areas, with a focus on the senses. The company is striving to be the global leader in using the benefits of sea water for health purposes.

The mission of the company is to improve the quality of life by taking care of their clients' health. It is being achieved by virtue of a clearly defined set of values, team work at all levels of the organization, closeness in communication, excellence in a clear and highly positioned set of goals and standards of quality and performance. During the time when the economic crisis undermines social relations and destroys trust between groups, awareness of the importance and responsibility that organizations have on modern society is more important than ever before. At the same time, being socially and environmentally responsible means not only fulfill legal obligations, but goes further and invest more in human capital, environment and relations with stakeholders. The company is constantly evolving in the cultural, organizational, competence, technological and process area in order to create the necessary conditions to solve a broader range of customer needs through personalized, proactive service as a value-added delivery to the purchaser. JGL strives to be a reliable partner to the customer and his first solution to business challenges.

JGL continuously implements the principles of social and environmental responsibility in its business and, in interaction with other stakeholders, it aims to set an example and contribute to the harmonization of its own long-term growth with the sustainable development. Two DOP Index¹ Awards, received in the category of large companies, are just an example of numerous recognitions given to the company that raises its standards of development and environmental protection year after year.

While enhancing the quality of life through health care globally, JGL continually strives to be a reliable and responsible member of the community in which he lives and works. Furthermore, JGL put intense emphasis on the development of environmental awareness and responsibility towards the local community. Protecting the environment and conserving natural resources are high priority to JGL. By taking care of responsible management and commitment of employees, JGL strives to conduct its operations in an environmentally responsible manner. Health and environmental protection goals are outlined starting from the initial stage of developing the product and further below. Accordingly, the company continues to adopt new environmental standards, to act proactively in the direction of environmental protection, healthy personal development and affirmative social action.

In the following text it will be displayed a specific company activities that aim of contributing to the economic, social and environmental dimensions of sustainability.

There are number of initiatives that stand out in the contribution of the environmental dimension of sustainability. By optimizing its processes JGL strives to achieve measurable results in the areas of environment protection and fuel usage through: reduction of harmful effects - control and separating waste water, increasing the amount of disposed waste, reducing the amount of municipal waste, reduction of water consumption, reduction of electricity consumption, reductions in fuel consumption and emissions in their own transport. In order to ensure the fulfillment of these objectives, JGL keep records on these indicators and prepares relevant reports, which are available to all interested parties. One of the most significant to post is the traverse from conventional to renewably produced sources of electricity. By this action, JGL sends a very strong message to the public about sustainability and provides a concrete contribution to the development of alternative energy technologies. This is a praiseworthy initiative that shows the strategic thinking of enterprise and understanding of future development trends.

Many environmental solutions, departing from the conventional ones and surpassing the legally stipulated solutions, were planned and implemented in the project of the Pharma Valley complex through the company's choice of advanced technological and environmental solutions, as well as reaching the level of maximum possible energy savings in future exploitation. These include the installation of a ventilation system in clean rooms with the free cooling system, which controls the use of fresh outdoor air depending on the temperature, and a power plant with a highly efficient cooling tower. Heating was solved through a burner system powered by extra light heating oil or gas in the second stage. Most of the lighting throughout the building and its surroundings was realized in the LED regulation technology that enables significant annual energy savings and consequently lower CO₂ emission.

As for the waste management, depending on the type and properties of waste, the following methods were applied: recycling, thermal treatment, disposal, authorized collectors financed

¹ DOP Index is a methodology that provides a comprehensive insight into the socially responsible practices of Croatian companies. They consider activities in six areas, namely: enterprise focus on economic sustainability, inclusion of corporate social responsibility and sustainable development in business strategy, responsible policies and practices in the work environment, responsible policies and practices of environmental management, corporate social responsibility in market relations and corporate social responsibility in community relations.

by the Fund, the pre-treatment and treatment. Waste management is applying very strict principles with the aim of minimal environmental impact. It is also significant that the part of the waste is sold as raw material thereby also protecting the environment, and also earns additional income.

Also, it is worth mentioning that an additional pool of 100 m³ was added to the water reservoir. Its purpose is to collect clean technological waste water, which is then used for watering plants. Other technological waste water passes through a biological purifier before being discharged into the sewer system. A special attention is given to the sea, its inhabitants and the coastal area, and a series of actions are organized for the purpose of its preservation. Some of the activities are: Traditional cleaning of beaches, Mediterranean monk seal tracking, raising public awareness about the connection between quality of life and preserving the environment and the importance of healthcare.

It is important to emphasize the implementation of the national project "Education of children of preschool and school-aged children in Croatia about the need to preserve and protect the Adriatic Sea" with the expert assistance of associations PAKS. The project aims to educate children, young people and parents and to encourage care for the preservation of the Adriatic Sea. The same is based on workshops that are held in kindergartens and primary schools and dividing manuals and educational DVDs. Additional promotional activities that are implemented with the aim of stimulating interest in the project among school is and the maintenance of national competition called "The sea is alive", and the contestants had a chance to win prize trips. The company also participates in the organization of conferences on the topic of environmental protection, human health and moral values. Particular emphasis is to promote the Adriatic Sea as a source of health, and its beneficial effects on human health and disease prevention. Also, the new physical insights of the water molecule and the importance of water in the human body are being emphasized.

JGL continuously seeks to have a more open attitude to employees, provide a stimulating work environment, cultivate healthy interpersonal relationships and maintain good communication with internal and external stakeholders, all with the aim of creating a climate that supports the creativity, free expression of opinions, discussion of the problems. Further, the company is continuously encouraging all stakeholders on permanent learning and development, as well as taking responsibility and initiative towards achieving added value to company themselves and their partners.

One of the key parts of the story about the social dimension of responsibility is certainly cooperation, active involvement and supporting the community in which the company live and works. The above is reflected through many examples. One of them is the cooperation with the academic community by means of providing support to new generations of young professionals. It is realized at many levels: through the implementation of teaching, mutual work on projects, and a perfunctory of professional practice. Furthermore, efforts have been intensified to encourage awareness of the importance of health care by participating in public health actions, and special care, love and resources are directed towards the children, the helpless, the sick and the needy. Through a series of sponsor-donor initiative to clubs, associations, events that primarily take care of sick children and the sea, the company is trying to return a part to the community that it takes from. Help and support is targeted to many athletes as well, like - karate, marathoners, triathletes, footballers, judoka, and as always, JGL was especially facing the sea, swimmers, divers and sailors...

It is also noteworthy to mention a JGL's commitment to development based on innovation and product development as shown by a significant investment in research, cooperation with scientific institutions and the education of its own experts in order to increase competence.

These are all indicators of the company desires to grow on its own knowledge and to conquer markets advanced solutions and new products that enhance quality of life.

5. Conclusion

Companies are more intensively recognizing advantages of sustainable initiatives and undertaking steps to incorporate them in their businesses. Making business more sustainable will present both opportunities and threats, but companies need to synchronise their activities to the development of the sustainability agenda if they want to be competitive in the future. When it comes to the marketing part, it is important for marketers to break their traditional frame of reference and reconsider their marketing strategies. Marketing intensively puts importance on sustainability. The aim is satisfying the wants and needs of the customers while putting equal emphasis on environmental and social issues, thus generating profit in a responsible way. It is essential that firms examine the ways in which their marketing mix can become more sustainable, which will, among others, be one of the influencing factors of success in the future. It is crucial to take a pro-active stance on environmental and social responsibly, that is, proactively introduce positive changes before it is made necessary. In order to achieve that, companies will need to invest a considerable amount of effort to change their supply networks and their in-house or contract manufacturing systems. Recycling of materials like paper, metals, plastic etc should be much more widespread and included in the activities of the company. Also, saving energy using the energy efficient lighting and appliances, using efficient and environmentally friendly modes of transportation are also one of possible contributions. Furthermore, it is necessary to avoid any kind of discrimination, child or forced labor, corruption, bribe or similar. The most successful companies in doing this sincerely embrace sustainability principles at its core; set clear and measurable goals; and clearly, transparently and truthfully communicate with their stakeholders about the ecological and social impacts of their products and services. These companies use the four Ps to enhance and fulfill their sustainable positioning. (Gittel et al., 2012).

JGL certainly shows awareness about the strategic importance of sustainable development and reporting on the economic, social and environmental indicators, establishes communication with employees, customers, clients, suppliers and the general public. Its business is based on the principles of sustainable development which implies economic growth with ecological balance and social progress. While stressing the orientation toward to being a reliable and responsible member of the community in which they live and work, they believe that doing good business means and doing commonweal. The company is continuously trying to improve and enhance the working and environmental conditions without consciously reducing environmental impact. Furthermore, particular importance is put on raising awareness of diversity and inclusion, responsible business management and supporting the highest standards of ethics at every step of creating a quality product - from research and development to sales and marketing. By investing in advanced, currently unconventional solutions in the area of energy efficiency, JGL has achieved a significant reduction in operating costs compared to the past, an increase in productivity, and ultimately an increase in the quality of delivery of its services and products to its customers and consumers. This bears testimony to great responsibility toward the local community and the area in which the company operates and builds.

In order to increase the level of sustainability actions, it would be useful to consider the introduction of the assessment and selection of suppliers based on their effects on the environment and society in order to spread sustainability chain to other stakeholders. When looking at a sustainable-marketed product, consideration should be made for sourcing of materials, ingredients used, and the manufacturing of the product. This includes using more natural and organic materials, sourcing local and through fair trade suppliers, utilizing

environmentally friendly materials, using lean manufacturing and distribution methods that minimize the company's carbon footprint. Each company, in striving to achieve more sustainable marketing strategy can rethink how sustainability can be integrated into activities such as product design and development, branding, packaging, pricing, distribution, personal selling, advertising and sales promotion (UNEP, 2005).

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Strategic Priorities for Consumer Co-operatives' Development in the Republic of Moldova

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Abstract. The consumer co-operatives from the Republic Moldova represent a significant sector of socio-economic system of the country. The recent evolution of the co-operative system confirms that it has not yet become stable and durable state, and it is easily influenced by internal and external factors. Nowadays challenges and the internal need for change require rethinking the co-operatives' organization and management, their domains of economic activity, their relationship with members, ownership relations and the motivational system. By signing the Republic of Moldova–European Union Association Agreement, Moldova has expressed its adherence to the European values and focuses toward its integration into the European Economic Area. This requires the adoption of new visions in the co-operatives development and in the implementation of European co-operatives' good practices. This paper is focused on the analysis of the consumer co-operatives from the Republic of Moldova, identifying the strategic directions for sustainable development and strengthening the position on the domestic and foreign market. The main objectives of co-operatives' development are: consolidation of members' community, improving management and organizational structure, diversification and modernization of co-operative activities, assuring financial stability, resource efficiency, human capital development, increasing the competitiveness on internal and foreign market, and strengthening the relationships with foreign partners. The research results were used in the elaboration of the Strategy of Consumer Co-operatives' Development for 2016-2019. The Strategy was approved by the co-operatives' Congress (February 12, 2016). The implementation of innovative and strategic solutions would boost the development of the consumer co-operatives in Moldova.

Key words: *consumer co-operatives, modernization, optimization, economic efficiency*

1. Introduction

Consumer cooperatives, according to their mission and objectives, play an important economic and social role in Moldovan society. Existing for over 147 years, this system has continuously expanded its activity areas getting fully involved in the implementation of national programs for social and economic development.

In order to ensure further development of national consumer cooperatives, strategic planning for the medium and long term development of this sector has an important role focusing on implementation of development policies, advanced modernization of the system, supporting increase of competitiveness as well as of consistent, efficient and sustainable development of

consumer cooperatives while fully meeting the needs of their members, employees and population served.

Given the importance of this issue and based on the Law regarding consumer cooperatives no. 1252/2000 [3], at the request of the Central Union of Consumer Co-operatives from the Republic of Moldova the research team of the Trade Co-operative University of Moldova elaborated the Development Strategy of Consumer Co-operatives for 2016-2019 (hereinafter the Strategy), which was approved by the XVIth Congress on February 12, 2016 and is being implemented currently.

2. Strategy development stages and methodology

Given the importance of the Strategy several steps have been undertaken for its development, such as:

- a) studying of relevant evaluation documents (reports) regarding the implementation of National Development Programs and recorded progress,
- b) analysis of the implementation of Consumer cooperatives development Program for 2012-2015 [9],
- c) SWOT analysis of consumer cooperatives activity as well as of encountered challenges,
- d) social and economic analysis of rural environment where consumer cooperatives entities operate,
- e) analysis of European regulatory and strategic development framework for consumer cooperatives,
- f) analysis of national strategic development documents of the Republic of Moldova until 2020,
- g) analysis of statistical data, reviews, social and economic reports,
- h) identification of internal needs that are challenging the consumption cooperation system, identification of stakeholders (members, employees, other beneficiaries of cooperative services, authorities, etc.) needs and expectations [7, 8],
- i) analysis of strategies and programs for local (district and community) development of consumer cooperatives in 2016-2019,
- j) consultation with sector's key stakeholders (cooperatives and cooperative enterprises, cooperative members, academics, researchers, farmers, processors and traders from rural areas, local government).

The Strategy was developed based on Art. 74 (c) of the Law on consumer cooperatives no. 1252 – XIV of September 28, 2000 [3], on the priorities of social and economic development of the Republic of Moldova established in the National Development Strategy "Moldova 2020", approved through Law no.166 of 11/07/2012 [4], on European economic integration priorities contained in the Republic Moldova - European Union Association Agreement [1], ratified by the Moldovan Parliament on July 2, 2014 (Law no. 112 of July 2, 2014) and by the European Parliament on November 13, 2014, on the Strategy "Europe 2020" providing for smart, sustainable and inclusive growth [2], on national sectorial strategies for economic development, on other policy documents according to international cooperative principles, Regulation (EC) no. 1435/2003 of the Council from July 22, 2003 on the Statute for a European Cooperative Society (SCE) [6], the Promotion of Cooperatives Recommendation R193 of International Labour Organisation, adopted by the ILC session no. 90 on June 20, 2002 [5], the international priorities for the development of cooperatives promoted by International Cooperative Alliance (ICA) [10], Cooperatives Europe (CoopsEurope – The European region of ICA) [11], sectoral international organisations of cooperative activity fields, and to other relevant documents.

The Strategy is based on the following principles: participation and transparency; complementarity and correlation with other strategic documents; additionality of resources;

efficiency. The Strategy is developed on the basis of systemic, complex, problematic approaches and is aimed towards boosting the development of Moldovan consumer cooperatives under increased competition, economic globalization, development of information society.

3. The scale and development of consumer cooperatives in 2012-2015

During the last four years consumer cooperatives continuously offered a wide range of services and promoted various activities (retail and wholesale trade, purchase of agricultural products and of agricultural products of animal origin, their processing, various services, including educational, market, catering services), this activity depending on the interests of their members and of the population from the activity area, thus providing service to about 57% of the population.

As a membership-based system, consumer cooperatives continuously choose community strengthening and development of infrastructure, which currently includes:

- cooperative members – over 144 thousand,
- economic entities – 161, including consumer cooperatives – 98,
- trade units – 1930 with commercial area of 185 thousand m²,
- catering facilities – 230,
- locations where consumer cooperatives exist – 770,
- markets – 32 with 10850 places for sale,
- the production sector comprises 21 factories and bakeries, 14 confectionery-pastry departments, 16 slaughterhouse, 29 agricultural products processing facilities, including 15 for sunflower seeds, 10 for grain, 2 sausage departments, 5 production enterprises,
- educational institutions – 3,
- employees – 4265.

Aiming for increased quality of services offered by cooperative enterprises, in the previous period these focused on infrastructure modernization, on trade, manufacturing and service update. Thus, in 2012-2015:

- 31 trade units were re-opened and put into service of the rural community, 190 stores were re-designed and upgraded in terms of commercial technology,
- 54 catering facilities were refurbished,
- 2 companies and 15 specialized purchasing units and their branches were created in different areas of the country,
- 12 bakeries within the system were refurbished and 5 cafeteria departments were re-equipped,
- 12 commercial markets were refurbished.

Mobilization of domestic resources, employment of existing potential, development of cooperative infrastructure favored growth of all areas of activity as well as of economic activity results during 2012-2015:

- in the mentioned period retail sales have grown up by 8.4%, wholesale sales - by 52.1%, together registering 3,124.7 million lei and 383.5 million lei respectively;
- during the mentioned period, purchase of agricultural production, of animal type and other production has grown by 13.2% recording 315.4 million lei;
- manufacturing of industrial production increased by 7.2%, totaling 238.5 million lei for the reference period;

- from 2012 to 2015 payment-based services for the population have grown by 31.1%, including market services by 27.1%, and accounted for 589.5 million lei;
- export volume amounted to 64.7 million lei, growing 3.8 times;
- domestic investment amounted 88.6 million lei;
- turnover (net sales) increased by 8.4% and amounted 3716.7 million lei;
- net profit increased to 14,057 thousand lei in 2015 (compared with 45 thousand lei in 2012);
- increased contributions to the republican budget by 26.4%, accounting for about 431.8 million lei.

However, lack of financial resources is one of the main impediment factors for intensive and extensive development of consumer cooperatives. Lack of required investment and unattractiveness of the system for foreign investors remain an important barrier to sustainable long-term development of consumer cooperatives.

4. SWOT analysis

In order to design an overall view on the development of consumer cooperatives a SWOT analysis of this system was conducted.

Strengths:

- social background of consumer cooperatives system consisting of cooperative members, associated on the basis of free consent and contribution to their charter capital,
- the legal basis for the operation (national and international) of consumer cooperatives,
- organizational unity of consumption cooperative system,
- multidimensional (diversified) character of economic activities (trade, purchase-processing, services, etc.),
- unified management system based on democratic principles and participatory management,
- image created by a socially oriented system,
- contribution to the implementation of several national development programs,
- experienced personnel for cooperative sector activity,
- established sales market,
- decades-lasting working experience,
- established domestic relations,
- own infrastructure (technical and material),
- investment in infrastructure upgrade,
- own educational system existing at various stages of professional education,
- available research potential,
- contribution to rural development,
- ubiquity of cooperatives worldwide and support of the cooperative activity worldwide,
- national consumer cooperatives system is part of the international cooperative system,
- transfer of experience and international best practices toward the national consumer cooperatives.

Weaknesses:

- imperfection of the legislative and regulatory framework regarding consumer cooperatives,
- decreasing interest of cooperative members in support and development of cooperatives,

- imperfect mechanisms of members' co-participation in economic and administrative activity of cooperatives and of cooperative members responsibility for the work of cooperatives,
- certain imperfect and inefficient elements of the organizational structure,
- diminished responsibility of several managers and employees of cooperative entities for financial and economic results,
- partially obsolete, unused or inefficiently used infrastructure,
- insufficient financial resources for the implementation of extensive programs of infrastructure modernization, refurbishment and work expansion,
- unattractiveness of consumption cooperation system for foreign investment due to the nature and legal status of economic entities from this sector,
- trend towards disintegration among several cooperative organizations,
- positional decrease of cooperative enterprises and organizations within activity markets,
- low profitability of economic activity in certain areas mainly caused by the social character of cooperative benefits in rural regions,
- imperfect motivational system,
- insufficient public information on the benefits of consumer cooperatives.

Opportunities:

- improvement of legislation, harmonization of domestic needs with the *acquis communautaire*,
- state structures' support of consumer cooperatives activity, synergistic cooperation with all-level public authorities,
- increase of the credibility in front of foreign partners and of attractiveness for foreign investment,
- strengthening of cooperative members community and recruiting of new members,
- enhancement of integration and associative processes,
- optimization of cooperatives' structure and management,
- modernization of cooperative infrastructure,
- diversification of the areas of cooperative activities according to the needs of society and to international best practices,
- entering new markets and domestic market niches (urban, regional, food products, etc.) as well as entering external market,
- cooperation with other cooperative areas and cooperatives types,
- implementation of an informational system integrated into consumer cooperatives system,
- rapid adaptation to constantly changing internal and external environment,
- expansion and diversification of the supply of goods and enhancing the quality of goods available to consumers,
- enlargement of opportunities for attraction and employment of consumer purchasing funds,
- increasing confidence, implementing customer loyalty programs.

Threats:

- maintaining contradictions between the legislation on consumer cooperation and other laws, including civil legislation,
- substantial reduction of positions in segments of economic activity,
- reduced interest for consumer cooperatives association,
- uneven competitive environment for all economic players operating in the domestic market, maintaining of unfair competition,

- underestimation by public authorities of the consumption cooperatives system and of the role of businesses and organizations from this system for the achievement of state social policies, lack of support for social-based cooperative activities in remote or low populated regions,
- amplification of the impact of economic and financial crisis,
- destructive demographic trends from the country, labor migration, population and demand decrease,
- reduction of income and purchasing power of the population from service area,
- variation of the structure of population consumption expenditure,
- discrepancies between qualification levels of personnel and skills required for innovative, effective consumer cooperatives activity,
- low attractiveness of consumer cooperatives for youth enrollment in their work,
- limited financial possibilities,
- amplification of disintegration process.

5. Vision, strategic lines and objectives

Vision. Development of consumer cooperatives as a sustainable and competitive system, resistant to internal and external challenges, ensuring welfare for its members and for the population served as well as benefits for its employees.

Strategic lines:

- development of consumer cooperatives as a unified system, economically strong,
- strengthening the positions of consumer cooperatives system within the internal market (rural) and entering other markets (urban), enhancing the competitiveness of consumer cooperatives system, its economic growth,
- amplification of integration and association processes in the consumer cooperatives, expansion of these processes within internal and external dimensions,
- synergistic cooperation with public authorities, potential investors, other stakeholders,
- modernization and innovative development of cooperatives' system,
- integration into the international economic turnover.

Strategic objectives:

- i. strengthening cooperative members' community,
- ii. optimization of organizational structure and making the management of cooperatives' system more effective,
- iii. optimization of traditional activities promoted by consumer cooperatives and diversification of cooperative benefits,
- iv. ensuring financial stability, efficient and effective use of resources, ensuring the efficiency of cooperative entities work,
- v. development of internal potential and increase of system's competitiveness on domestic and foreign markets,
- vi. strengthening relations with external partners.

The strategy includes priority directions for the development of cooperative activity as well as actions necessary for its successful implementation. The main directions are given below.

Strengthening cooperative members' community. The increase of the number of members requires implementation of an effective incentives mechanism, motivation to support and develop local cooperatives, stimulation of investment in the development of cooperatives, increase of subscribed shares. Development of a motivational system for members has become urgent.

An effective tool in this regard would be the allocation of a part of the benefit obtained by cooperative organizations to their members according to the subscribed capital.

In the following period it is necessary to implement an information system in order to keep record of cooperative members and to timely renew the database.

Optimization of organizational structure and making the management of cooperatives' system more effective. Optimization of internal organization of consumer cooperatives system should focus on integration (vertically and horizontally) and association processes, regardless of the territorial area of operation and of the profile of economic activity (retail, wholesale, purchase-processing-storage-distribution of agricultural products, etc.)

Organizational restructuring must be based on:

- diagnosis of the activity of cooperative economic entities across the country and re-organization/disbanding of inefficient and legally non-conforming entities;
- support of economically strong cooperative organizations and integration of their infrastructure into a single economic system,
- re-structuring of cooperative enterprises and their integration into structures specialized in cooperative areas (trade, purchase, services, etc.) at republican and regional levels.

Managerial re-structuring must be based on the optimization of both vertical and horizontal managerial hierarchy of consumer cooperatives through:

- reduction of hierarchical structure and transition to a two-level structure (consumer cooperatives - Central Union),
- optimization of cooperative organizations' management bodies,
- organizational re-structuring of internal management (cooperatives, enterprises).

Optimization of traditional activities promoted by consumer cooperatives and diversification of cooperative benefits.

Trade is the traditional economic activity area having a dominant share in consumer cooperatives turnover. Within this area mapping and assessment of trade facilities in terms of economic and social efficiency, of territorial location, of specialization profile, of the role for community development is planned as well as the elaboration of a *concept regarding the development of cooperative trading system*.

Has become urgent the need for a *unified (integrated) trade system* based on enterprises and on available trade infrastructure of consumer cooperatives' system (retail and wholesale trade), which could compete with national and international networks operating on the domestic market.

In order to strengthen the image and to increase the visibility of consumer cooperatives it is necessary to develop and promote *own trademark(s) for products manufactured and/or sold* through consumer cooperatives networks and trade facilities.

Transport- and logistics-related constraints to trade directly and indirectly affect the competitiveness of the sector. Establishment of a *unified system for product distribution* within consumer cooperatives employing a modern logistics system will allow to reduce distribution costs, lower prices for consumer goods, optimize expenses, and streamline the decision-making process.

An important role in promoting cooperative trade services further lies with expanding the implementation of "CoopPrim" and "CoopPlus" stores formats, development and implementation of new formats of trade facilities.

Special attention must be given to implementation of digital forms and instruments for sales promotion, to initiation and development of electronic trade within consumer cooperatives.

Development of the sector for purchasing agricultural-, animal origin- and other products has strategic importance for the development of cooperatives system. This activity area, similar to trade, comes to support the state with the promotion of its social policy in rural regions, therefore it requires support from authorities.

The development of this sector is hampered by shortage of funds, lack of a unified system for sale of purchased production and for processing, unfair competition on the market of agricultural food products, etc. In order to revitalize this sector evaluation of purchasing potential of the consumer cooperatives' system is imperative based on: agricultural specialization of republic's regions and districts, capacities of cooperative enterprises and organizations, investment needs and *elaboration of a long-term development program for the sector*, attractive for both domestic and foreign investment and involving stakeholders.

Lack of horizontal and vertical coordination of purchase chains within the consumption cooperatives' system, scattering of financial, logistical, human resources as well as information deficiencies cause low competitiveness of this sector and justify the need and opportunity for *establishing a republican cooperative enterprise specializing in purchase-processing-trade-export*.

Industrial sector development is an important source for creating cooperatives' own resources and product supply. Cooperative industry is mainly oriented towards the manufacture of essential products, including bread and bakery products, confectionery and pastry, pasta, sausages, beverages, etc.

Further development of the industrial sector and its economic efficiency can be achieved through integration of production structures (enterprises, departments) into a *single complex* with the centralization of certain functions (design and development of new products, joint information infrastructure, joint distribution system, etc).

Development and launching of *own co-operative production brand* as well as its promotion will increase the visibility of these products internally and externally and will increase consumer confidence.

Services development and diversification will focus on the diversification of services, upgrade of relevant infrastructure, expansion of services traditionally rendered by cooperative entities (catering, marketing, educational and research, etc.) and increase of their quality as well as beginning to render certain social services, services provided to farmers, advertising and other services.

Ensuring financial stability, efficient and effective use of resources, ensuring the efficiency of cooperative entities work is an important factor for sustainable operation of cooperative organizations and enterprises, implementation of projects regarding modernization and expansion of cooperative benefits, increase of service quality, rewarding of cooperative members and of employees from the system.

Insufficient financial resources remain a significant barrier to the development of consumer cooperatives, especially in areas where cooperative activity is unprofitable but needed by the population, primarily for ensuring products of first necessity. Since social mission is the responsibility of public authorities, in order to maintain cooperative benefits in such regions and improve the economic condition of cooperative entities urgent authorities' support of such cooperative activities, that can be achieved in various forms (grants, exemption or reduction of location fees, etc.), is required.

As main external factors that can contribute to the improvement of economic activity of the consumer cooperatives' system, the following can be listed:

- development of economic activities, entering new markets, diversification and expansion of cooperative services,

- modernization and upgrade of cooperatives' infrastructure,
- establishment of internal audit units within the cooperatives' structure,
- implementation of an integrated information system for recording economic and financial results,
- improvement and streamlining of financial and economic activity management, employment of financial management- and risk management tools for economic and financial management of the system,
- cooperation with credit and investment organizations for financing consumer cooperatives development programs,
- establishment of own consumer cooperatives' financial institutions.

Further sustainable development of consumer cooperatives requires strengthening investment potential through:

- attraction of external financial resources (loans, credits, deposits, etc.) from various third parties without losing cooperative identity,
- attraction of monetary resources from members, cooperative employees and from the population,
- application to microfinance and technical assistance projects,
- development and implementation of an effective investment reward system,
- accessing European funds for the development of cooperatives infrastructure.

Development of internal potential and increase of system's competitiveness on domestic and foreign markets. Given continuous economically and socially changing environment, increasing competition on domestic and foreign markets, development of digital economy, in order to meet these challenges the consumer cooperation must follow a process of continuous modernization, implementation of innovations, development of its internal resources, expansion of partnerships with stakeholders (internal, national and international) and with other beneficiaries.

Infrastructure development must focus primarily on three dimensions: expansion of cooperative infrastructure, strengthening of material and technical basis of the cooperative system and refurbishment of activities.

A major priority for increasing the competitiveness of consumer cooperatives' system internally and externally is the implementation of digital marketing tools (e-marketing) in cooperative activity for better visibility and promotion of services.

Human resources are the key resource for ensuring sustainable development of each enterprise and consumer cooperatives. Personnel employed in consumer cooperatives' system, although distinguished by loyalty and having great working experience, are characterized by an "aging" process. This trend and the acute shortage of labor in rural regions urgently need a *program regarding ensuring competitive human resources for consumer cooperatives* in the medium and long term.

Domestic and external economic environment, internal needs of cooperatives' system require imperative development and implementation of a *corporate integrated information system* within consumer cooperatives for integration of all data and information flows, of all cooperative system components and of its management, thus facilitating a more efficient and transparent decision-making, resource optimization, efficiency of economic activities.

An important role for the future development of consumer cooperatives lies with employment of opportunities offered by modern ICT for economic activity and beneficiaries' information. In this regard has become urgent: expansion of cooperative activities in cyberspace;

implementation of electronic forms for the trade and sale of goods, of B2C, B2B and B2A e-commerce models; implementation of electronic payment methods, etc.

Internal change needs as well as European integration aspirations of the Republic of Moldova determine the need to harmonize national legislation on consumer cooperatives with the *acquis communautaire* to the extent ensuring maximal approximation with EU legislation.

Strengthening relations with external partners. To provide the population with goods, particularly of primary need, consumer cooperation requires support from authorities at all levels (from the central to local one). Partial compensation of expenses related to the implementation of social projects in remote localities with small populations, and support of these activities can be realized by:

- allocation of subsidies for economic activities conducted by consumer cooperation and directed towards providing goods of vital importance (production and delivery of bread, etc.) or partial coverage of the costs for transportation of such products;
- exemption of location taxes, local taxes, other tax of cooperative units entities in localities where economic activity is unprofitable due to low number of population served, difficulties related to goods supply.

Development of partnerships should be also extended on the dimension of cooperation with other types and forms of cooperatives (manufacturing, agricultural, entrepreneurship etc.) in order to promote projects of common interest, to modernize legislation, to amplify the potential of promoting common interests and protection.

Cooperation on the external dimension will focus in the future on: implementing international best practices regarding normative-legislative regulation of cooperative activity, organization of cooperatives, attraction of members; extending cooperation with overseas cooperative organizations in carrying out joint economic activities, commodity exchange; promoting export of products purchased and processed by the consumer cooperatives in the country, benefiting from advantages offered by the signed Deep and Comprehensive Free Trade Agreement etc.

6. Conclusions

Implementation of the Strategy will have an impact both *economically*, materialized in enhancing the economic potential of cooperative system, creating favourable conditions of work, improving the legal framework in the field, increasing investment in development, and *socially*, expressed in improving the level of service to its members and to other categories of beneficiaries, affordability of cooperative services, consumers' protection, contribution to the development of localities and community.

Strategy implementation will contribute to achieving the following progress indicators:

- turnover increase by 3-5% annually,
- increase the income of cooperatives on average by 4-6% annually,
- attraction, at least, of 250 new cooperative members annually, implementation of incentive mechanisms for them in developing consumer cooperatives at local, regional and republican levels,
- increase of wages for employees working in consumer cooperatives, provision by 2019 of a share of 75% of the average monthly salary in the country,
- organization of 500 new jobs during the Strategy period of action.

Development of consumer cooperatives will help increase the indicators characterizing the economic and financial activity: retail sales will grow annually during the Strategy period of action by 3-5%, wholesale sales will increase by 5-7%, purchasing of goods - by 4-7%,

production of goods - by 3-6%, provision of paid services - by 3-5%, sales revenue will increase by 3-5% and net profit will increase by 3-6%.

Implementation of the Strategy will contribute to sustainable and intelligent recovery of the consumer cooperatives potential in all its dimensions (institutional, infrastructural, human, financial, informational, managerial, etc.), and will support progress in economic and social development of this system.

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Knowledge transfer offices in the context of knowledge spillover theory of entrepreneurship

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Abstract. Paper will present aspects of the knowledge transfer offices (KTO) from the EU Knowledge Transfer Study report, through the prism of the knowledge spillover theory of entrepreneurship (KSTE). It will also add the argument, based on the existing literature, that knowledge cannot be managed but only the information resources can. This paper contributes to the on-going research of Secondary Experience, whose main aim is to explore avenues for designing information system that will support better usage of the existing scientific papers between universities and their environment, including public, private and civil sector. There is a limited number of the EU wide research studies of the EU universities Knowledge transfer offices. Existing one are sending non-promising results. In the last EU report addressing KTO not even one hypothesis addressing KTO related policies is accepted and one of the hardest parts in conducting research was to find the contacts of the KTO's. It is aligned with results from the master thesis of one of the authors, where sources of information were analysed in terms of the transparency of the projects and their funding related information among 466 universities in the Danube region. That alerted us and opened up completely a new set of questions. In this paper, we use secondary data as content for our research.

Key words: *knowledge transfer entrepreneurship information resources*

1. Introduction

The main research question addressed by our ongoing research, to which paper contributes, is related to the design information system that supports a production and communication process of the scientific documents and interaction of the all agents involved in the process, including academia, public, private and civil sector [1, 2]. Primary focus is on the Danube region universities ecosystem. To design the information system, we have to understand the information behaviour, including information searching and seeking patterns [3]. We also have to gain insights to the what type of information resource, what type of communications channel and what type of the media formats (e.g. scientific journal, conference proceedings, web pages etc.) are used in the process of interaction between agents. Those variables (type of information resources, type of communication channels, information seeking patterns and media formats) except explaining interaction process itself also create solid analytical framework to analyse impact of the already published scientific papers by their environment. Another research inquiry is in the area of interaction, or precisely speaking, what are the motivation drivers and factors that influence the interaction and cooperative and collaborative

processes between scientists and their environment. If we understand the motivation drivers and factors that influence interaction, cooperative and collaborative processes, then we can implement them into a design of an information system. Information systems can be understood as the “extension of meaning engagement practice through mediating and organising social interactions” [4]. Also, patterns of the information system usage can configure cognition and behaviour of a user in the process of accomplishing work-related tasks [5]. Any information system consists of social, technological and informational components, which are not separate but interrelated [6], and there is an inherent inseparability between the technical and the social [7]. So available technical and information components in the information system supporting will influence behaviour of social agents and by doing so we believe that we could increase effectiveness and efficiency of creation and usage of scientific documents. Aim of this paper is to present results from the EU Knowledge Transfer Study 2010-2012 and put them in the context of the Knowledge Spillover Theory of Entrepreneurships (KSTE). Paper is organised as follows: next chapter will present results study and provide recent definitions of the KTOs found in the literature, following by brief explanation of KSTE in the context of KTO. As those two are presented, paper will discuss how issues could be approached from the information system design perspective. This paper is of the exploratory nature and there will be any bold conclusions.

2. Knowledge Transfer Study 2010-2012 results

The objective of Knowledge Transfer Study 2010-2012 was to monitor the status of implementation of the European Commission’s *“Recommendation on the management of intellectual property in knowledge transfer activities and Code of Practice for universities and other public research organisations”* from 2008 [8]. Those Code of Practice recommendations are presented in the Table 1 [9]. Findings are based on the questionnaire send to the Public Research Organisations (PRO) in 28 EU Member States and survey has to be fulfilled by the recommendation requirement that Member States should *“inform the Commission by 15 July 2010 and every two years thereafter of measures taken on the basis of this Recommendation, as well as their impact”*.

Table 1 KTO Code of Practice principles

CoP 1: Existence and publication of IP policy	CoP 7: Existence and publication of publication/ dissemination policy	CoP 13: Sharing of KTT returns between organisation, department and researcher
CoP 2: IP policy provides clear rules for staff and students	CoP 8: Used set of exploitation mechanisms and partners	CoP 14: Monitoring and publication of IP, KTT and research activities
CoP 3: Promoting identification, protection and exploitation of IP	CoP 9: Revenues not prime objective of IP/KT policies	CoP 15: Compatible rules and practices for collaborative and contract R&D
CoP 4: Providing incentives to staff to implement the IP policy	CoP 10: Professionalization of knowledge transfer ser- vices	CoP 16: Early clarification of IP issues
CoP 5: Creation of coherent IP portfolios and patent/IP pools	CoP 11: Existence and publication of licensing policy	CoP 17: Ownership of IP in collaborative and contract R&D
CoP 6: Raising IP and KTT awareness and skills through training actions	CoP 12: Existence and publication of spin-off policy	CoP 18: Access rights to IP

In this study, no correlation was found between total KT performance and KT policies. Results from the study regression analyses that used six performance indicators for which data was collected in the WP2 survey are presented in the table 2.

Table 2 Indicators for accessing the knowledge transfer activities of the PROs they serve

Indicators	Correlations findings
Invention disclosures	No correlation was found between KT policies and invention disclosures – the regression line is almost even (correlation coefficient 0.05)
Patent applications	No correlation was found between KT policies and patent applications – the correlation coefficient is slightly negative (-0.09).
Patent grants	No correlation was found between KT policies and number of patent grants (correlation coefficient 0.09).
Number of spin-offs,	No correlation was found between KT policies and the number of start-ups from PROs. The correlation coefficient is slightly positive (0.13).
License agreements,	No correlation was found for KT policies and license agreements (correlation efficient 0.22).
Licensing income	No correlation was found between KT policies and licensing income. The absolute value of the correlation coefficient was the largest of all indicators, but still not noteworthy high (- 0.2).
Research agreements.	No correlation was found between KT policy intensity and number of research agreements. The regression line is almost even (correlation coefficient: -0.002).

The focus of our interest was the statement from the Knowledge Transfer 2010-2012 study which was that *“most time-consuming step is to obtain contact information for the KTO that serves each PRO. This was done through using both data from professional associations and from telephoning the central administration offices of PROs and asking for this information [10].”* This is very interesting statement considering the same report states, *“many European PROs have established Knowledge Transfer Offices (KTOs) that can provide professional advice to assess the patentability of inventions, interact with firms, and provide licensing expertise [11].”* Formal technology transfer mechanisms include patents, copyrights, trademarks, licensing agreements between the university and private firms, and university-based start-ups and property based institutions such as incubators and accelerators and research, science, and technology parks [12]. According to Siegel and Wright [13], *“Knowledge Transfer Offices (aka Technology Transfer Offices) are an “intermediary” between suppliers of innovations (university scientists) and those who can potentially (help to) commercialize these innovations (i.e., firms, entrepreneurs, and venture capitalists). They facilitate commercial knowledge transfers of intellectual property resulting from university research through licensing to existing firms or start-up companies of inventions or other forms.* According to same authors’ positive side is that they could create additional revenue for the universities (through licensing agreements and spin-offs), they could open employment opportunities for graduate students (including post doctorate researchers) and could impact local economic and technological spillovers through the stimulations of additional R&D investment and job creation. On the negative side their cost could outweigh benefits of the revenues generated and could take university from their role of educators and fundamental research.

Below are the results from the Knowledge Transfer Study 2010-2012 based on the questionnaire send to all EU members’ states. Surveys was designed to obtain information for the six key indicators (number of invention disclosures, number of priority patent applications, number of technically unique patent grants, the number of start-ups, the number of licenses or option agreements with companies, the amount of license income earned) along with three supplementary indicators (the number of R&D agreements between the affiliated institutions and companies, number of USPTO patent grants, the number of successful start

ups). Results will be presented and briefly commented in the context of our ongoing Secondary Experience research.

Table 3 Distribution of Expenditure

	Universities		Other research organizations		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
up to 5 m	60	16.2%	6	8.8%	66	15.1%
5 m - 14 m	74	20.0%	8	11.8%	82	18.7%
15 m-39 m	67	18.1%	15	22.1%	82	18.7%
40 m-79 m	70	18.9%	14	20.6%	84	19.2%
80 m -159 m	49	13.2%	16	23.5%	65	14.8%
160 m or more	50	13.5%	9	13.2%	59	13.5%
Total	370	100.0%	68	100.0%	438	100.0%

Source: MERIT, European Knowledge Transfer Indicator Survey 2011 and 2012.

Note: Based on answers for EKTIS 2011, question 12.3 and EKTIS 2012, question 13.3. Results include ASTP, DASTI (DK), HEFCE (UK), RedOTRI (ES) and UTEN (PT) respondents.

Table 3 shows distribution of research budgets. Average size EU university has 23,750 students [14] that shows us through calculation that per one student per university in the first half of the distribution (up to 39M EUR, in total 54.3%) has maximum 1642.15 EUR for research, and second half of the distribution with (based on 160M/number of students) with budgets of 6736.84 Euro. We witness up to 4 times higher budgets per students in the two distribution of expenditure from those data, which is quite a big difference. Such difference is important, since larger universities do not perform better as a result. Data confirming this statement will follow later in this text.

Table 4 Distribution of Licence income

	Universities		Other research organizations		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
Zero	107	30.9%	16	22.5%	123	29.5%
€1 - € 19,999	54	15.6%	7	9.9%	61	14.6%
€20,000 - €99,999	68	19.7%	13	18.3%	81	19.4%
€100,000 - €249,999	34	9.8%	11	15.5%	45	10.8%
€250,000 - €499,999	25	7.2%	7	9.9%	32	7.7%
€500,000- €1,999,999	40	11.6%	9	12.7%	49	11.8%
€2,000,000 or more	18	5.2%	8	11.3%	26	6.2%
Total	346	100.0%	71	100.0%	417	100.0%

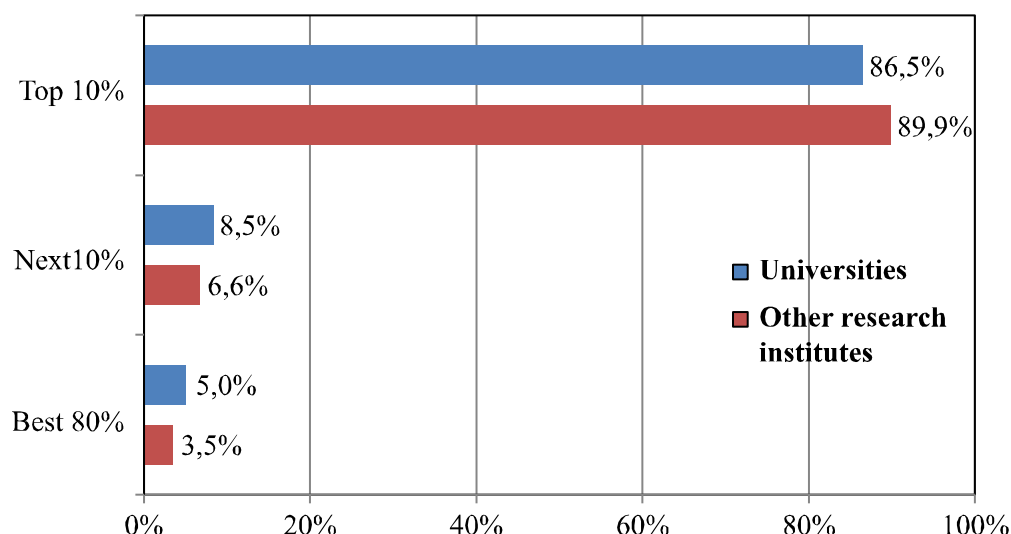
Source: MERIT, European Knowledge Transfer Indicator Survey 2011 and 2012.

Note: Based on answers for EKTIS 2011, question 9.3 and EKTIS 2012, question 10.3. Results include ASTP, DASTI (DK), HEFCE (UK), RedOTRI (ES) and UTEN (PT) respondents.

Table 4 shows income size distribution and that 66.2% of the universities have income less than 100,000 Euro. Another interesting finding from this table is that 50.7% of “other

research organisations” have income lower than 100,000 EUR since they are organisations that should create new knowledge only (no education).

Table 5 Outcomes of the top performing universities



Source: MERIT, European Knowledge Transfer Indicator Survey 2011 and 2012.

Note: Based on answers for EKTIS 2011 question 9.3 and EKTIS 2012, question 10.3. Results include ASTP, DASTI (DK), HEFCE (UK), RedOTRI (ES) and UTEN (PT) respondents. Total reported license income earned at universities was €251 million and €160 million by other research organisations.

Table 5 shows us that top 10% create 86,5% licence income (universities) and 89,9% (“other research organisations). Remaining 80% create 5% (University) and 3,5% (other research organisations). This number shows central power of the large research organisation and their importance in the new knowledge creation and innovation eco system.

Table 6 Distribution of licenses toward different firms by size

	Start-up companies		Other firms with <250 employees		Firms with >250 employees		Total	
	licenses	%	licenses	%	licenses	%	licenses	%
Universities	331	22.2	611	41.0	547	36.7	1489	100.0
Other research organisations	63	12.5	245	48.6	196	38.9	504	100.0
Total	394	19.8	856	43.0	743	37.3	1993	100.0

Source: MERIT, European Knowledge Transfer Indicator Survey 2011 and 2012.

Note: Results are limited to KTOs that reported licenses and have answered in which category the license belongs.

Based on answers for EKTIS 2011, question 9.2 and EKTIS 2012, question 10.2. Results include ASTP and UTEN (PT) respondents.

Table 6 shows who are the “customers” of those universities and research organisations. We find it interesting that the larger part of the total revenue is coming from the companies up to 250 employees and approximately 20% from start-up companies. In total almost 62% comes from small and medium businesses. This could be explained by saying that larger companies have their in-house R&D departments. It also shows that most of the interaction is happening in between research organisations and small and medium business.

Table 7 Share of license revenue by subject area

	Universities	Other research organisations	Total
Biomedical	34.9%	40.8%	36.1%
Computers, communication equipment and software (ICT)	16.8%	12.7%	16.0%
Nanotechnology and new materials	7.7%	6.4%	7.4%
Low/zero carbon energy technologies	3.6%	1.9%	3.2%
Other subject areas not listed above	37.0%	38.3%	37.3%
Total	100.0%	100.0%	100.0%

Source: MERIT, European Knowledge Transfer Indicator Survey 2011 and 2012.

Note: Based on answers for EKTIS 2011, question 10 and EKTIS 2012, question 11. Results include ASTP and UTEN (PT) respondents.

Table 8 License revenue by subject area

	Universities	Other research organisations	Total
Biomedical	81.6%	93.7%	87.0%
Computers, communication equipment and software (ICT)	5.9%	1.4%	3.9%
Nanotechnology and new materials	1.4%	0.2%	0.9%
Low/zero carbon energy technologies	4.0%	0.1%	2.3%
Other subject areas not listed above	7.1%	4.6%	6.0%
Total	100.0%	100.0%	100.0%

Source: MERIT, European Knowledge Transfer Indicator Survey 2011 and 2012.

Note: Based on answers for EKTIS 2011, question 9.3, and 10 and EKTIS 2012, question 10.3, and 11. Results include ASTP and UTEN (PT) respondents.

Tables 7 and 8 show the share of license revenue and licence revenue by subject area. We can see that biomedical makes almost 90% of the total revenue. We can ask a question, why public owned organisations make the most money by selling licenses that could have the strongest social impact such as health to the companies. Taxpayers' money goes to the research organisations, new knowledge is generated and social benefits could be achieved, but then licenses end up as ownership of private companies that generate profit. Interesting finding from our ongoing research that is relevant to this distribution is that at the time when EU Human Brain Project research started and was valued at 1,190 B EUR [15], the top seller category of depression medications was losing its patent rights in 2013. [16] Note that academic literature defines depression a high potential market for pharmaceuticals [17].

Table 9 Performance of KTO'S

	Performance per 1,000			Mil Eur to prod 1 output			Top PRO's		
		Top PRO's	All-Top		Top PRO's	All-Top	US	Mil Eur to prod 1 output	
Table	3,21	3,24	-0,03	3,22	3,25	-0,03	3.25 US	3.23 EU	3.23 US
Invention disclosures	16,4	15,2	1,2	3,3	3,9	-0,6	2.1	3.3	2.1
Patent applications	8,5	8,3	0,2	6,6	7,5	-0,9	2.3	6.6	2.3
USPTO patent grants	5,3	5,4	-0,1	10,4	12	-1,6	NA	NA	NA
Patent grants	1,3	1,3	0	47,1	49,8	-2,7	9.7	10.4	9.7
Start-ups established	1,6	1,3	0,3	30,4	39,9	-9,5	68.0	30.4	68.0
Successful start-ups	2,7	2,5	0,2	16,4	18,6	-2,2	NA	NA	NA
License agreements	6,6	6	0,6	7,5	8,9	-1,4	7.5	7.5	7.5
License income (in M Euro)	0,6	0,6	0	81,1	89,4	-8,3	24.4	81.1	24.4
Research agreements	81,3	75,4	5,9	0,6	0,7	-0,1	NA	NA	NA
Total	1,021,731	785,679		41,072	39,533		45,631	41,587	45,631

Table 9 shows us EU KTO performance in 2011 and 2012 combined. First column presents performance per 1000 research personnel. Second column presents same variable just for the top performing institutions defined in original report (PROs have more than per 1,500 of research staff). Third column presents difference between all KTO and top ones (that have more than 1500 research stuff). It is calculated using formula All-Top=X. Fourth column presents performance by research expenditures (million Euros to produce 1 output) and fifth column presents top PRO's (with with €30 million or more research expenditures). Sixth column presents difference between all and top (All-Top=X). Columns number seven, eight and nine compare top institutions (based on research expenditure) between US and EU PRO's. First raw "Table" indicates table number in the original document.

This table shows limitations of the KTO in terms of generating revenues and cost of their operations. For example, every thousand researchers produce 1.6 start-up companies and it costs almost 40 M EUR. Alternatively, to generate 1 M EUR in revenue from license income it costs universities more than 80 M EUR, while making single invention disclosure cost more than 3 M EUR. From another point, thousands of researches are needed to generate 80 research agreements and it costs around 0.6 M EUR. What also got our attention is negative impact of the size of PRO's in terms of research expenditure. Large organizations have lower return on investment ratio in all indicators. In addition, Table 5 shows that most of the revenue is generated by large organisations. So actually we have double negative impact, as money is not spent efficiently and most of the income comes from the real economy

(companies that operate on the market) so this inefficiency is transferred further. In addition, if we look at the Table 6 where we could see that most of the deals are done by start-ups and small and medium companies which are main generator of the economy. This forms a question related to KTO and their role in process of the social welfare and prosperity rise.

So how to explain these trends and why PRO's are not efficient in creating the benefits for the society through the placement of their output on the market?

As one of the potential frameworks we would like to discuss the difference between new and economic knowledge, how new knowledge becomes economic knowledge, what is happening in this process and who are the main agents of such a transformation. Knowledge Theory of Entrepreneurship covers all these points.

3. Knowledge Spillover Theory of Entrepreneurship

Knowledge Spillover theory of Entrepreneurship (KSTE) [18] clearly separates three main systems by interacting in the process of creation of the new knowledge. These are systems that create “new knowledge” (NKS), systems that creates “economic knowledge” (EKS) and systems that filter knowledge spillover (KFS) from NKS to EKS. Authors of this theory point at organizations that, by using their own capacities and resources to produce new knowledge and for various reasons opted to not commercially exploit it call “**Knowledge Incubators**”. This could be a *private firm, non-profit organization, government, university, or research institution*. Economic agents that are *able to absorb knowledge spillovers and convert them into economic knowledge* are called “**High-impact Entrepreneur**”. They differentiate from other entrepreneurs by *utilizing the spillover from the knowledge incubator, commercializing this knowledge by founding a new firm, entering the marketplace, and converting the new knowledge into economic knowledge*. In addition, it is important to mention that they are not liable for the full cost of new knowledge creation but rather invest their resources to the process of filtering spillovers thus generating income and profits as a reward for risks involved. There are three main characteristics involved in the process of decision making related to economic knowledge (as an opposite to normal economic goods) that influence the cost of decisions making [19]. Those are **high degree of uncertainty**, information is the **asymmetric nature**, and **valuation of knowledge and ideas is non-trivial**.

As this is a process of high risk and high cost, the spillover does not happen automatically. According to authors of KSTE, filter “must be penetrated by knowledge to be appropriated, packaged, modified, and enhanced for it to ultimately contribute to economic growth” [20]. This filter could be modelled under assumptions presented in Table 10 [21].

Table 10 Knowledge Filter Assumptions (cited from Acs et al., 2004)

Economic production functions (goods, knowledge/invention, entrepreneurial/innovation)	<i>Individuals can either be employed in the goods producing sector, the knowledge (invention) producing sector or in the entrepreneurial (innovation) sector</i>
Distribution of entrepreneurial ability	<i>Entrepreneurial ability is distributed unevenly (and exogenously) across individuals</i>
Efficiency of knowledge transformation	<i>There is a filter in the economy influencing how efficiently knowledge is transformed into economic knowledge, implying that only part of the stock of knowledge is converted into economically useful firm-specific knowledge</i>
Type of the channels of transformation	<i>There are two channels to transform knowledge (A) into economically useful knowledge. The first involves incumbent firms and the second involves the entrepreneurial startup of new (Schumpeterian) firms.</i>

Capacity and property of the channels	<i>Incumbent firms transform available knowledge into economically useful knowledge by employing knowledge workers which results in new inventions, new varieties of products and new knowledge. The “thickness” of the filter determines how efficiently firms can transform knowledge into goods and services (commercialization). The thicker the filter, the less efficient exploitation of knowledge.</i>
Emergent property	<i>A start-up (innovation) represents any kind of new combination of existing or new knowledge, where individuals draw on their (given) entrepreneurial ability and the aggregate stock of knowledge.</i>
Competitive conditions	<i>Knowledge produced by firms is non-rivalrous and partly non-excludable</i>

4. Discussion

We would like to contribute to the existing body of knowledge related to KSTE by proposing schematic view of the three systems involved. It is shown in Figure 1 and we believe it could be used as an analytical matrix that could help better understand three systems involved in commercialization of the new knowledge process.

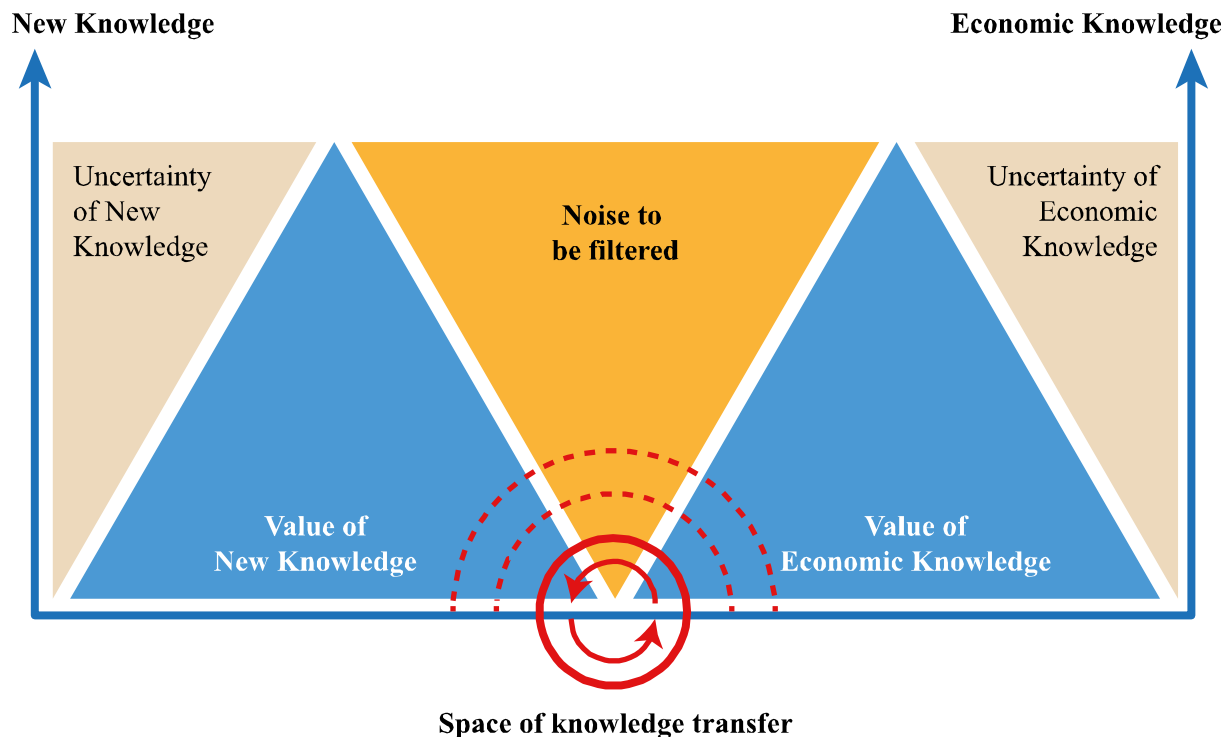


Figure 1 Systemic overview of the KSTE process

The picture above shows three systems; “new knowledge” (NKS), system that creates “economic knowledge” (EKS) and system that filters knowledge spillover (KFS) from NKS to EKS. In the early phase of the research, interests were characterized by high uncertainty. By researching and learning about phenomena of interest, uncertainty is reduced until the NKS system achieved its peak in terms of value. As soon the peak is achieved, it got potential to become economic knowledge, but to do so it should be transformed into EKS system through the KFS. A volume of the noise in the channel is high (and it should be filtered to achieve commercialization). After the peak of the NKS, potential value starts to decline for various reasons so the main corrector is time. For example, invention has higher value at the moment of the discovery than after the results are published and after patents are obtained. Value is reduced in the administrative process of writing and publishing papers, reports and

filling patent forms. By having employed thousands of researchers is high expense and time needed to publish results and fill the patents documentation could take years. Therefore, time directly influences cost of the KTO activities. Once the patents are registered and scientific papers are published, there is no noise involved, but also potential market value is reduced. According to the performance we see indicators as presented above in the text, that in this space most of the activities of KTO are over. By observing the KTO performance through the lens of proposed analytical framework, we could explain high costs associated with time dimensions and low level of noise in the channel. The higher the noise is, the higher benefits and commercial impact can be achieved, but also the risk is higher. Moreover, if KTO offices belong to government owned organizations, incentive schemes involved for the employees that are “pitching” the new knowledge to industry usually is not very flexible. This is the area where **High-impact Entrepreneurs** become important factor. They work in the companies they own, or have shares of and are highly motivated by potential rewards for their risk taking. In addition, as these are smaller companies, negotiation with organizations that are interested in outputs of NKS could be streamlined, and conducted more efficiently. Therefore, we could say that we have competition in the NFS between government owned organization KTOs and **High-impact Entrepreneurs**. Competition is welcome, but the problem is that PRO KTO's are very expensive to run with very limited results in terms of performance and economic impact. At the right side of the picture, we could again see the increase of the uncertainty, but this time it is related to the market and economic knowledge. For example if new patent is acquired and company is the first on the market and if it has a period when nobody could compete, because of legal restrictions, we get the peak of the EKS potential. Nevertheless, as time goes on, more and more competitive products enter the same field, uncertainty increases and EKS has to turn back for the new portion of the signals from the NKS.

As the evidence of the noise presented in our systemic overview, we would like to present in short some findings from the master thesis of the one of the authors in which 270 universities web pages were analysed, where some kind of research is offered to the public. Initial aim of the research was to analyse type of the projects where universities are involved with (private/government/NGO), and what are the budgets of those projects and what is the quality of the information related to the projects. In the process of data collection we have to switch from the initial research questions and change the methods from quantitative to qualitative, as there is no possibility to conduct planned analysis. The data presented on those web pages was incomplete, even in some cases it did not exist and it was not possible to find common pattern that could be used to structure collected data. We even moved step back and went to look for simple numbers such as number of teachers and employees and results of our findings were not very encouraging. We have done analysis of the universities web sites and Wikipedia pages and there was relatively small percentage of universities that even have data about actual number of people teaching at those universities (Czech Republic 13,8%, Austria 38,5%, Croatia 37,2%). Those findings are aligned with the EU study we presented earlier, where *“most time-consuming step is to obtain contact information for the KTO that serves each PRO”*.

5. Conclusion

Instead of the conclusion we would like to cite Professor Wilson who, almost 15 years ago, reminded us that *“data and information may be managed, and information resources may be managed, but knowledge (i.e., what we know) can never be managed, except by the individual knower and, even then, only imperfectly”*. To create the social and economic benefit from the new knowledge made by the academic institutions we should focus on the managing the noise

that stands on the way in this process. In addition, we could do it by systemic view on the sender, receiver, message and information it conveys from the humanistic perspective that challenge technocratic paradigm to which knowledge management belongs. With this approach, entrepreneurship, which as a discipline has a major task challenging existing paradigms, should play an important role.

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Which Freedoms are most Important to Entrepreneurship?

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Abstract. The purpose of this paper is to identify those dimensions of economic freedom which have a stronger influence on business creation at different levels of development and institutional quality. It investigates the relationship between the level of new firms' creation and the dimensions of economic freedom in groups of countries. To measure entrepreneurial activity data were collected from World Bank Doing business on new business density, as the dependent variable while the ten components of the Index of economic freedom released by the Heritage Foundation and Wall Street Journal are used as independent variables. The research uses data for 76 countries, grouped in two clusters according to their level of development and several economic freedom characteristics. The findings reveal certain differences between the two groups of countries in terms of the types of freedom influencing business creation. Econometric modelling shows that in those countries with lower level of development and weaker institutions, the level of start-up entrepreneurship is mostly influenced by trade freedom and business freedom while in more developed countries with higher quality of institutional framework, the level of new business formation is positively influenced by financial freedom and low government spending.

Key words: *entrepreneurship, new business density, economic freedom, statistical methods*

1. Introduction

Entrepreneurship has been widely acknowledged as a driver for economic performance, greater entrepreneurial activity being associated with greater economic prosperity (Holcombe, 1998; Baumol, 2002; Van Praag&Versloot, 2007).

At the same time, the existing literature emphasizes on the importance of institutions in supporting entrepreneurial activity (Sautet, 2005; Aidis et al., 2008; Valdez&Richardson, 2013). That is, institutional quality can explain and model the relationship between entrepreneurship and economic development (Díaz Casero et al., 2013) and influences the nature of entrepreneurial activities (Baumol, 1990; Hall&Sobel, 2008; Powel, 2008).

Economic freedom is one dimension of institutional quality which has been largely explored in literature as related to entrepreneurial phenomenon. Kreft&Sobel (2005, 614) conclude their study on the relationship between public policy, entrepreneurship and economic growth by stating that "economic freedoms generate growth primarily because they promote underlying productive private-sector entrepreneurial activity". Campbell&Rogers (2007) showed that there is a positive and powerful relationship between economic freedom and new business formation.

At the same time the effects of economic freedom are proven to vary according to the stage of development (Kuckertz et al., 2016) and for a more accurate analysis its dimensions should be considered separately (Aidis et al., 2012).

Starting from these aspects, the aim of this paper is to identify those dimensions of economic freedom which have a stronger influence on business start up at different levels of development and institutional quality. It investigates the relationship between the level of new firms' creation and the dimensions of economic freedom in groups of countries. Countries' grouping is obtained with cluster analysis. The paper aims as well at estimating econometric models at cluster level to explain the variation of entrepreneurial activity in relation with the components of economic freedom.

This paper continues as follows: the next section provides a brief review of the recent literature on the subject. Section 3 focuses on data and methodology used in this study. The research results are presented and analysed in Section 4. The last section summarizes the conclusions of this study.

2. Literature review

The construct of economic freedom encompasses multiple dimensions such as, secure property rights, lack of corruption, small size of government, low business regulations, freedom to trade, to invest etc. Each of these dimensions is to a greater or a smaller extent related to entrepreneurial activity.

Property rights protection is proven as significantly positively related to the level of start-up (Chowdhury et al., 2015). Freedom from corruption is also significantly related to new entries (Aidis et al., 2012). Desai et al (2003) find that better protection of property rights and greater fairness (the opposite of corruption) are associated with higher rates of entry and lower exit in Central and Eastern Europe. The authors conclude that "greater fairness and stronger protection of property rights are critically important in encouraging both the emergence and the growth of new enterprises, particularly in emerging markets" (Desai, Gompers & Lerner, 2003, 31).

Besides secure property rights and better legal structure, a smaller government sector tends to increase entrepreneurship (Nyström, 2008). High government spending can create barriers to entrepreneurship and a large public sector may reduce the market options of the potential entrepreneurs (Díaz Casero et al., 2015).

When it comes to fiscal freedom, several existing studies show that the greater the level of taxes, the lower the level of new firm startup (Chowdhury et al., 2015) and the tax administrative burden significantly diminishes the entry rate (Braunerhjelm & Eklund, 2014). On the other hand the relationship between fiscal freedom and entrepreneurship is considered a complex one and "can vary depending on existing factors such as capital gains tax, income tax and corporate tax" (Herrera-Echeverri et al., 2014).

Investment freedom is also positively related to starting a business. Removing barriers and making financial resources available encourage startup entrepreneurial activity (Chowdhury et al., 2015).

The link between business creation and freedom to trade was also explored in literature (Sobel et al., 2007). Some researchers argue that there is a "symbiotic relationship" between them (Herrera-Echeverri et al., 2014, 1922).

Low business freedom in terms of numerous start-up procedures is negatively correlated with the level of new firm start-up (Klaper et al., 2006; Chowdhury et al., 2015).

These are only some of the dimensions of the broad concept of economic freedom we also use in this study. The above literature review has the purpose to set a brief state of art on the subject and to provide the rationale for our research.

The next part of the paper focuses on the used data and the applied methodology.

3. Data and methodology

3.1 Data

Data used in this study were collected from three different sources. Entrepreneurial activity is measured in terms of *New business density* from World Bank Doing business. It is used as the dependent variable and it reflects the number of new registered companies per 1000 working-age people (age ranging from 15 to 64 years).

Economic freedom data are the independent variables. The study uses the components of the Index of Economic Freedom released by the Heritage Foundation and Wall Street Journal. The Index covers ten freedoms grouped into four pillars: Rule of Law (Property rights, Freedom from corruption), Limited Government (Fiscal freedom, Government spending), Regulatory Efficiency (Business freedom, Labour freedom, Monetary freedom) and Open Markets (Trade freedom, Investment freedom, Financial freedom). Each component is graded on a scale from 0 to 100, the higher the value, the higher the degree of freedom. Also, each is being given an equal weight in aggregating the overall index of a country's economic freedom.

GDP per capita is also used as an independent variable. Data are in current U.S. dollars and they were drawn from World Bank.

Our study database includes 76 countries. Data were collected from 2014 surveys.

3.2 Methodology

Correlation analysis is used in order to study the intensity of the relationships existing between the variables and identify those factors which have a strong association with the level of entrepreneurial activity. For the considered sample, of 76 countries, the bivariate correlation between *New business density* and each independent variable using the Pearson correlation coefficient was studied.

The economic freedoms from each pillar having the highest correlation coefficients were subsequently selected to perform a cluster analysis: from Rule of Law we selected *Property rights*; from Limited Government, no dimension was chosen since none of the two is significantly correlated with New business density; from Regulatory Efficiency, *Business freedom* was selected and *Financial freedom* from Open Markets. GDP per capita was also included.

At the level of the two resulting clusters, new correlation analyses were performed and several econometric models were estimated to explain the variation of *New business density* in relation with the economic freedoms, at cluster level. The most significant factors were selected using stepwise regression method.

4. Results and analysis

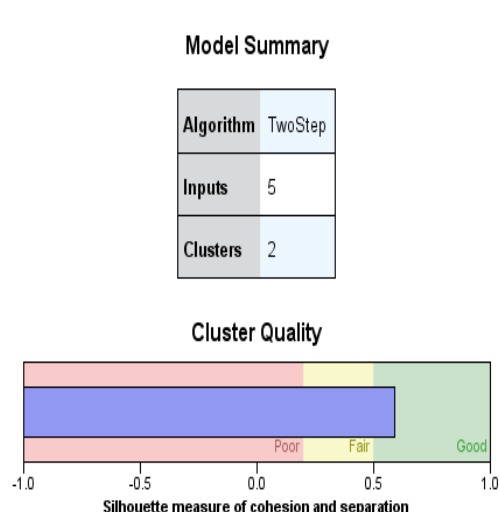
The correlation analysis results show that *GDP per capita* and eight of the ten economic freedoms namely, *Property rights*, *Freedom from corruption*, *Government spending*, *Business freedom*, *Labour freedom*, *Monetary freedom*, *Trade freedom* and *Financial freedom* are positive associated with the level of New business density.

Table 1 Correlations

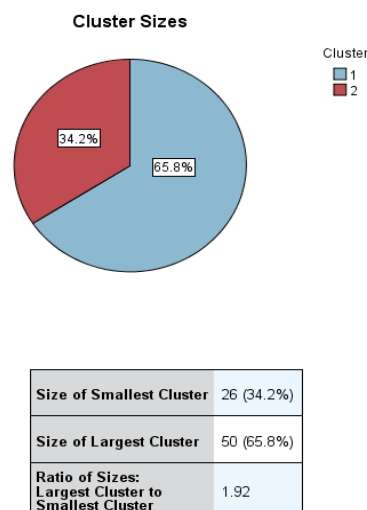
	New business density		
	Pearson correlation	Sig.	N
New business density	1		76
Property rights	0.520	0.000	76
Freedom from corruption	0.493	0.000	76
Fiscal freedom	0.042	0.718	76
Government spending	-0.039	0.738	76
Business freedom	0.524	0.000	76
Labour freedom	0.382	0.001	76
Monetary freedom	0.330	0.004	76
Trade freedom	0.409	0.000	76
Investment freedom	0.419	0.000	76
Financial freedom	0.538	0.000	76
GDP capita	0.348	0.002	76

Source: authors' presentation based on the output obtained in SPSS.

Two-step cluster analysis results show that the analysed countries can be optimally grouped into two clusters, as shown in *Figure 2* and *Figure 3*.



Source: Output obtained in SPSS.

Figure 2 Clusters' Quality

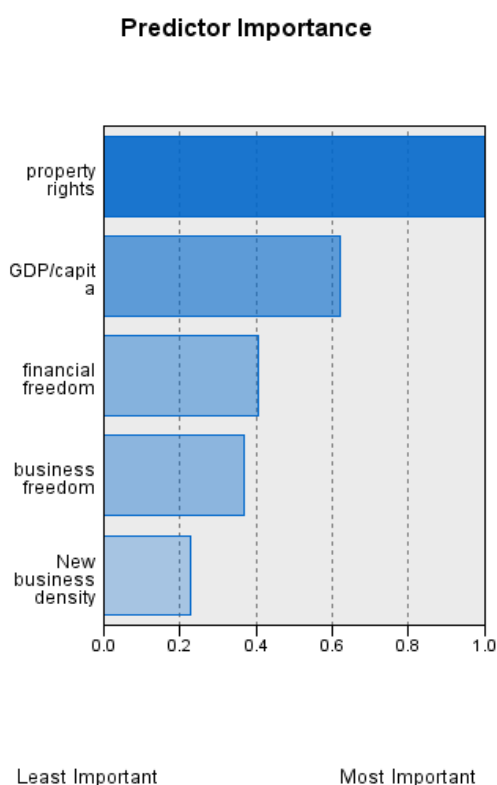
Source: Output obtained in SPSS.

Figure 3 Clusters' Sizes

The results presented in *Figure 2* and *Figure 3* show that the optimal number of clusters considering the similarities and differences between countries is 2. The cluster quality chart indicates that the overall quality of the model is „Good”, the coefficient of cohesion and separation being above 0.5.

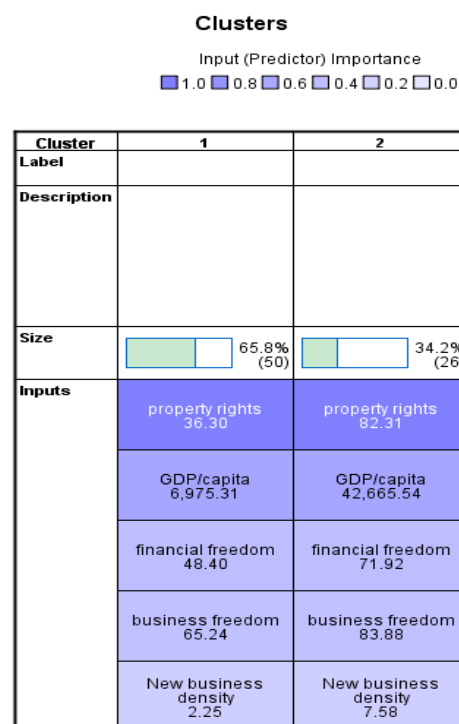
The descriptives for each cluster is presented in *Figure 4*. The variables are sorted according to their overall importance in separating the countries into the two clusters. Thus, the variable that contributes the most is *Property rights*, as opposed to *New business density*, which contributes the least in creating the two clusters. The group averages for all the considered

variables are higher for the countries belonging to the second cluster. The differences between the clusters in terms of the analysed variables are as well observed in *Figure 5*.



Source: Output obtained in SPSS.

Figure 4 **Clusters' Description**



Source: Output obtained in SPSS.

Figure 5 **Comparison between the Two Clusters**

The countries' membership to clusters is illustrated in *Table 2* below.

Table 2 Countries' Membership to Clusters

Country	Cluster membership	Country	Cluster membership	Country	Cluster membership	Country	Cluster membership
Australia	2	Norway	2	Croatia	1	Morocco	1
Austria	2	Portugal	2	Dominican Republic	1	Nepal	1
Botswana	2	Qatar	2	El Salvador	1	Nigeria	1
Canada	2	Singapore	2	Georgia	1	Pakistan	1
Chile	2	Spain	2	Guinea	1	Peru	1
Cyprus	2	Sweden	2	Hungary	1	Romania	1
Czech Republic	2	Netherlands	2	India	1	Russian Federation	1
Denmark	2	Algeria	1	Italy	1	Rwanda	1
Estonia	2	Argentina	1	Jamaica	1	São Tomé and Príncipe	1
Finland	2	Armenia	1	Jordan	1	Senegal	1
France	2	Azerbaijan	1	Kenya	1	Serbia	1
Hong Kong	2	Belarus	1	Kyrgyzstan	1	Slovakia	1
Iceland	2	Belize	1	Latvia	1	Slovenia	1
Ireland	2	Bhutan	1	Macedonia	1	Suriname	1
Israel	2	Bolivia	1	Madagascar	1	Thailand	1
Japan	2	Bosnia and	1	Malaysia	1	Timor-Leste	1

		Herzegovina					
Lithuania	2	Brazil	1	Mexico	1	Togo	1
Mauritius	2	Bulgaria	1	Mongolia	1	Turkey	1
New Zealand	2	Costa Rica	1	Montenegro	1	Zambia	1

Source: authors' presentation based on the output obtained in SPSS.

Further on, we built econometric models for each cluster, using stepwise regression, in order to identify the most significant factors that can help us explain the variation of *New business density*.

The model summaries for each model, for the two clusters, are presented in Table 3.

Table 3 Regression models summary

Model Summary										
Cluster Number	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
						R Square Change	F Change	df1	df2	Sig. F Change
1	1	.489 ^a	.239	.223	2.00844	.239	15.063	1	48	.000
	2	.551 ^b	.303	.274	1.94181	.064	4.351	1	47	.042
2	1	.524 ^c	.274	.244	5.92898	.274	9.078	1	24	.006
	2	.656 ^d	.430	.380	5.36793	.156	6.279	1	23	.020

a. Predictors: (Constant), trade freedom

b. Predictors: (Constant), trade freedom, business freedom

c. Predictors: (Constant), financial freedom

d. Predictors: (Constant), financial freedom, government spending

Source: output obtained in SPSS.

The correlation coefficients (R) for the final models are above 0.5, which means that there is a moderate to a strong dependence between *New Business Density* and the independent variables.

For the first cluster, we notice that adding the *Business freedom* significantly improves the original model, between *New business density* and *Trade freedom* (Sig.=0.042<0.05).

Similarly, for the second cluster, *Government spending* was added to the model between *New business density* and *Financial freedom*, and the result is an improved model compared to the initial model (Sig.=0.02<0.05).

The regression estimates are presented in Table 4.

Table 4 Regression estimates

Coefficients ^a							
Cluster Number	Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
			B	Std. Error	Beta		
1	1	(Constant)	-6.857	2.364		-2.900	.006
		trade freedom	.118	.030	.489	3.881	.000
	2	(Constant)	-7.884	2.338		-3.372	.002
		trade freedom business freedom	.084 .056	.034 .027	.348 .291	2.495 2.086	.016 .042
2	1	(Constant)	-15.122	7.623		-1.984	.059
		financial freedom	.316	.105	.524	3.013	.006
	2	(Constant)	-18.780	7.054		-2.662	.014
		financial freedom government spending	.301 .104	.095 .041	.499 .395	3.164 2.506	.004 .020

a. Dependent Variable: New business density

Source: output obtained in SPSS.

For the first cluster, the estimated regression equation is:

$$\text{New business density} = -7.884 + 0.04 * \text{Trade freedom} + 0.056 * \text{Business freedom}$$

Both regression coefficients are positive, which implies that an increase in *Trade freedom* and *Business freedom* scores results in an increase in *New business density*'s score. On average, an improvement of 0.084 in *Trade freedom*'s score determines a one point increase in *New business density*'s score. Also, an increase of 0.056 in *Business freedom* determines an average increase of one point of *New business density*. Examining the values of standardized coefficients, we observe that the most important factor of influence on *New business density* is *Trade freedom* (0.348).

According to the methodology of the Heritage Foundation and Wall Street Journal, Business freedom stands for “the ability to start, operate, and close a business that represents the overall burden of regulation as well as the efficiency of government in the regulatory process” (<http://www.heritage.org/index/regulatory-efficiency>) while trade freedom is “a composite measure of the absence of tariff and non-tariff barriers that affect imports and exports of goods and services” (<http://www.heritage.org/index/open-markets>).

The countries in this cluster are the ones with lower GDP per capita and less secure property rights, lower business freedom and less financial freedom. Worth mentioning, all former communist countries included in our sample, except for Czech Republic, Estonia and Lithuania, are included in this cluster. The fundamental market institutions in these countries are still to be developed. The burden of numerous procedures and costs for starting a business generate high transaction costs and discourage start-up entrepreneurial intentions.

For the second cluster, the estimated equation of regression is:

$$\text{New business density} = -18.78 + 0.301 * \text{Financial freedom} + 0.104 * \text{Government spending}$$

An increase in *Financial freedom* and in *Government spending* scores determines an increase in *New business density*'s score. The values of the estimated regression coefficients shows that an average increase of one point in the *New business density*'s score is determined by an increase of *Financial freedom*'s score with 0.301 and by the increase of *Government spending*'s score by 0.104 points. The most important factor of influence on *New business density* for the second cluster of countries is *Financial freedom* (0.499).

Financial freedom, a component of Open Markets pillar, captures banking efficiency and measures the independence from government control and interference in the financial sector (<http://www.heritage.org/index/open-markets>). Government spending is included in Limited Government pillar and takes into account the level of government expenditures as a percentage of GDP (<http://www.heritage.org/index/limited-government>)

The countries in this cluster are the more developed ones, with high institutional quality, which encourage entrepreneurial activity by increasing the ease of doing business, securing property and providing access to financial resources. At the same time, government spending is often high and supported by a high level of taxes which may discourage entrepreneurs by weakening the incentives. And, as the existing studies point out, a welfare state reduces the incentives for necessity entrepreneurs (Aidis et al., 2012) and in the case of higher taxes, potential entrepreneurs will be discouraged to engage in business start-up (Braunerhjelm & Eklund, 2014; Chowdhury et al., 2015).

5. Conclusions

The purpose of this study was to identify those dimensions of economic freedom which have a stronger influence on business start up at different levels of development and institutional quality in 76 countries.

The results of this paper once again confirm the relation between institutional quality, hereby measured with components of economic freedom and entrepreneurial activity.

The results of the correlation analysis pointed out that stronger property rights, lower levels of corruption, lower government spending, higher business, labour, monetary, trade and financial freedoms are positively significantly associate with the degree of business creation. Also, there is a positive relation between economic development in terms of GDP per capita and the level of business start-up. Our findings are in line with research results from the existing literature.

The estimated econometric models show that there are differences in the components of economic freedom that influence new business creation, according to the level of economic development and institutional quality. For the cluster which includes those countries with a lower level of economic development and lower institutional quality, the variations in the degree of business creation are rather explained by business freedom and trade freedom.

For the other analysed countries, with opposite characteristics for the cluster predictors, low government spending and high financial freedom are the dimensions which better explain new business formation.

These aspects suggest the directions of intervention for increasing the degree of business start-up: increasing the ease of doing business and removing barriers from trade, in countries with lower level of development and weaker institutions and diminishing the size of government, i.e. reducing government spending and increasing access to financial resources in developed countries.

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**CIET
2016**

Track 3

**Information Technology,
Electrical Engineering and
Mechanical Engineering**

Knowledge representation in the ontological engineering using conceptual modeling and graph-based reasoning

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Abstract. The process of software engineering follows a few basic stages of development: the business system analysis, the design of the new software solution, the software development with correctness verification and, finally, the software implementation in a user environment. Ontological engineering is also considered through the basic engineering steps. It can be perceived as a support for the process of developing information systems through two aspects: the conceptual modeling and the formal implementation. The conceptual knowledge is a representation of knowledge of considering the business system domain. Tools and languages for building formal ontology support the knowledge representation described with the conceptual model. The integration of ontological engineering in software engineering can be considered as the improvement in the development, implementation and use of the information system.

In this paper, the knowledge representation and reasoning formalism of ontology are presented with a graph-based formalism. This formalism is logically founded, and it is a key feature for knowledge representation and reasoning.

An ontology lifecycle development starts with competency questions about the domain specification. The specification of concepts and basic relationships by a conceptual graph model are the foundations for the modeling of formal ontology elements such as rules and constraints. Complex queries derived from competency questions are also presented with graph-based formalism. Relations between graphs like specializations and generalization operations, and also mapping like homomorphism, will optimize the ontology structure. The described process of ontology development is applied to a case of education domain modeling.

Keywords: *knowledge base, knowledge reasoning, ontology, competency questions, conceptual graph*

1. Introduction

Development and maintenance processes of software solution can be complemented by the usage and integration of ontologies. The role of ontology using is manifold: the support in modeling, the impact on the architecture of processes and data, and the implementation of ontology as an integral part of the new software versions [1].

Using the ontology we can show the structure of any domain, organized at the level of concepts and their relationships. In practice ontology represents a meta-model for database model of individual software solutions. Defined standards are used to support programs with the aim of the better communication with the environment. In this case we are talking about achieving interoperability (especially on the Web) among software solutions [2]. We say that the ontology allows efficiency of collecting and processing the diverse and multi-purpose knowledge. So the ontology becomes an integral part of knowledge representation. Using the software solution

supported by the ontology [3] and by Semantic Web [2] [4] we have the following important features:

- *Providing communication* between people and systems supported by computer because it reduces the conceptual and terminological ambiguities. The ontology increases the consistency of information, eliminates ambiguity and combines different versions of the same domain.
- *Information retrieval* on the Internet is facilitated by using the ontology. The ontology contains information structured in a vocabulary. Web becomes a huge dictionary that provides faster and more comprehensive access to the source of the requested information.
- *Accessing to information* from the user or the system can be expressed in an unfamiliar language or an unknown format. Ontology helps to identify information and helps to improve associations between sets of concepts and relations between concepts.
- *Interoperability* as an interaction among different users or software tools for data exchange. In this case the ontology plays a role of the reference domain model that will be able to support translation from one programming language to another and from one data structure to another.

A development and implementation of the ontology is not an easy task. This problem requires a detailed and sophisticated development methodology, and even with this strategy ontology development is more an art than conventional technological or engineering task [4].

Authors of ontology development use ontological editors that offer a graphical interface for creating and editing ontology which is necessary to define the ontological concepts, their attributes, properties and relationships. After this activity it is necessary to decide how to record the ontology in a formal language such as OWL and RDF / RDFS [5].

In this paper we proposed a method of ontology development combining the best practices of several established sources. We are using, so called, competency questions [6] in learning about domain (such as user requirements in software engineering). Elements of ontology modeling are creating according to the ontology engineering such as methodology in [5]. For the domain knowledge representation and reasoning we are using techniques of conceptual graphs [7]. This procedure follows the development of a case study of the Human Resource Management (HRM) domain.

The second chapter of this paper describes opportunities provided by ontological engineering for upgrading the software solution development and an information system architecture. The third chapter defines specification purpose and scope for example of ontology cluster for HRM. We create a part of concepts and relations taxonomies for HRM ontologies. In the fourth chapter we have used, so-called, Competency Questions (CQs) for developing an ontology purpose and scope. For those CQs examples we made compatible conceptual graphs. The fifth chapter is composed of (1) an example of the conceptual graph formalized into RDF(S) language, and (2) the conceptual graphs homomorphism that help us to demonstrate that individual programs can be upgraded with ontology. The conclusion highlights the possibility of sharing the software engineering and the ontological engineering.

2. Ontologies in software engineering

The software (or the information system) construction is a complex process, and it is necessary to look at the overall architecture of the business processes. The study of enterprise business includes activities like modeling the business organization, the business information and the business technology. These models are then used in business software engineering, from problem analysis, program's design, program's development, to testing and implementation in user's environment.

2.1 Ontological engineering as an extension of software engineering

Software engineering is composed of several basic stages of development such as analysis of the business system, the design of future software, development of the software solution, testing, validation and verification, and, finally, the implementation in the user environment (Figure 1). At the very beginning, before development activities, it is necessary to make a project plan and also, consider the business problems and the scope of the required solutions. It is necessary to create a schedule of software development activities according to the selected methodology.

The complexity of development of the entire information system required to pay attention to the *information system architecture* [8] [9] [10]. Except the functionality of business it is necessary to examine the relationships of different business subsystems, especially data and information sharing among these subsystems. These requirements have influence to the architecture of databases, software, hardware, communication and so on.

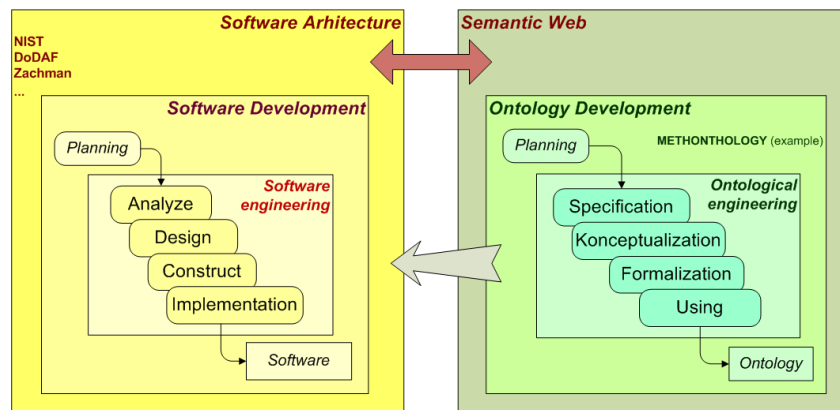


Figure 1 Software development and Ontology development

On the other hand, methodologies for *ontology development* are used in various areas of business and human activities [4] [5] [11]. To improve the process of information system development and quality assurance of software solutions we are considering the influence of ontological engineering as a part of software engineering.

In the ontology development we also recognize the basic engineering steps. Figure 1 shows the *ontological engineering* composed of the specification of domain models, the conceptualization of domain elements and the formalization of these elements in the computer supported ontology. We can conclude that the combination of the ontological engineering and the software engineering together is an improvement of development, implementation and use of the system [12].

2.2 Ontological engineering process

The elaboration of basic stages of the ontology development is described in detail in several methodologies [4] [5] [11] [12]. Some methodologies describe only the ontology development and some others are comprehensive and include planning, management of ontology developing and results monitoring. Examples of such methodologies are METHONTOLOGY [5] and NeOn [13].

According to aforementioned references, we can conclude that, in addition to the basic stages of ontology development, we need a detailed specification of each phase (Figure 2). Like a classical requirements engineering in the software engineering process, the ontology development starts with the domain specification which is composed of (1) the specification of purpose and usage of the ontology, scope of the domain and, finally, degree of the formality, and (2) data collection using different methods. The conceptualization phase is divided into (1)

the conceptualization of domain vocabulary and the result is the preliminary ontology, and (2) consideration of possible integration with other ontologies. The implementation phase is composed of (1) the formalization in an ontology language and (2) the evaluation of the completeness, consistency and redundancy of developed ontology. Most of these steps, we will describe and use in modeling the HRM case study.

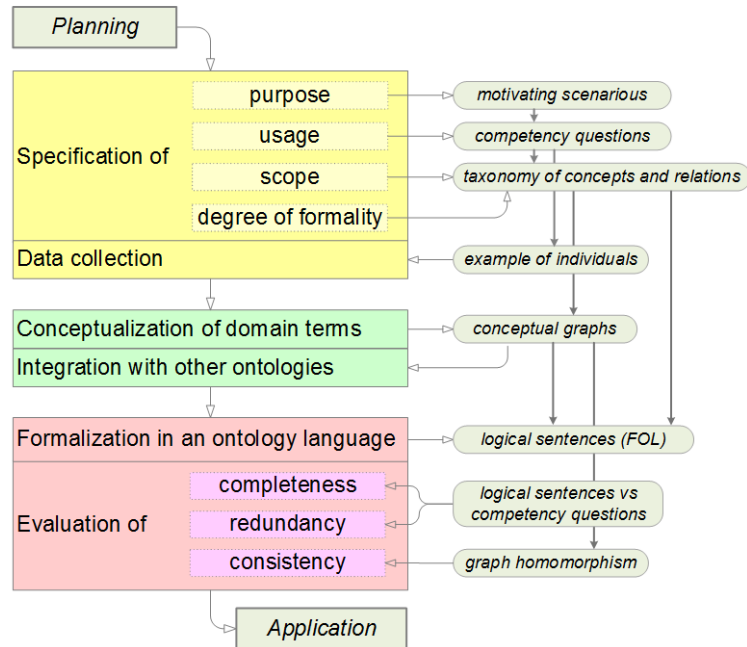


Figure 2 Ontological engineering phases and models

Figure 2 shows the steps of the ontology development and input/output documents or models. Techniques used in this paper for modeling ontology elements during ontological engineering are motivating scenarios and competency questions for the domain description [6], and graph-based knowledge representation and reasoning for the ontology structure [14]. Logical sentences are a form of knowledge representation described by CQs. Logical sentences are written using conceptual graphs. Construction, testing and modification of conceptual graphs are accompanied by reasoning formalisms.

3. Ontology design for the domain of Human Resource Management

A HRM problem will be the basis for a case study where we will present (1) development of ontology model elaborated towards activities in Figure 2, (2) model of domain knowledge using conceptual graphs, and (3) application in a Web environment by testing the possibility of matching a one software example in the default ontological model.

Literature [15] [16] describes mentioned problem and suggests some solutions. The enterprise management emphasizes the HRM as an ongoing process that important fields are shown in Figure 3. The focus of the case study will be on education, competence and knowledge.

3.1 Ontologies cluster for Human Resource Management

The set (the cluster) of HRM ontologies are based on two key elements: *Job Offer Ontology* and *Job Seeker Ontology*. *Job Seeker Ontology* includes information from a CV like education and acquired knowledge, previous jobs, skills and competences. *Job Offer Ontology* contains information about employers, job offers and job vacancies.

Education Ontology includes information about levels and fields of education. Fields of education are based on FOET¹ taxonomy and level of education on standard ISCED 97² [17].

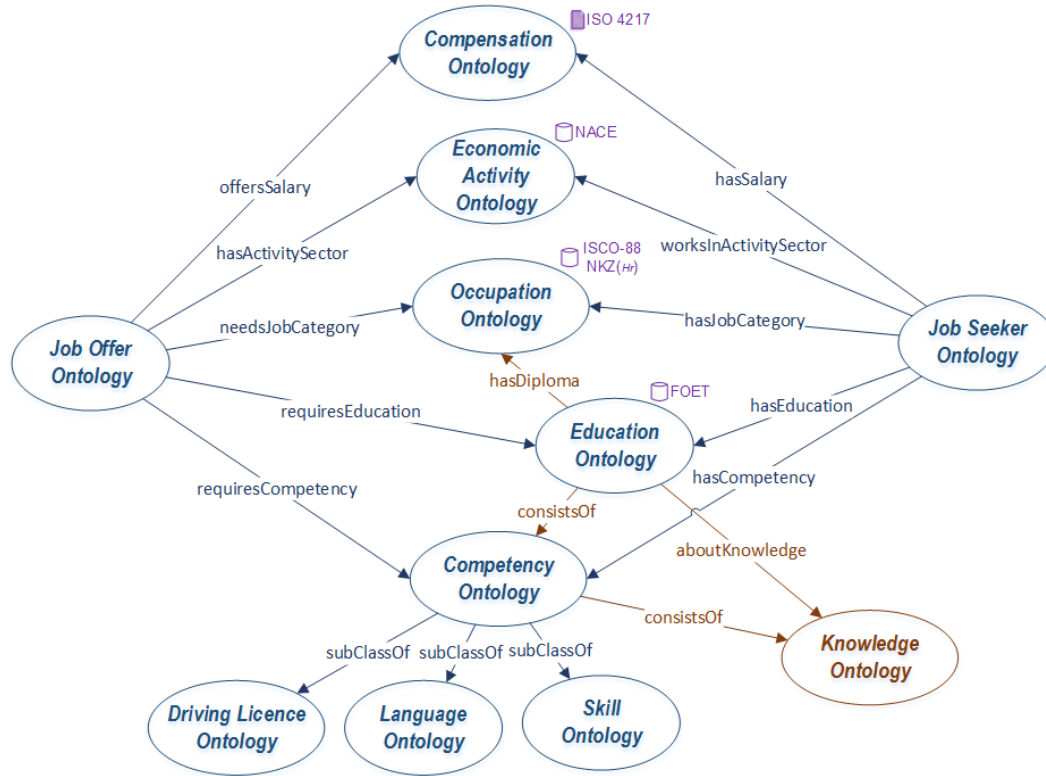


Figure 3 Ontologies cluster for Human Resource Management [18]

Occupation Ontology includes information about occupations and workplaces. An integral part of this ontology is taxonomy of workplaces standard ISCO-88³ [19]. In the following discussion it will be analyzed the set of occupations associated with *Job Seeker Ontology* work experience and workplace, or required work experience from *Job Offer Ontology*.

Compensation Ontology describes the concepts related to salaries and wages for employees. An integral part of this ontology is the currencies concept standard ISO 4217⁴. *Economic Activity Ontology* describes a model of economic activities which includes a taxonomy of standard NACE⁵ [20]. For simplicity and because of the case study specification of purpose, *Compensation Ontology* and *Economic Activity Ontology* will not be include in further considerations.

Competency Ontology combines several sub-ontologies from different fields of competences. Figure 3 shows examples for skills, language and driving license. *Competency Ontology* and *Job Offer Ontology* are connected via the vacant jobs. Both are related to *Job Seeker Ontology* through the application of candidates. *Education Ontology* is connected via competencies required by education. For simplicity of further analysis of our case study, only *Competency Ontology* (not its sub-ontology) will be considering. It is not easy to give a precise definition of competence. Many papers highlight this issue and give a proposal of definition. So the

¹ FOET Fields of Education and Training

² ISCED International Standard Classification of Education was adopted by the UNESCO General Conference in November 2011. The ISCED classification serves as an instrument to compile and present education statistics both nationally and internationally. The framework is occasionally updated in order to better capture new developments in education systems worldwide.

³ ISCO-88 International Standard Classification of Occupations

⁴ ISO 4217 International Standard for currency codes

⁵ NACE European Classification of Economic Activities

definition from the paper *ECTS User's Guide* [21] says that the competencies include dynamic combination of knowledge and understanding, intellectual and practical skills, and so on.

Clusters described above are extended with *Knowledge Ontology*. Concepts of knowledge areas are associated with *Education Ontology* and *Competency Ontology*. For our case study, we have set a small part of the Computer science knowledge area [22].

3.2 The importance of the selected ontologies cluster and fraction of their taxonomy

We have seen that ontologies clusters described above (cluster of *Job Offer Ontology* and cluster of *Job Seeker Ontology*) containing well-defined standards. Concepts and relations of standardized taxonomies are the foundation for automating queries addressed to the potentially interested actors. For example, after RH joined EU, our citizens have the opportunity for employment in the large labor market. However, if we have search (via the Web) these wide area, we probably will not receive clear answers about job offer or job seeker and what are their requests. So far we have looking for the job in RH where we know a lot of information about enterprises, their activities, workplaces and so on. Now, we can access to the large number of data at EU level, but these data are not unified in one location neither are grouped by businesses, professions, education areas or languages. Therefore, it makes sense to modeling the conceptual knowledge level about this complex issue, and for the beginning it is exactly the model in Figure 3. The problem is very complex and detailed design of all clusters and related ontology exceed the scope of this paper (there are examples of case studies that deal with these details, such as [15] [18]).

However, for further analysis of our case study we should develop our ontologies in more detailed elements (concepts and relations). Figure 4 shows only the part of concepts taxonomy and relations taxonomy. We will specify the definition of vocabulary in the following way:

Definition of vocabulary: Let a triple (T_C, T_R, I) is consists of T_C , T_R and I that are finite pairwise disjoint sets. The set of concepts T_C , the set of relations T_R , and the set of individuals I defined vocabulary $\mathcal{V} = (T_C, T_R, I)$, and there are satisfying the following conditions:

- T_C is the set of concepts with a subsumption⁶ relation, denoted \leq , and with maximal element denoted \top ,
- T_R is the set of relation divided into subsets T_R^1, \dots, T_R^k with arity $1, \dots, k$, respectively. Any two relations with different arities are not comparable. Every relation subset has subsumption hierarchy.

By the definition, in Figure 4 is shown the part of the vocabulary of the HRM. There is a set of concepts (A), a set of relations (B) and an example of individuals (C). An example of the ontologies cluster is made in the tool *CoGui* [23].

4. Ontology specification and conceptualization

Specification of the problem begins with the purpose of our case study.

The first step in the specification of ontology is the creation of, so-called, *motivating scenarios*, which describe a business problem. Scenarios are the basis for defining the *competency questions* about a detail level of conceptualization. Furthermore, these questions are the basis for the development of ontology elements, like dictionaries and taxonomies, and also rules among concepts and relations [24].

⁶ A **subsumptive** containment hierarchy is a classification of object classes from the general to the specific. Other names for this type of hierarchy are *taxonomic hierarchy* and *is-a hierarchy*. The taxonomical structure is a subsumptive containment hierarchy.

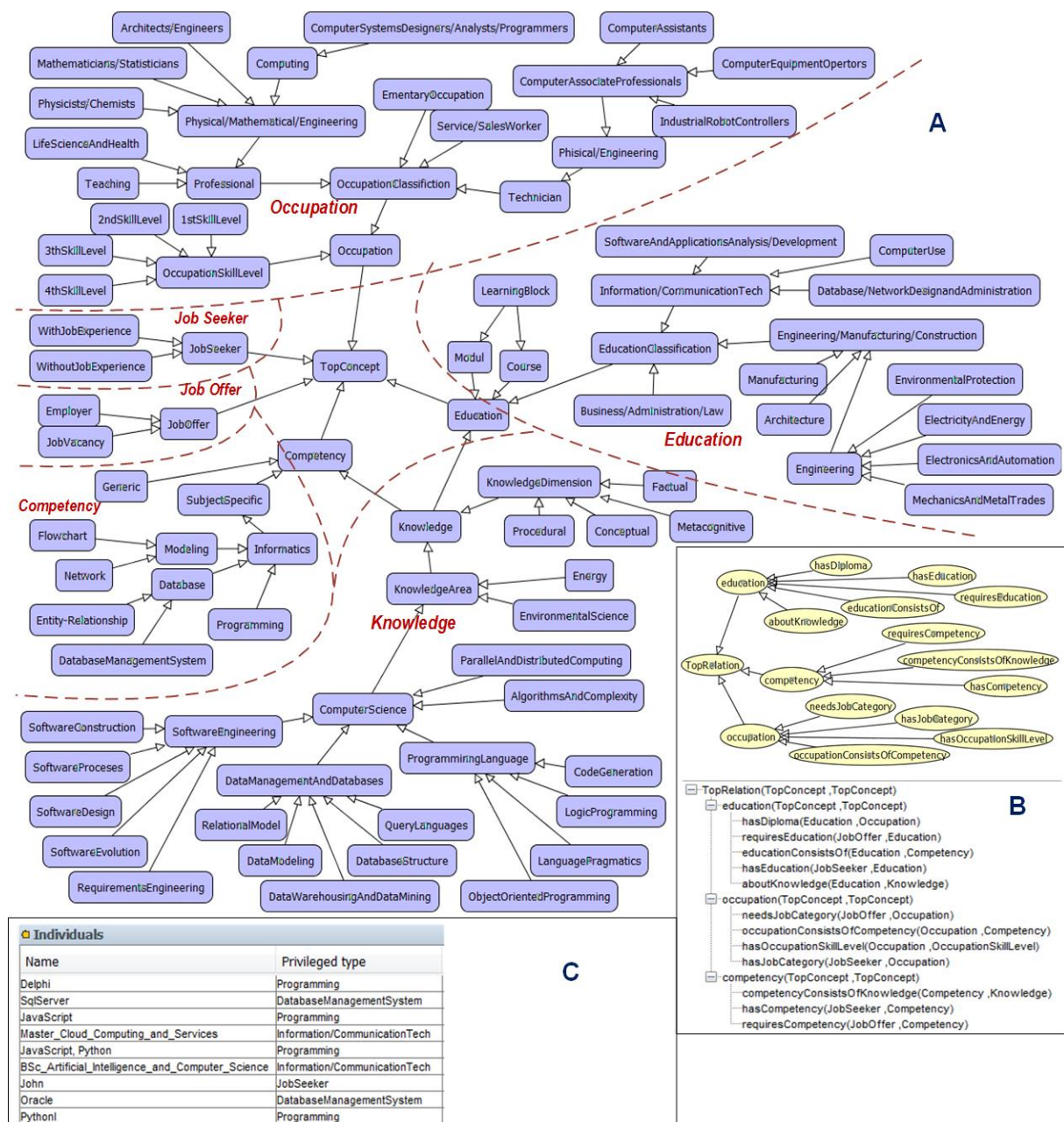


Figure 4 A part of ontology cluster for Human Resource Management

4.1 Motivating scenarios

We chose one motivating scenario that describes an example of request for workplace:

In the job offer of ICT sector someone is seeking candidates for Computer Systems Designers/Analysts/Programmers jobs, for example, for the working place of BI/DWH⁷ developers. Required knowledge must be in the field of Software Engineering (specifically in fields of Software Design and Construction Software), Programming (specifically in fields of Object Oriented Programming and Algorithms and Complexity) and Data Management and Databases (specifically in fields of Database Structure, Query Languages and Data Warehousing and Data Mining). Candidates must have a degree of bachelor or master of profession of ICT studies. The skills that candidates must have are excellent knowledge of software tools such as Word, Excel, PowerPoint, JavaScript, C # and SQL Server or Oracle.

⁷ Business Intelligence / Data Warehouse

This scenario describes a typical example of job advertising. This is a good reason to modeling the scenario functionality through the ontologies cluster, like the example in Figure 3. According to [6] [25] the detail specification of the scope and usage will be written in the form of competency questions.

4.2 Competency questions and conceptual graph

Competency questions (CQs) are written in the informal form and they describe elements of ontology. Responding to these questions ontologist checks taxonomy of concepts and relations, and develops other structure of the ontology. CQs are made on the basis of motivating scenarios. For the scenario from the previous chapter, here are some important CQs:

- CQ1)** *Job Offer provides jobs for a certain profession and completed education with specific skills and competencies.*
- CQ2)** *Job Seeker was completed ICT education, he has a knowledge about databases and programming, and he is looking for developer jobs.*
- CQ3)** *The person was working as a software engineer and acquired 3th⁸ level of skills, and also, he was working as a programmer and acquired 4th⁹ level of skills.*
- CQ4)** *What skills can expect employers for completed education in the field of software and application analysis/development?*

In the practice, the use of CQs is quite subjective and depends on the ontologist experience (after all, this process is similar to the user requirements specification in software engineering). One of the important dilemma when we are creating the vocabulary and taxonomies is an identification of granularity. It is important, but not easy, to determine the level of detail when we build the structure of concepts (also the structure of relations). For example, in Figure 3, we can ask the question whether we will develop *Education Ontology* on the level of overall FOET taxonomy, or we will make only the elementary level. Because of the limited space of this paper an example of taxonomy, Figure 4 shows a small part of whole ontologies cluster.

Four examples of CQs will be written in the form of graph-based sentences. Parts of these sentences are concepts and relations with each other graphically related. We will specify the definition of conceptual graph in the following way:

Definition of Conceptual graph: A basic conceptual graph over a vocabulary $\mathcal{V} = (T_C, T_R, I)$, is a 4-tuple $G = (C, R, E, l)$ satisfying the following conditions:

- A triple (C, R, E) is a finite bipartite multigraph. C is the set of concept nodes, R is the set of relation nodes, and E is the family of edges,
- l is a labeling function that joined nodes and edges,
- Edges incident to a relation node $r \in R$ are totally ordered and they are labeled from 1 to arity of relation r .

According to [26] each recognized CQs will be modeled in appropriate conceptual graph. All relations in the conceptual graphs in Figure 5 have arity of relation 2. Labels of concepts and relations are specified in all graphs, and the edges of relations should not be labeled because each of edges is the first (start arrow) or the second (end arrow).

The conceptual graph in Figure 7a) is the result of procedures like generalization and specialization of graphical structures in Figure 5 (procedures are described in [14]). If we apply these procedures, we can define a procedure that optimized the development of the integrated graph. In this paper we assume the existence of the graph in Figure 6. The procedure itself will be the subject of the further research.

⁸ According to the ISCO-88 specification that may include skills such as communication with customer, understanding the needs of business system, and the coordination and control of the software development process.

⁹ According to the ISCO-88 specification that may include skills such as passed advanced courses of programming languages, analysis of complex algorithms, design of demanding interfaces, and integration of software solutions.

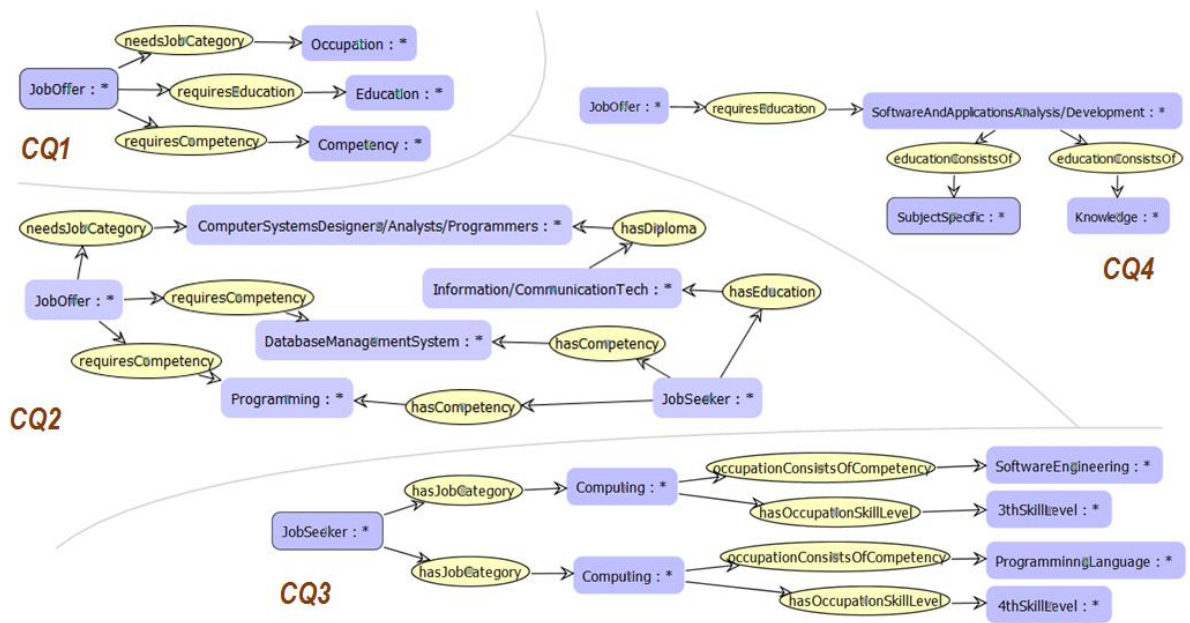


Figure 5 CQs in the form of conceptual graphs

5. Formalization and evaluation

Characteristics of the Web are the basis for the development of ontology languages (*Web-based ontology language* or *ontology markup language*). The syntax of ontology languages is based on HTML and XML languages. RDF (*Resource Description Framework*) and its extension RDFS (*RDF Schema*), together denotes as RDF(S), allowing the construction of semantic annotations given by a set of triples (*subject, predicate, object*) [4]. RDF(S) is a language designed for processing metadata to support the exchange of information by the Web (interoperability among applications).

5.1 An example of general concepts formalization

Ontologies cluster for our case study is a reference model for the structure, format and the understanding of information. Take a look at descriptions of some basic elements of RDF(S) language [5]. The most general class is *rdfs:Resource* for defining any Web resource. The class *rdfs:Class* defines the class of all classes. The class *rdf:Property* defines the class of properties. Some of core properties are: *rdf:type* states that a resource is an instance of a class, *rdfs:subClassOf* and *rdfs:subPropertyOf* are used to define class taxonomies and property taxonomies respectively. The conceptual graph and RDF structure share very similar characteristics. Therefore, the conceptual graph can be written in RDF(S) language [27] following the comparison shown in Figure 6.

Conceptual graph element	RDF(S) triple
C concept type	C rdfs:type rdfs:Class
R binary relation type	R rdfs:type rdf:Property
$C \leq D$	C rdfs:subClassOf D
$R \leq S$	R rdfs:subPropertyOf S

Figure 6 Comparison between conceptual graph and RDF(S) triples (a part of)

Applying the aforementioned rules conceptual graph in Figure 7a) can be written in RDF(S) triples form as it is written in Figure 7b).

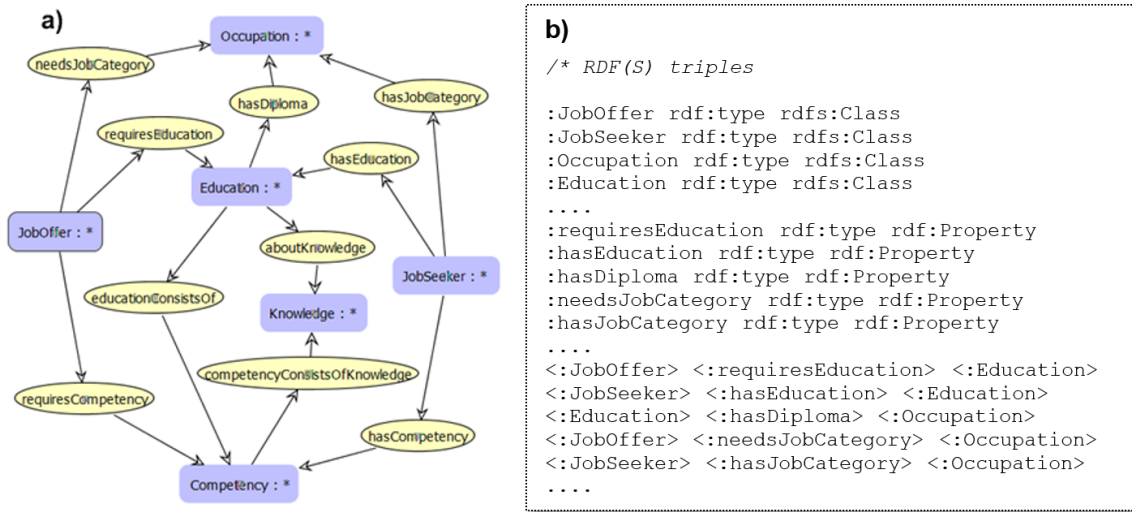


Figure 7 a) General concepts of ontology cluster for HRM and b) their equivalent in RDF(S) triples

5.2 Database and graph homomorphism

This previously described procedure makes sense if the wide community adopts the significance of ontology concept, and also be able to involve actively in the development of ontology conceptual structure and its implementation. Despite extensive analysis and study of possible applications of ontology, today it is still not represented in significant extent.

By now, we was developed (a part of) the formal HRM cluster ontology. In practice, an individual instance of HRM database can be partially mapped with the ontology through the structure and rules. Figure 8 shows the comparison of two graphs. On the left side is an imaginary graph-based data model of enterprise HRM business process, and on the right side is our HRM ontologies cluster. Comparison can be done through the formal verification of graphs homomorphism.

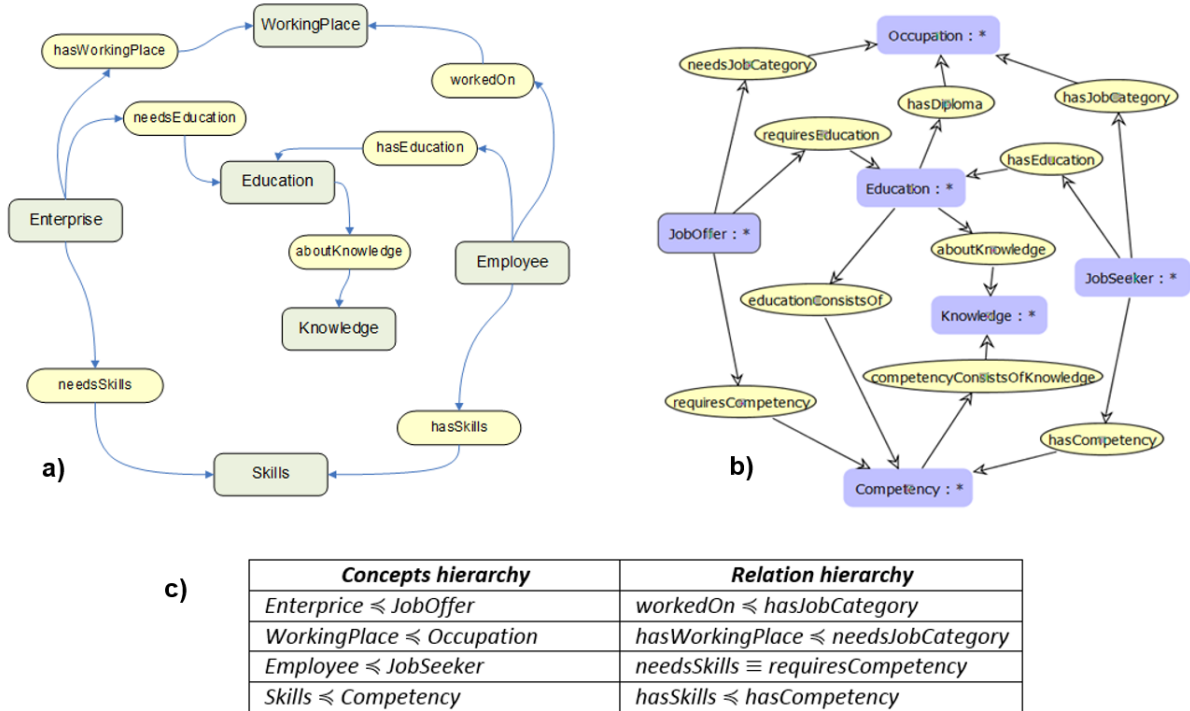


Figure 8 a) Graph-based data model, b) graph-based reference ontological model, and c) properties, facts and rules for generalization/specialization

Definition of Graph homomorphism: Let $G = (C_G, R_G, E, l_G)$ and $H = (C_H, R_H, E, l_H)$ be two conceptual graphs defined over the same vocabulary. A homomorphism π from G to H is a mapping from C_G to C_H and from R_G to R_H which preserves edges and related labels of concepts and relations, and satisfying the following conditions:

- $\forall (r, c) \in G \Rightarrow (\pi(r), \pi(c)) \in H$, where $r \in R_G$ and $c \in C_G$, and
- $\forall e \in C_G \cup R_G \Rightarrow l_H(\pi(e)) \preceq l_G(e)$.

According to the definition and using the rules listed in the table in Figure 8c) we can conclude that the left graph, Figure 8a), is homomorphic with the right graph, Figure 8b). This example shows how the software solution can adapt and upgrade to the existing ontology.

6. Conclusion

A practical application of the ontology today is still lagging behind the potential that it offers. Two problems are constantly present. The first is the development of an ontology for some domain because it is a tedious task for the whole community of interest. The second problem is the inclusion of individual software solutions in developed and usable ontology. Adjustment software solutions requires an extra effort that may not be cost effective or may not be known for developers.

However, the Internet (specifically Semantic Web), business expansion and globalization emphasize the importance of the software solution customization with the ontological platform. According to the stages of ontology development, the ontology specification and conceptualization can extend the process of software solution reengineering. Comparing conceptual structures using mapping such as homomorphism helps to identify the place where one can customize and change the existing software solution.

In the further work it is necessary to develop the comparison process for the structure of individual software solution, comparing it with the existing ontology. This process is time consuming because it involves all phases of the ontology development. Therefore, it is important to improve the activities of the ontology development which can enhance the software solution.

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Damping and excitation in the torsional vibrations calculation of ship propulsion systems

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Abstract. Calculation of torsional vibrations is essential in the early phase of the design of any ship propulsion system, after selection of shafting diameters in accordance with the Classification Rules. Later on, during ship trials, the calculation shall be validated by measurements on board. The calculation results depend upon inertial moments of actual masses, stiffness of shafting components, damping in the actual shafting components, as well as the excitation forces and moments exerted by the propulsion engine(s) and the propeller. Inertial moments and stiffness can be determined with no ambiguities. However, this is not the case with either the damping, or the engine excitation. Actually, during validation on board the calculation supposed damping is the main influential factor to be verified. The aim of this paper is to present and compare several models to define and compare damping definitions in the the torsional vibrations calculation (Frahm's model, Archer's model, physical damping, magnification factor, etc.) in a systematic way, to enable designers to correctly apply the selected damping model. Further on the engine excitation may be expressed by means of cylinder pressures or tangential forces to the cranks. The essentials of the two models and the procedure to convert one excitation model into another one are also presented. The application of the presented damping and excitation models is presented on an actual ship propulsion system and conclusions drawn.

Key words: *marine shafting design, steady-state torsional vibration analysis, SimulationX, validation by on-board measurements, acceptance criteria*

1. Introduction

Designer of any ship propulsion system has the main goal from the very beginning: to select the propeller that enables ship to achieve contracted speed for the given ship hull form, as well as to select the proper main propulsion prime mover (e.g. Diesel engine, steam or gas turbine plant and reduction gearbox) able to produce and transmit power to the main propulsion shafting.

The next step is determination of design form, dimensions, material and service loading of the shafting itself. Preliminary dimensions, i.e. external and internal diameters of particular shafts may be easily determined on the basis of MCR power, relevant rotational speed and mechanical properties of the selected material by implementing classification Rules. These classification Rules are generally based upon IACS Unified Requirement UR M68, comprising simple formulae applied to the calculation of these diameters.

However, in this very first design phase it is very important to determine the shafting steady state response to the engine and propeller variable torque excitation around the shafting axis, i.e. torsional vibrations response. It is a difficult task in this phase, because the entire shafting system has not been completely defined yet. Unfortunately, in case of improper design in this phase, there is not much that can be done in later phases, other than providing and installing the torsional vibration damper. For this reason, proper calculation of torsional vibration is necessary in the initial phase of the marine shafting design.

In general, torsional vibrational response of shafting depends also upon its design form, dimensions, material and service loading. The most appropriate model for the analysis of shafting system torsional vibrations is the model with lumped masses (represented by their mass moments of inertia around the shafting axes), massless shafts (representing stiffness and damping of parts of the system) and engine loading.

Considering steady-state response in terms of angular, torque and stress amplitudes for various shafting rotational speeds in the operational speed range the particular necessary data to be provided are the mass moments of inertia for each concentrated mass, the torsional stiffness of shafts, structural damping in the shafts, damping of propellers, flexible couplings and torques due to cylinder pressures and inertial forces of the reciprocating parts of engine systems for a single engine cycle (two-stroke or four stroke).

Evaluation of either mass moments of inertia for each lumped mass in the system, or stiffness of every particular shaft element is not difficult and can be performed in a rather straightforward non-ambiguous manner. Unfortunately this is not the case with the estimation of damping for particular elements of the system. The damping may be defined in various terms. In addition to this, the excitation engine torques may be defined in several different ways: cylinder pressures or crank tangential forces, both in closed form or expressed by the Fourier series coefficients.

For these reasons this paper focusses on presenting several definitions of damping in the torsional vibrations shafting model, the methods to convert among them, as well as the definitions of excitation torques in the model and their origin. In addition to this, classification societies (e.g. in [1] and [2]) require validation of the torsional response of the shafting system by measurements on-board the first in the series of newly built ships. In case the results do not match the 5 per cent margin difference, the calculations shall be run again. So, it is necessary to have the proper reliable methodology for defining of element damping properties and excitation forces readily available in the shafting numerical model.

2. Modelling of torsional vibrational damping

The torsional damping estimation is the most ambiguous for the marine shafting designers. No designer can be completely confident whether the damping data introduced and implemented in the torsional vibration calculations are correct, unless the calculation results are validated by means of measurement on-board [3].

The damping is the effect tending to reduce the vibratory amplitude of any oscillating system. Energy dissipation always accompanies damping itself. For the calculation of marine shafting torsional vibrations the four main types of damping are important [3]:

- viscous damping;
- fluid damping;
- internal damping; and
- structural damping.

The cause of viscous damping is the energy loss occurring in lubricating liquid between the system parts in relative motion. Viscous damping force is directly proportional to the relative

velocity between the moving parts of the vibrating system. Viscous damping may be considered as absolute (between the moving part and the non-moving environment) or relative (between the two parts in relative motion) [3].

The cause of fluid damping is the dynamic interaction of propeller and surrounding water. The cause of internal (material) damping is the mechanical energy dissipation within the material of the shafting, material of flexible couplings, as well as within the torsional vibration dampers. The cause of structural damping is the relative friction between the shafting system elements that are in mutual contact [3].

Owing to the fact that only the linear viscous damping model enables a simplified analytical calculation approach, all the remaining types of damping models are in practice transformed to the equivalent viscous damping, as follows: fluid damping as absolute viscous damping, internal and structural damping as relative viscous damping [3].

For the above stated reasons there exist several possibilities to define and enter damping data in various torsional vibration calculation computer programs. The definitions of damping used in the most important programs will therefore be presented here.

Program SimulationX, developed by ITI GmbH [4], Dresden uses the following approach. Viscous damping torque amounts to:

$$T_D = b\omega [\text{Nm}] \quad (1)$$

and the damping approach factor, B (in the expression: $b = B\sqrt{k}$) uses the following "rule of thumb" to estimate the damping:

$B = 0,005 \dots 0,01$ - damping in metallic materials (e.g., shafts)

$B = 0,10 \dots 0,25$ - damping in highly elastic materials (e.g., rubber coupling elements)

$B = 0,05 \dots 0,15$ - structural and contact damping (e.g., gear teeth contacts / toothings)

Relative damping (ratio of damping energy), ψ (nonlinear, frequency dependent)

$$\psi = 2\pi \frac{\omega}{k} b \rightarrow b = \frac{\psi}{2\pi} \cdot \frac{k}{\omega} \quad (2)$$

Lehr's damping factor, D

$$D = \frac{\psi}{4\pi} = \frac{b\omega}{2k} \rightarrow b = 2D \cdot \frac{k}{\omega} \quad (3)$$

where:

k – element linear stiffness, Nm/rad

b – element linear viscous damping, Nms/rad

ω – phase velocity of vibration, rad/s

In the program ShaftDesigner, developed by prof. Y. Batrak, the following damping definitions are used (the denotations for the k , b and ω as specified above):

Ratio of damping energy, ψ

$$\psi = \frac{2\pi \cdot b\omega}{k} = 2\pi\kappa = \frac{2\pi}{\sqrt{Q^2 - 1}} = 4\pi\varepsilon = \frac{2\pi}{M} \quad (4)$$

where:

κ – non-dimensional damping factor

Q – vibration magnifier

$$Q = \frac{\sqrt{k^2 + b^2 \omega^2}}{b \omega} = \frac{\sqrt{1 + \kappa^2}}{\kappa} = \frac{\sqrt{4\pi^2 + \psi^2}}{\psi} = \frac{\sqrt{1 + 4\varepsilon^2}}{2\varepsilon} = \sqrt{1 + M^2} \quad (5)$$

ε – percent of critical damping, %

$$\varepsilon = \frac{b \omega}{2k} = \frac{\kappa}{2} = \frac{\psi}{4\pi} = \frac{1}{2\sqrt{Q^2 - 1}} = \frac{1}{2M} \quad (6)$$

M – dynamic magnifier

$$M = \frac{k}{b \omega} = \frac{1}{\kappa} = \frac{2\pi}{\psi} = \sqrt{Q^2 - 1} = \frac{1}{2\varepsilon} \quad (7)$$

Program GTORSI, developed by MAN Diesel & Turbo, Copenhagen, uses the following definitions:

- absolute torsional damping (in % of critical damping), ρ_θ [%]
- physical damping (between the actual and previous inertia), b_θ [Nms/rad]
- percentage modal damping wrt. stiffness, ρ_{inner}
- resulting physical damping, $b = \frac{2\rho_{inner}}{\omega} k$ [Nms/rad] (8)

For its importance, the damping of the propeller deserves to be presented separately, regardless of the calculation program. Propeller damping may be presented by means of the equivalent absolute viscous damping. Dimensional equations are generally implemented, so the user is to take care about the units used.

Frahm's propeller damping factor, D_F (in practice: 2,9...3,7), is used to define the propeller absolute damping (Frahm), b_{Ap} as follows:

$$b_{Ap} = D_F \cdot \frac{30}{\pi} \cdot \frac{T_p}{n_p} = D_F \cdot \left(\frac{30}{\pi}\right)^2 \cdot \frac{P_0}{n_{p0}^3} \cdot n_p = D_F \cdot \left(\frac{30}{\pi}\right)^3 \cdot \frac{P_0}{n_{p0}^3} \cdot \omega_p \text{ kNms/rad} \quad (9)$$

Archer's propeller damping factor D_A (in practice: 25...35, based upon the open water characteristics of the Wageningen B-propeller series) implements a similar approach as for the Fram's factor [3]:

$$b_{Ap} = D_A \cdot \frac{T_p}{n_p} = D_A \cdot \left(\frac{30}{\pi}\right) \cdot \frac{P_0}{n_{p0}^3} \cdot n_p = D_A \cdot \left(\frac{30}{\pi}\right)^2 \cdot \frac{P_0}{n_{p0}^3} \cdot \omega_p \text{ kNms/rad} \quad (10)$$

Obviously:

$$D_A = D_F \cdot \frac{30}{\pi} \quad (11)$$

In the above equations the following denotations have been used:

P_0 – engine nominal rating power (MCR), kW

n_0 – engine nominal speed at MCR, rpm

i – gearbox transmission ratio

$$n_{p0} = \frac{n_0}{i} \text{ – propeller nominal speed, rpm} \quad (12)$$

$$\omega_p = \frac{\pi \cdot n_p}{30} \text{ – propeller angular velocity, rad/s} \quad (13)$$

n_p – propeller speed, rpm

$$T_0 = \frac{30}{\pi} \cdot \frac{P_0}{n_0} - \text{engine nominal torque, kNm} \quad (14)$$

$$T_{p0} = i \cdot T_0 - \text{propeller nominal torque, kNm} \quad (15)$$

$$P = P_0 \left(\frac{n_p}{n_{p0}} \right)^3 - \text{propeller power curve, kW} \quad (16)$$

$$T_p = T_0 \left(\frac{n_p}{n_{p0}} \right)^2 - \text{propeller torque curve, kNm} \quad (17)$$

Other propeller damping definitions, such as Ker Wilson's formula, Dien-Schwanecke's formula, as well as MAN Diesel & Turbo's recommendation to set propeller damping as 5% of the critical have been presented in detail in [3].

3. Modelling of engine excitation loading

The Diesel engine cylinder may be provided by the engine manufacturer expressed in various forms:

- actual cylinder pressures vs. crank angle in the range of either $\pm 180^\circ$ for two-stroke engines, or $\pm 360^\circ$ for four-stroke engines;
- crank forces in tangential (circumferential) direction vs. crank angle, originating also from the combustion pressure in engine cylinders
- crank forces in tangential (circumferential) direction in terms of Fourier series coefficients (precisely trigonometric approximation coefficients for the orders of 1; 2; 3; ... in case of two-stroke engines and orders of 0,5; 1,0; 1,5; 2; 2,5; ... for four stroke engines.

In practice it is often necessary to provide simple means to convert among these forms. Harmonic analysis, i.e. expressing of cylinder pressure/crank force vs. crank angle in the terms of trigonometric approximation coefficients, from (a) to (b) or to (c) above, is rather easy, following the procedure for the approximate calculation of Fourier series coefficients by e.g. their numerical integration. However, the reverse procedure, from (c) to (b) or to (a) above, may be a tricky one. For this reason the Excel/VBA program *S06HarmSynt* has been developed and will be shortly presented hereafter.

Program *S06HarmSynt* calculates tangential force, cylinder pressure and crank torque, all vs. crank angle, for the two cases: case of gas normal firing and gas compression only (misfiring) for 2-stroke and 4-stroke internal combustion engines, from the following input data: cylinder bore diameter, ratio of crank radius and connecting rod length, crank radius and harmonic cosine and sine components of Fourier series expansion of gas normal firing and gas compression only tangential pressure values, given for orders 0,5; 1; 1,5; 2; ... for 4-stroke engines or orders 1; 2; 3; ... for 2-stroke engines.

Program input data comprise the gas normal firing and misfiring N harmonic (cosine and sine) components F_{TC} and F_{TS} expressed as: $p = F_T / A_{cyl}$, where

F_T – force in tangential direction, N

$$A_{cyl} = \pi d^2 / 4 - \text{cylinder area, mm}^2 \quad (18)$$

The calculation procedure can briefly be described as follows:

Crank angle range α in 2-stroke engines

$$-360^0 \leq \alpha \leq +360^0 \quad (19)$$

Crank angle range α in 4-stroke engines

$$-180^0 \leq \alpha \leq +180^0 \quad (20)$$

Ratio of crank radius to the connecting rod length

$$\lambda = r/l \quad (21)$$

Connecting rod angle

$$\sin \beta = \lambda \cdot \sin \alpha \quad (22)$$

Gas force (positive downwards)

$$F_{gas} = p \cdot \frac{\pi d^2}{4} \quad (23)$$

Tangential force on the crank journal due to gas forces

$$F_T = F_{gas} \cdot \frac{\sin(\alpha + \beta)}{\cos \beta} \quad (24)$$

Cylinder pressure from tangential force

$$p = \frac{4F_T}{\pi d^2} \cdot \frac{\cos \beta}{\sin(\alpha + \beta)}; \sin(\alpha + \beta) \neq 0 \quad (25)$$

(valid under condition: $\sin(\alpha + \beta) \neq 0$, otherwise: linear interpolation for nearby values)

Trig. approximation for tangential forces

$$F_T = \frac{F_{T0}}{2} + \sum_{k=1}^N F_{TC,k} \cos \frac{k\alpha}{2} + F_{TS,k} \sin \frac{k\alpha}{2} \quad (26)$$

for zero crank angle

$$F_{T0} = -2 \sum_{k=1}^N F_{TC,k} \cos k\pi \quad (27)$$

Mean indicated pressure (numerical integration)

$$p_{m,i} \frac{1}{2} \int_{\alpha_{\min}}^{\alpha_{\max}} p(\alpha) \left(\sin \alpha + \lambda \frac{\sin \alpha \cdot \cos \alpha}{\sqrt{1 - \lambda^2 \sin^2 \alpha}} \right) \cdot d\alpha \quad (28)$$

The calculation example to illustrate the presented methodology for a two-stroke engine cylinder excitation, where inertial forces are to be considered separately begins from the data presented in the following table.

Table 1 Input data for an actual engine excitation loading calculations

Engine licence: **MAN B&W**

Type: **6S50MC-C, 9180 kW / 123 rpm**

engine working cycle (two stroke-2, four stroke-4)

cycle= 2

cylinder bore

D= 500 mm

ratio of crank radius and connecting rod length

$\lambda = r/l = 0,4878$

crank radius (half of piston stroke)

r= 1000 mm

Order	Inertia	Gas normal firing		Total Ampl	Gas misfiring only		Ampl	[Nmm/mm ³]
	SIN	COS	SIN		COS	SIN		
0	A₀=	1,2624064		A_{0comp}=	0			
1	0	0,762603	1,459809		-0,0003	0,1566		
2	0	0,0092984	1,727643		-0,0016	0,2393		
3	0	-0,234102	1,315507		-0,0009	0,2222		
4	0	-0,277969	0,930338		0,0011	0,1672		
5	0	-0,297135	0,600769		0,0006	0,1235		
6	0	-0,230167	0,362201		0	0,0899		
7	0	-0,1787	0,224368		0,0003	0,0644		
8	0	-0,137667	0,1123		0,0004	0,0454		
9	0	-0,085266	0,048867		0,0001	0,0319		
10	0	-0,0569	0,0176		-0,0002	0,0226		
11	0	-0,0326	-0,00943		0,0003	0,0154		
12	0	-0,010833	-0,0175		0	0,0108		

The calculated results have been presented in Figure 1.

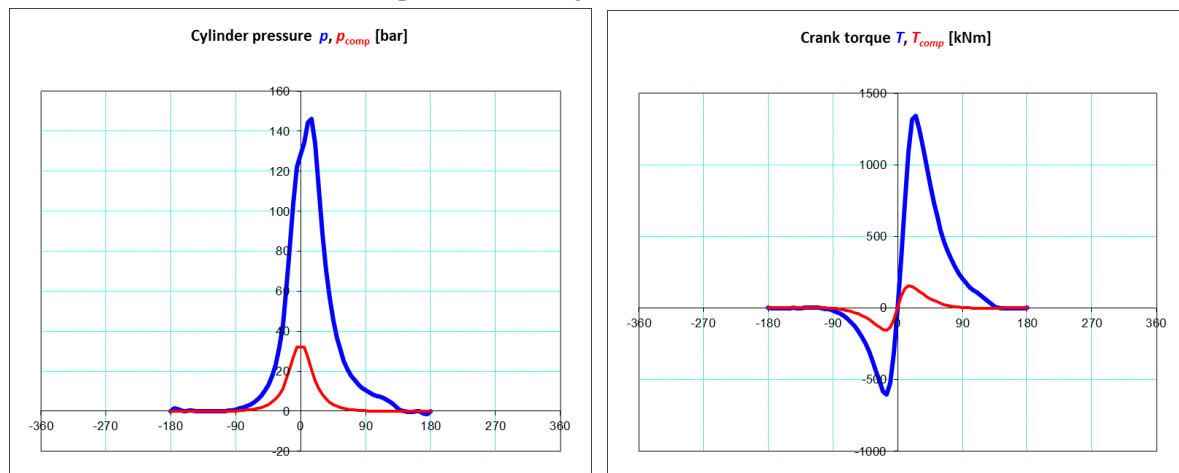


Figure 1 Calculation results, cylinder pressure and crank torque vs. crank angle

4. Validation of calculation on-board

Torsional vibrations calculation shall be verified on-board the first ship in the series. The most practical way is measurements by strain-gauges, connected into the full Wheatstone-bridge, that are glued on the surface of the shafting part which can be easily accessible from the machinery space (e.g. intermediate shaft). The strain-gauges measure strain, for the various levels of shafting rpm. This strain is converted into torsional stress and finally the

torsional stress vs. shafting curve is plotted. Looking into this graph easily reveals critical speeds and maximal stress levels. In accordance with class Rules, measured critical speed shall not differ to the calculated ones by more than 5%. A more detailed presentation of measurement methods and interpretation of the results would be beyond the scope of this paper.

5. Illustrative example of the torsional vibration calculation

For the illustration of the proposed methodology, the two-stroke propulsion engine system has been selected to be briefly presented hereafter. These calculations have been performed with and the results obtained by the SimulationX program [4].

The main propulsion system of the oil-tanker consists of the 5-cylinder two-stroke slow speed main propulsion engine connected to the fixed-pitch four bladed propeller by means of the intermediate shaft and the propeller shaft.

The absolute damping in the engine cylinders, as well as the absolute damping of the marine propeller in the system, is modelled by means of dynamic magnification elements specially developed for this purpose. This possibility to develop and implement self-developed elements is an important advantage of the SimulationX software.

Figure 2 shows the calculation model for the shafting system.

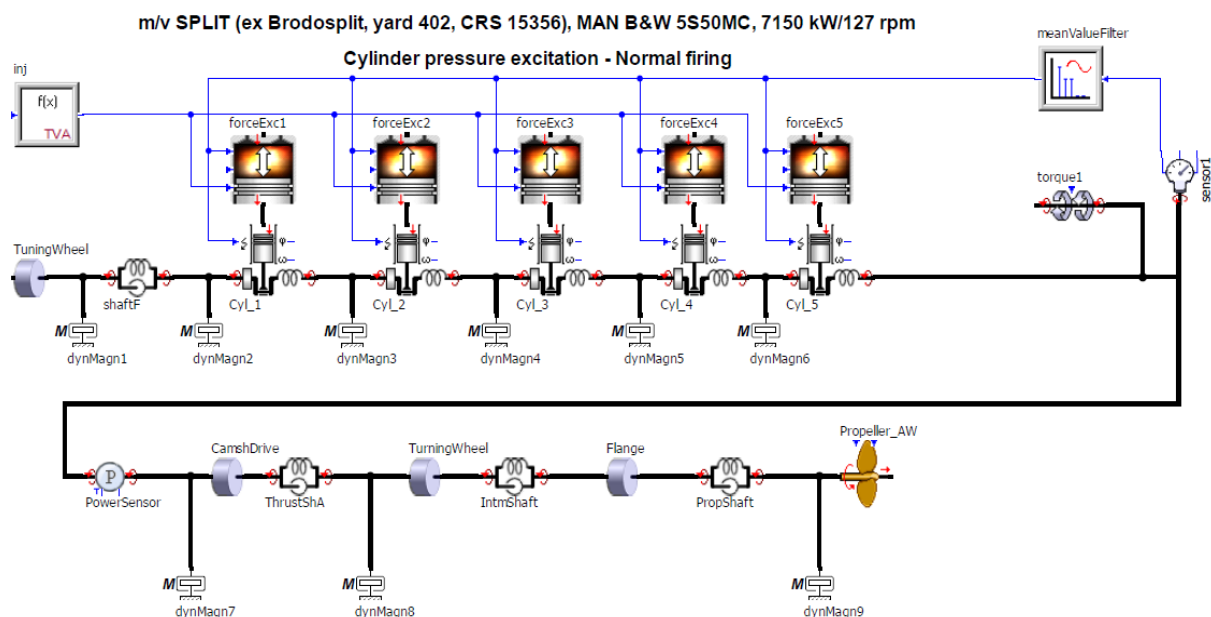


Figure 2 SimulationX shafting model for the calculation of torsional vibrations

Figures 3 and 4 present the steady-state calculation results for the torsional stress (MPa) in the intermediate and propeller shaft vs. the shafting speed (rpm) for each excitation order separately, as well as their sum and mean value. The allowable stress levels are also shown.

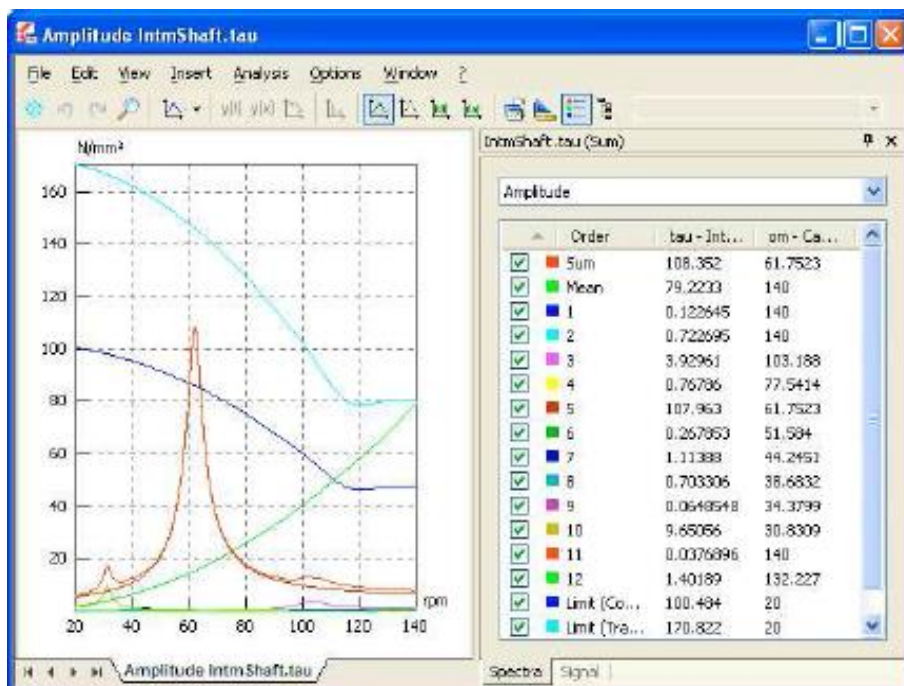


Figure 3 Calculation results: torsional stress in the intermediate shaft

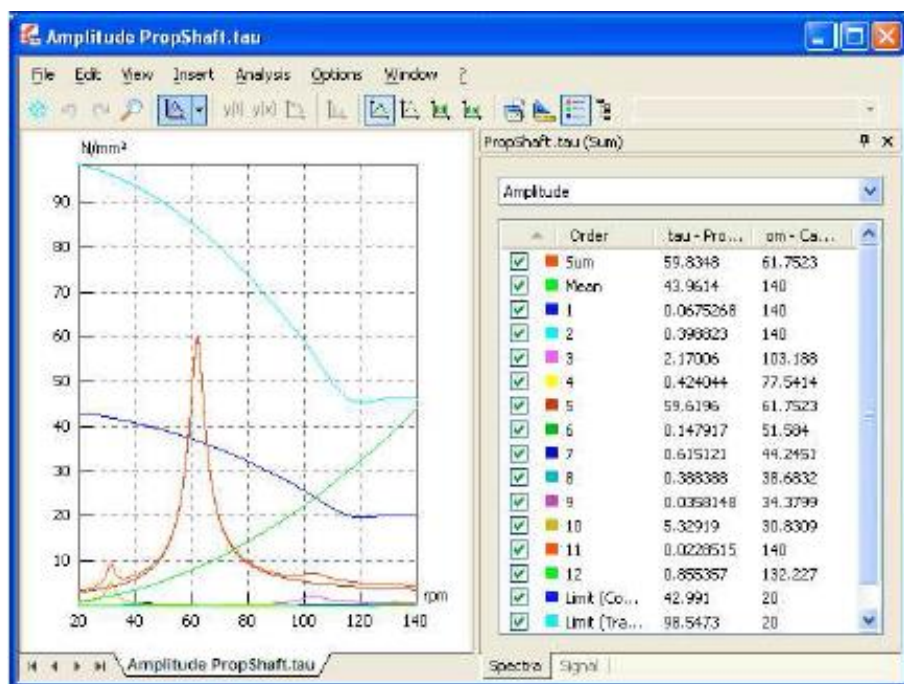


Figure 4 Calculation results: torsional stress in the propeller shaft

An important outcome of these analyses is that, for the particular ship in question, the propulsion system continuous operation within the range of shafting rotational speed of about 60 rpm should be avoided (barred speed range), in order to decrease the possible damage to the system due to resonance caused by excitation.

6. Conclusion

Torsional vibrations calculations are essential calculations which have to be performed in a very early stage of the shafting design process, by means of an appropriate software program.

The most difficult part in preparing data for these calculations, i.e. steady state response of the system modelled by lumped mass and massless stiffness and damping elements is to define damping and engine excitation in a proper way.

For this reason the methodology of definition of the damping implemented by several modern software programs has been presented in such a way that particular values can be easily converted from one to another and the results compared. This was the primary goal: to enable user to select the damping model best fitted for the purpose of modelling the real system.

An additional goal was to present the approach to the calculation of engine excitation in other forms (cylinder pressure vs. crank angle, or crank tangential force vs. crank angle), when these are given in terms of trigonometric approximation (Fourier's coefficients) for various excitation orders. There are some tricky points in this approach, to which the attention has been drawn.

Validation of the calculation results is essential, by measurements on-board, being the only way to check out whether the damping and engine excitation has been correctly taken in the calculations.

An illustrative example, showing the system and the obtained shafting torsional stress results has been presented in the end, just to show the powerful possibilities of one of the calculation programs intended for torsional vibration calculations (such as SimulationX).

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Simulation contributions of frequency convertors applied for AC motor in electric propulsion

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Abstract. The advantage of a simulation is the level of detail that can be obtained from it. A simulation yields results that are not experimentally measurable with our current level of technology. Most of the time, simulation testing is cheaper and faster than performing multiple tests of the real design. Designing and testing is becoming much easier with development of simulation tools. The pretesting while the model is still under construction can eliminate the different oversights that can be made. Three of the most commonly used types of converters used as motor drives for AC motors in electric propulsion are presented in this paper: cyclo-converters, PWM converters and synchro-converters. Modelling the frequency convertors in simulation software, it is possible to define which converter is suitable for a given power system.

Key words: *electric propulsion, Matlab Simulink, motor drives, power quality.*

1. Introduction

Modeling and simulation techniques have an advantage of simulating the behaviour and performance characteristics of real physical systems without conducting actual expensive and potentially dangerous physical experiments. Besides the benefits in evaluating and optimising existing systems and their states, modeling and simulation techniques also bring many advantages to designing new electric propulsion systems or some of their elements. In this way, the expensive and time consuming process of building a prototype, testing it and performing its modification is bypassed. The other advantage is that the behaviour of unmeasurable variables can also be observed and taken into a consideration.

Unlike in a mechanical propulsion system, in an electric propulsion system there is no direct link between the prime mover and the propeller, so the speed of a prime mover (for example gas turbine) can be optimised regardless of the propeller speed, which leads to better efficiency and lower fuel consumption.

The electric propulsion system allows more flexible ship design and can be integrated in a known or previously designed ship construction more easily, while the mechanical propulsion systems have to be taken into consideration at the very beginning of the ship construction designing process. It also requires less of the internal ship's space than the mechanical

propulsion system. The free volume acquired in this way can bring additional economical benefits to the ship, according to its allocation. In this way, for example, war-ships can use the extra volume for additional or bigger weapon storage, commercial ships for more passengers or load. In technical sense, the electric propulsion is used mainly where there's a need for a high level of maneuverability.

As shown on Figure 1, electrical propulsion system consists of a prime mover, a generator, a motor drive, a motor and a propeller. Rotation speed of electric propulsion motor is typically regulated by a static frequency converter, which is the most significant component of the electrical propulsion system, whose efficiency, output power quality and transient response depend upon it significantly.

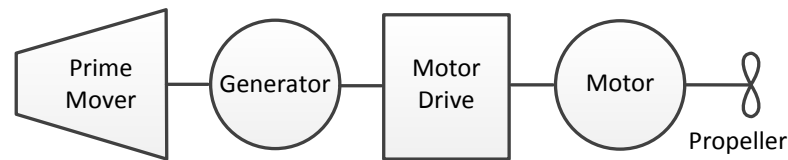


Figure 1. Electrical propulsion scheme

In order to improve the electric propulsion system efficiency, every element of the electrical propulsion scheme should be carefully chosen and modelled. Typical values of electrical efficiency for basic elements of the electric propulsion system are given in Table 1.

Table 1. Typical values of electrical efficiencies in diesel-electric propulsion (DEP) system[1]

	Typical values of electrical efficiency
Generator	0.95 – 0.97
Switchboard	0.999
Transformer	0.99 – 0.995
Frequency Converter	0.98 – 0.99
Electric Motor	0.95 – 0.97
Diesel engine shaft to electric propulsion motor shaft	0.88 – 0.92

2. Electrical drive

Electrical drive is chosen depending on the electrical propulsion motor. Thyristor controlled DC drive that directly converts AC to DC voltage is used for DC electrical propulsion motors, which are being slowly abandoned, mainly due to their size, purchase and maintenance costs. For rotation speed regulation of AC electrical propulsion motors, most commonly induction (asynchronous) machines, classic synchronous and permanent magnet synchronous motors, both voltage and frequency control must be applied.

There are three main types of converters used as motor drives for AC motor electric propulsion: cyclo-converters, pulse width modulation (PWM) converters and synchro-converters. Cyclo-converters perform direct AC to AC conversion and can be used to drive all AC electrical machines. PWM converters also used as drives for all AC electrical machines. Synchro-converters are used exclusively for synchronous machines perform indirect conversion in two steps: AC to DC and DC to AC voltage conversion. While cyclo- and synchro- converters played a significant role in the past, in a last decade they are being replaced by PWM converters. The main reason for more frequent application of PWM converters is the rapid development of power electronics, which made it possible to produce electrical power high enough for electric propulsion demands as seen on Figure 2. For very

high power, the most favoured option is to use a pair of high efficiency, high voltage AC synchronous motors with fixed pitch propellers (FPP) driven at variable speed by frequency control from electronic converters. A few installations have the combination of controllable pitch propellers (CPP) and a variable speed motor. Low/medium power propulsion (1-5 MW) may be delivered by AC induction motors with variable frequency converters or by DC motors with variable voltage converters. The prime-movers are conventionally constant speed diesel engines driving AC generators to give a fixed output frequency.

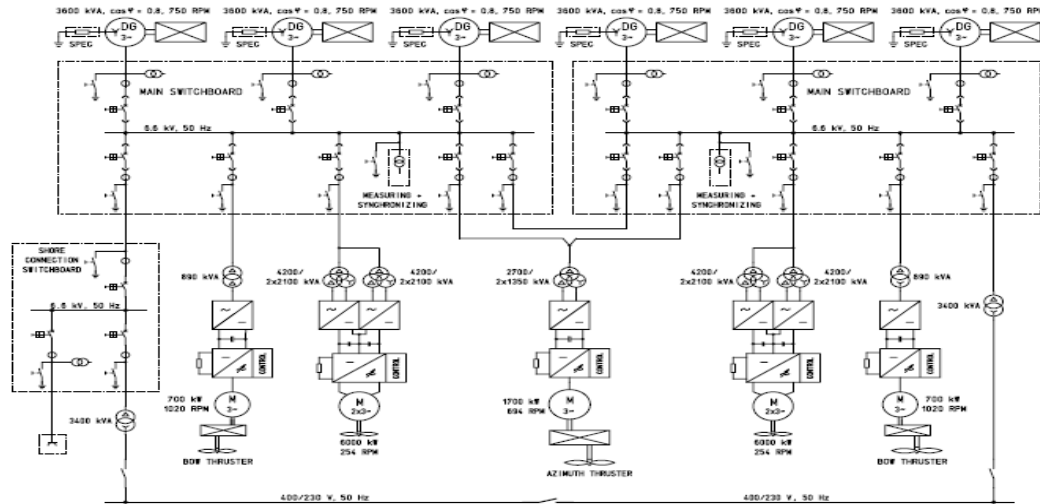


Figure 2. Single line diagram of electric propulsion system with PWM converters 2x6 MW, 24-pulses
SOURCE: <http://www.sam-electronics.de/dateien/pad/broschueren/1.002.pdf>

3. Contributions of simulations of pulse width modulation (PWM) control

There are three most commonly used modulation methods of PWM current control: hysteresis PWM, sine-triangle pulse width modulation SPWM and space vector PWM. They were explained, conducted and compared in [3]. Figure 3. represents Matlab Simulink model of PWM regulated propulsion motor that was used in [3].

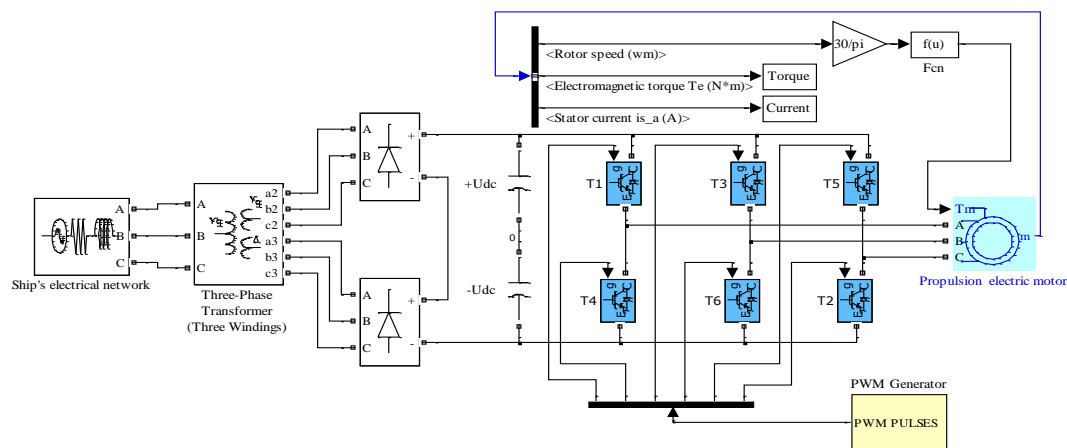


Figure 3. Matlab Simulink model of PWM regulated propulsion motor [3]

Electrical propulsion motor is presented as an induction machine and modelled in a stationary time frame. Ship's electrical network is connected to the converter through the three-phase Y/y/d transformer. The converter consists of a rectifier, which is a serial connection of two three-phase six-pulse diode rectifiers, DC link and a six-pulse two level PWM inverter with IGBT transistors.

The model simulation and analysis is based upon electric propulsion motor power quality characteristics and doesn't take the converter's effect on the ship's electrical system into a consideration. For further and more complex analysis, the Matlab Simulink model and its elements could be additionally upgraded. Model presented in [3] focused on the PWM generator block, which was designed differently for each of the three analyzed modulation methods. Its programmed pulses bring transistor to required on and off stages and in this way control the output electric propulsion motor currents and voltages.

The principle of a hysteresis current control PWM method is the maintenance of electric propulsion motor current value within the error limits, set in relation to the referent current value, which is defined by the hysteresis bandwidth. The comparison is based on the current feedback. PWM inverter is controlled in a way that when the regulated current for a specific phase overreaches the referent current, it is being decreased by one of the upper transistors (T1, T3, T5) responding to that phase switching off and one of the lower (T4, T6, T2) switching on. When the regulated current decreases below the referent current value, the transistors switch contrariwise, which causes the wanted current increase. The advantage of a hysteresis current control PWM method is that it provides an output current independent of a DC link current ripple. Its imperfection lies in a necessity to ensure lock-out time between the transistors switching stages.

The principle of a sine-triangle PWM method is the maintenance of electric propulsion motor voltage value within certain limits, defined by a comparison of its referent sinusoidal voltage signal to a triangular carrier voltage signal. Programmed PWM pulses are switching semiconductor valves in geometrical intersections of those two compared signals, enabling the output voltage value to increase or decrease when it goes beyond boundary limits. The same carrier signal can be used in controlling all three output phase voltages. The quality of the output voltage and frequency spectrum can be described with a frequency modulation index m_f , defined as an ratio of the triangular sinusoidal carrier frequency f_c and the output voltage fundamental frequency f_o :

$$m_f = \frac{f_c}{f_o} \quad (1)$$

The principle of a space vector PWM method is the maintenance of electric propulsion motor voltage value close to its referent value, which is modulated by combining eight space vectors. Space vectors are defined by possible transistors switching stages, where each stage is defined by the upper and lower transistor of the same phase being in opposite modes, meaning one has to be off and the other one on. Since there are three phases with two possible switching states (upper transistor on and lower off representing logical 0, logical 1 represented by the opposite stage), this provides eight different combinations. Referent voltage signal vector formed in this way is then transformed from three-phase abc into stationary $\alpha\beta$ time frame and its α and β components and an angle between them γ are used for calculation of switching times.

The output characteristics for those three methods were compared in [3], considering the electrical propulsion motor current and voltage fluctuations and frequency spectra. The comparison was made in a stationary state for different motor loads and speeds and same switching frequency of 1800 Hz, which was approximately met with the hysteresis bandwidth of 0.1 per unit (p.u.) in hysteresis current control method, and accurately reached with constant frequency modulation index of $m_f = 93$ in sine-triangle and space vector control methods. For the purpose of showing the influence of the frequency modulation index m_f on the output metrics quality, the analysis for sine-triangle and space vector control methods was also performed for $m_f = 63$, which represents the switching frequency of 1260 Hz.

Figure 3. represents the results for the three analysed PWM modulation methods, expressed as the voltage and current harmonic distortions depending on the electrical propulsion motor speed. Total harmonic distortion THD is defined as a mean square value of higher harmonics

expressed as a percentage of the value of the first harmonic. The total harmonic voltage distortion THDu and the total harmonic current distortion THDi are defined as [7]:

$$THDu = \frac{\sqrt{\sum_{h=2}^n U_{(h)}^2}}{U_{(1)}} \cdot 100\% \quad (2)$$

$$THDi = \frac{\sqrt{\sum_{h=2}^n I_{(h)}^2}}{I_{(1)}} \cdot 100\% \quad (3)$$

As illustrated, of all three methods, for the same switching frequency of 1800 Hz, hysteresis current control PWM method (Hyst.) shows the highest THDi and significant increase in THDi harmonic distortions at lower motor speeds, which can be lowered by narrowing the hysteresis bandwidth, but it would have a higher switching frequency as a side effect, which would add to a converter complexity and cost. For the same switching frequency of 1800 Hz, the sine-triangle PWM method (STM, $m_f = 93$) gives sufficiently low and the space vector PWM method (SVM, $m_f = 93$) the lowest THDi. But, it can also be noticed that a frequency modulation index influences the THDi so strongly, that the sine-triangle PWM method for $m_f = 93$ gives lower THDi than the space vector PWM method for $m_f = 63$ (SVM, $m_f = 63$).

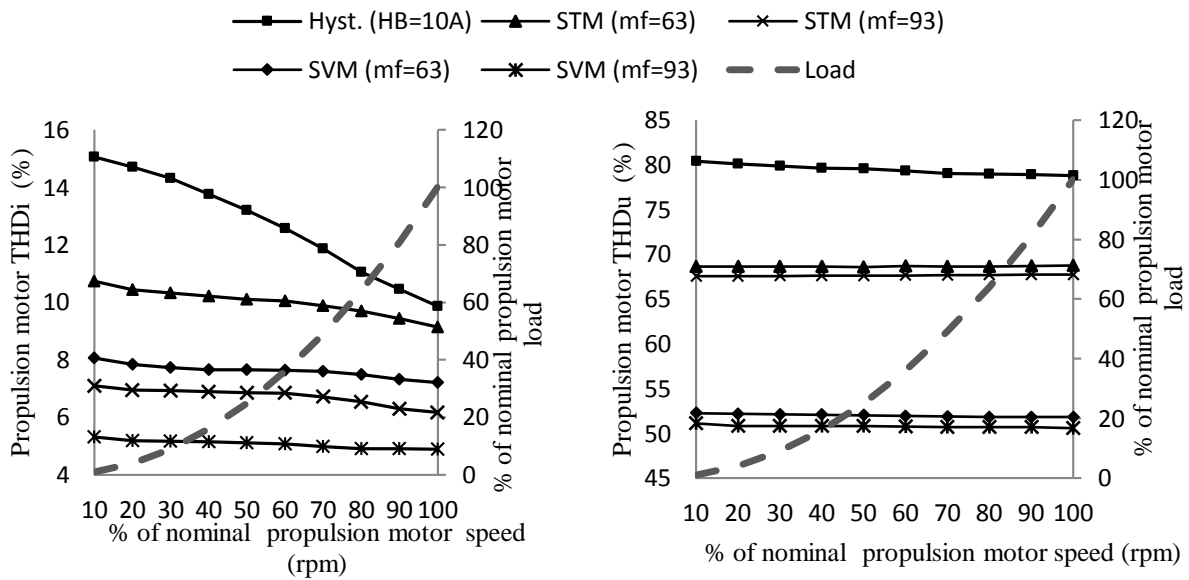


Figure 4. Comparison of total current and voltage harmonic distortion between simulated methods with different frequency modulation indexes as a function of propulsion motor speed [3]

THDu shows no significant dependence upon the propulsion motor speed. It is the lowest for the space vector PWM method and the highest for hysteresis current control PWM method and isn't significantly influenced by frequency modulation index m_f . By increasing the frequency modulation index, and therefore also the switching frequency, THDu shows only slight decrease. Although THDu is very high comparing to THDi, it has less influence on the electric propulsion motor performance.

Besides the lowest THDi $\approx 5\%$ and THDu $\approx 50\%$, space vector PWM method also gives the highest effective DC voltage utilization [3].

Table 2. shows technical data of a driven motor and the harmonic distortions as results of another sine-triangle PWM (SPWM) simulation [4], made in Electro Magnetic Transients

Program (EMTP), a professional software for simulation and analysis of transients in power systems.

Table 2. Technical data of a SPWM converter driven motor study case [4]

Converter characteristics	
SPWM converter:	
input frequency, output frequency: 12 Hz, amplitude factor: 0.9, carrier frequency: 108 Hz	
Driven motor characteristics	
Induction motor:	
3- phase, 12 Hz, 5 kV/ 10 MVA Y, 4 poles	
Harmonic distortion of study case	
Voltage THD	66 %
Current THD	22 %

In the simulation model a prime mover was analysed as a diesel engine and a cogeneration gas turbine, power generation as two to four synchronous generators capable of covering more than 50% of the installed load each, connected to the SPWM converter motor drive through the power transformer. Electrical propulsion motor is presented as an induction machine. Figure 5. represents the scheme of a three-phase PWM converter used as a motor drive in this simulation.

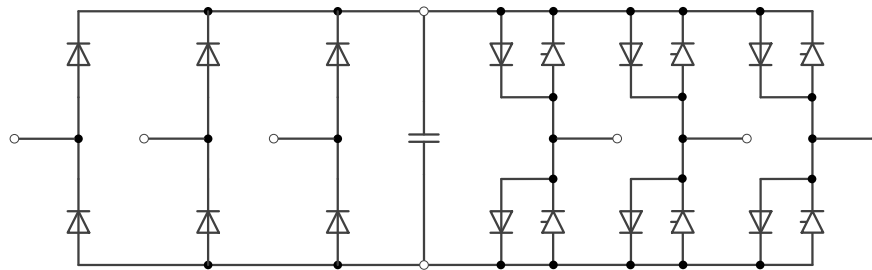


Figure 5. Typical structure of a three-phase pulse width modulation (PWM) converter

The SPWM converter consists of a three-phase six-pulse diode rectifier (a full wave bridge), DC link and a six-pulse two level transistor PWM inverter. Diodes connected in parallel to each switching transistor provide current bypass paths and protect the transistors. When a transistor is switched off, the current through the diode connected to it flows until all the energy in the inductive load (electric propulsion motor) is dissipated. [10]

The total harmonic voltage distortion $THDu = 66\%$ and the total harmonic current distortion $THDi = 22\%$ are higher than in the best case of previously considered PWM simulation, the one that used space vector PWM method. The reason for that lies in the approach to this simulation, which mainly focused on modeling of the converter and electrical propulsion motor, while the power quality was of a secondary consideration.

4. Contributions of simulations of cyclo-converter control

Table 3. shows technical data of driven motors and the harmonic distortions as results of cyclo-converter control simulation, made in EMTP [4].

Simulation model is presented with the prime mover as a diesel engine and a cogeneration gas turbine, power generation as two to four synchronous generators, a power transformer, a motor drive as a cyclo- converter. Two simulations were done, where the electrical propulsion motor was presented as an induction machine in the first case and as an synchronous motor in the other one.

Table 3. Technical data of cyclo-converter driven motors study cases [4]

Converter characteristics			
12- pulse IGBT cyclo- converter: 12 IGBTs per phase, input frequency: 50 Hz, output frequencies: 12 Hz, 5 Hz			
Driven motor characteristics			
Induction motor: 3- phase, 12 Hz, 5 kV/ 10 MVA Y, 4 poles		Synchronous motor: 3- phase, 5 Hz, 5 kV/ 10 MVA Y, 4 poles	
Harmonic distortion of study cases			
Voltage THD	24 %	Voltage THD	14 %
Current THD	13 %	Current THD	19 %

Figure 6. represents the scheme of a three-phase cyclo-converter used as a motor drive in this simulation.

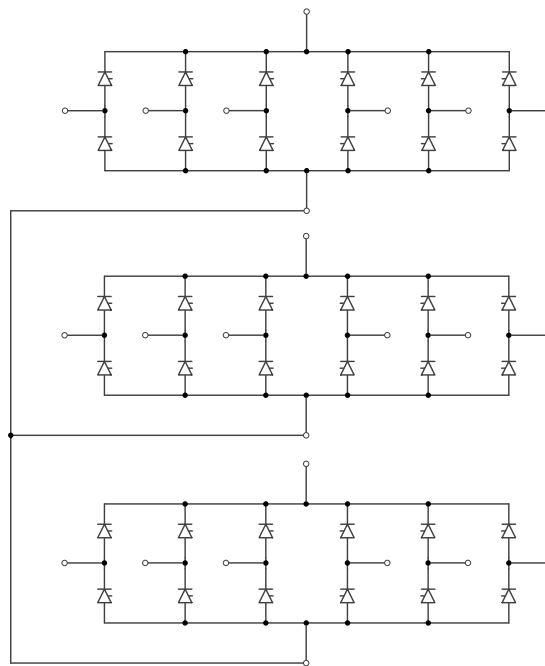


Figure 6. Typical structure of a three-phase cyclo-converter

A converter used in this simulation is a three-phase 12-pulse cyclo-converter, that consists of 36 thyristors. For each phase of the cyclo-converter, an input is connected to the corresponding phase of the power transformer and an output to the corresponding phase of electrical propulsion motor. A converter's phase consists of two 6-pulse inverter bridges connected in parallel, with mutually contrariwise directed six thyristors. One of the bridges is responsible for providing a positive and the other one for a negative cycle of the output current. A specific characteristic of a cyclo-converter is the omission of the intermediate DC link, for it provides a direct conversion of AC supply frequency and voltage to an output frequency and voltage.

The main power quality disadvantages of the cyclo-converter are large content of higher harmonics in voltage quantity and significant distortions in the output voltage waveform. The results of the study summary presented in Table 3. are the total harmonic voltage distortion $THDu = 24\%$ and the total harmonic current distortion $THDi = 13\%$ for the given induction motor and total harmonic voltage distortion $THDu = 14\%$ and the total harmonic current distortion $THDi = 19\%$ for the given synchronous motor.

Although total harmonic distortion factors for the three-phased cyclo-converter appear low in comparison to PWM converters, they grow significantly with the increase of the output

frequency. For that reason, cyclo-converters are limited in terms of the output frequency, that, in practice never goes beyond 30% of the input frequency. Nevertheless, due to the more loose power quality standards in the ship electrical propulsion system than in the land-based electrical power system, cyclo-converters provide satisfactorily low harmonic distortion factors and find their implementation electric propulsion systems.

The results also show that three-phase cyclo-converters give better output power factor characteristics for synchronous than for induction machines, which corresponds to their common application.

5. Contributions of simulation of super-capacitor hybrid converter control

In dynamic working conditions, such as dynamic positioning, the load variations influence the electric system stability. Dynamic working conditions sometimes entail the need for additional running engines, which causes significant increase in fuel consumption and increases the system maintenance costs. The enabling the increase of the average loading with as fewer running engines would provide environmental and economical benefits.

For dynamic working conditions, the performance of electric propulsion system can be additionally improved by choosing a modern hybrid converter control solution, that includes the super-capacitors, as introduced in [2].

Super-capacitors are a low cost new type of energy storage that can be implemented in both AC and DC grid systems and improve system efficiency up to 20%. They found their appliance mainly in transport industry. The geometry and the physical construction of a super-capacitor distinguishes it from a conventional battery, by bringing the advantages like greater capacitance within the same volume, ability to deliver frequent pulses of energy for quick charging, more than hundreds of thousands of cycles in a lifetime and a wide working voltage range. As a result, they also grant lower maintenance costs. Unfortunately, unlike the high power density, energy density is limited comparing to conventional batteries.

In electric propulsion systems with previously considered converters, super-capacitor would be implemented directly to the DC bus of the frequency converters, as shown in Figure 7.[2]

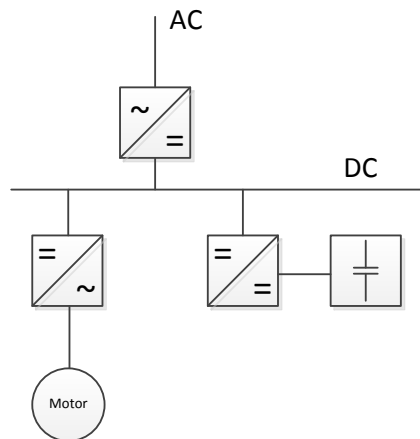


Figure 7. Implementation of a super-capacitor hybrid converter

The typical structure of a super-capacitor hybrid converter is shown in Figure 8. In the buck mode super-capacitor is being charged through the MOSFET T_1 and energy flows from the network to the super-capacitor. When the charging cycle is complete, the current through the super-capacitor is closed in the D_2 -L-SC loop and the current from DC bus is directly transmitted to the output $I_{DC}=I_{out}$. In the boost mode super-capacitor is being discharged through the diode D_1 and energy flows from the super-capacitor to the network. When the

discharging cycle is complete, the current through the super-capacitor is closed in the T_2 -L-SC loop and the current from DC bus is directly transmitted to the output $I_{DC}=I_{out}$.

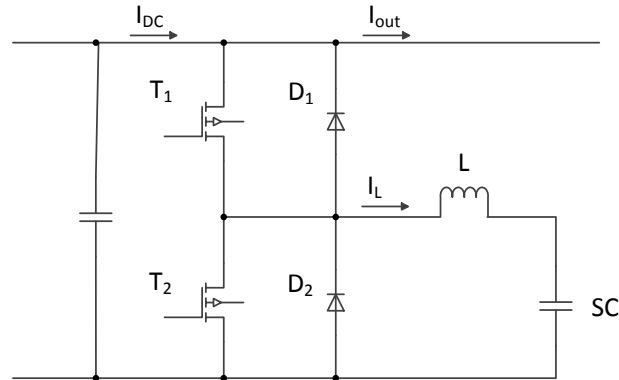


Figure 8. Typical structure of a super-capacitor hybrid converter

ABB designed drive control unit modified for the super-capacitor hybrid converter includes double loop control method that both controls the dynamic power flow and ensures that the super-capacitor voltage range is maintained between certain limits. Regulation of the control signal also takes into consideration the capability of a source regarding to a load power consumption. Figure 9. and 10. represent Matlab Simulink model of described ABB designed regulated propulsion and simulation results, respectively. [2]

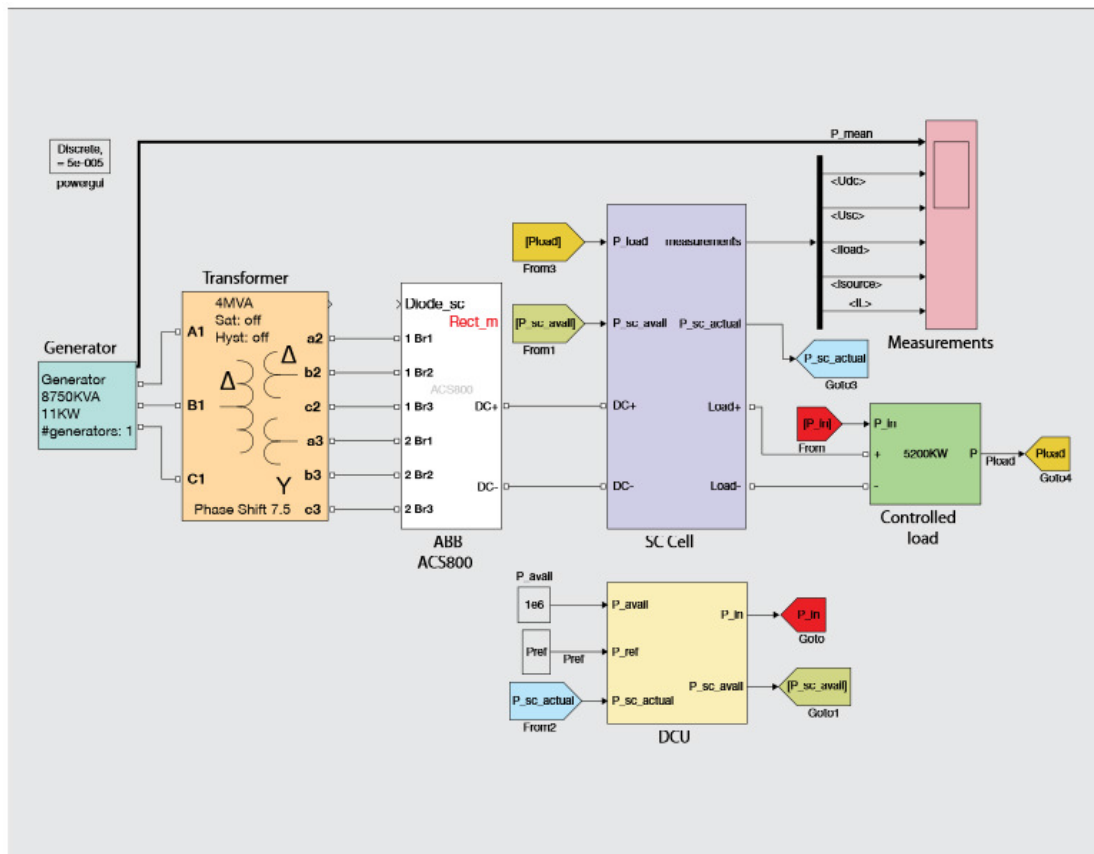


Figure 9. Matlab Simulink model of super-capacitor regulated propulsion motor [2]

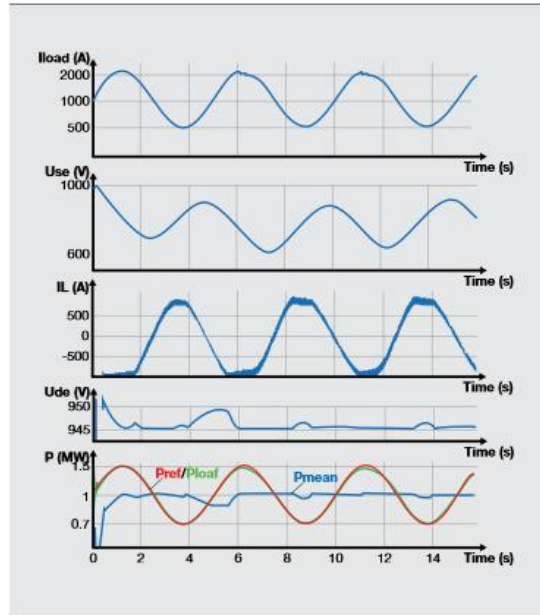


Figure 10. Simulation results [2]

Simulation results represent super-capacitor voltage U_{sc} and current I_L dependence on load current I_{load} and give an insight into the output powerquality. It can be noticed that the the super-capacitor is charged during the period of a low load current and discharged during the period of high load current. Dynamic load variation was set as sinusoidal function with values between 0,5 MW and 1,5 MW and a period of 5 s. The output power P_{load} follows the reference power P_{ref} practically without deviation. In the same time input power is limited to the available power signal of 1 MW maximum and about constant. Adding the fast-acting energy storage super-capacitors doesn't significantly effect the frequency converters output characteristics, therefor it can be easily implemented into existing electric propulsion systems. It can provide a higher level of independency between the power drawn for the network and variations in thruster load. Even with load variations, the network power remains limited and practically constant, which adds to the safety, economical and environmental benefits of the propulsion system designed in this way.

However, specific limitations in some practical uses should be further considered, especially in electric propulsion systems with ongoing rapid load variations, where the super-capacitors would be charging and discharging practically all of the time, like in the example given in simulation results. While the super-capacitor as a short-term energy storage improves power quality by limiting its fluctuations and maximum value and lowers the energy production costs, its usage as a long-term energy storage is still not researched enough. Focus should be on the super-capacitor costs in terms of energy, for they have disadvantages regarding low specific energy, disability of using the full energy spectrum and low cell voltage, which could impose the need for serial connections. Super-capacitor posses relatively high cost per watt-hour. [9]

6. Simulation of power generation and electric propulsion system (PGAEPS)

Constant increase in electric propulsion power demands and therefor a larger amount of that power that can't be used in other ship's electric power systems imply the future ships design as the all-electric ships with an integrated power system. An integrated power system would include and combine all electric systems: power generation system, distribution system, energy consumption, energy storage and power control systems. The simulation of electric

propulsion machines can be expanded to include both power generation and the electric propulsion system, which can, ultimately, help designers achieve higher efficiency and greater stability of the whole integrated power system, as it was exposed in [8]. Figure 11. shows Matlab Simulink model of PGAEPS introduced in [8].

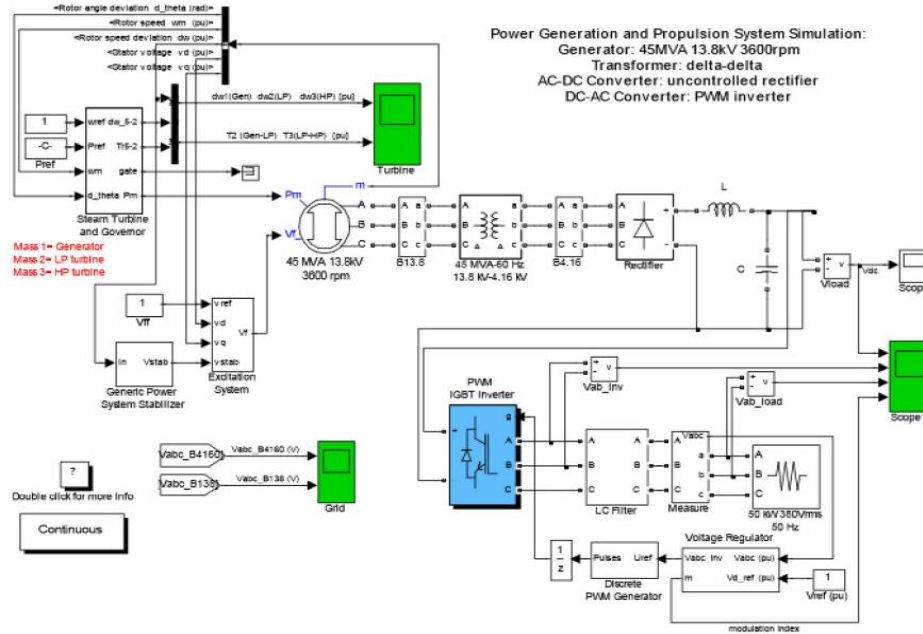


Figure 11. Matlab Simulink model of PGAEPS[8]

In power generation subsystem part of the model prime mover and governor are presented as turbine and governor block, generator as a synchronous machine block, exciter as an excitation system block, stabilizer as an generic power stabilizer block, transformer as a three-phase transformer block. The regulation part of power generation subsystem consists of voltage regulation, which is implemented in the Matlab Simulink model as a swing bus generator set up, and turbine speed regulation, which is implemented in the model as a regulation loop. In electric propulsion subsystem part rectifier is presented as an universal bridge block with diodes, PWM inverter as an universal bridge block with IGBTs and diodes, motor as a motor block, while the propeller, ship-speed dynamics and external forces are modeled as a three-phase parallel RLC load. The regulation part of electric propulsion subsystem consists of motor controller, which is implemented in the model as a voltage regulation loop.

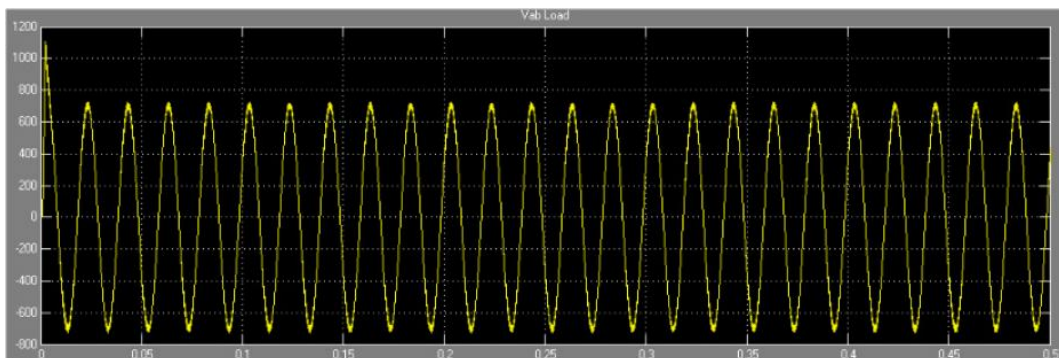


Figure 12. Output voltage of the PWM inverter [8]

Matlab Simulink, like other simulation programs, makes it possible to display any metrics of interest, which can enable easier implementation of changes in the initial design. Among all

electrical elements behaviors considered in this simulation, quality of PWM converter output characteristics is presented through the output voltage of the PWM inverter, shown in Figure 12., which is of sinusoidal shape with a little distortion and satisfying to the electric propulsion load demands. The PWM converter output voltage and, at the same time, output power quality can always be additionally improved by more sophisticated control design.

7. Conclusion

Three most commonly used types of converters used as motor drives for AC motor electric propulsion were presented in this paper: cyclo-converters, PWM converters and synchro-converters. What is the best solution? Each of the three types has its advantages and disadvantages. While the synchro-converter was proven as the simplest and the cheapest, being consisted only of uncontrolled diode rectifier, DC link and diode inverter, with a possibility for easy monitoring, and low THD, it has its specific limitations. The main limitation of a synchro-converter is the disability to be implemented in the electric propulsion systems with any other type of machine rather than the synchronous motor and is additionally limited only to slow speed motors.

The cyclo-converter was proven to be the most complicated, being consisted of three 12-switch thyristor bridges, and therefor also the most expensive, because of the need for 36 thyristors and often also for a transformer or motor-generator pair for supply. Its advantages are the omission of reduction gear and the fact that it can be used as a drive for middle and high power rated propulsion motors, although only for slow speed.

The PWM converters can be used for all electrical machine types and have no problem with driving high speed motors, although only low rated power ones, which makes them the most interesting of all of the three types of converters considered. They have the ability of easy filtering of harmonics. The cost and the complexity of the PWM converter, being consisted of uncontrolled diode rectifier, capacitor and the PWM driven IGBT transistor inverter, is much less challenging than of the cyclo-converter and more challenging synchro-converter.

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Track 4

Interdisciplinary
Teaching and Learning

Motivation and Attitudes in Foreign Language Learning: A Comparative Study of Croatian and Erasmus+ Exchange Students

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Abstract. Motivation, as one of the internal key features of successful foreign language achievement, is considered in this study as a variable correlated with complexity of emerging internal, external sociocultural and dynamic factors. Taking into account motivation components and attitudes toward learning the language a comparative study among junior and senior Croatian learners and Erasmus + exchange students, who are spending a semester at the University of Split in the academic year 2015/16 and are attending a Business English course, is conducted as a basis for understanding the implications and correlations between attitudes and motivations to study English. The study will look into integrative and instrumental reasons for learning the language, attitudes toward the target language and dynamic social processes to find underlying links between these factors and language proficiency. Our institution's involvement in Erasmus + exchange programs, as the main cause of higher occurrence of foreign students, offers an exceptional opportunity for a focus at a broader reference group encompassing not only domestic students but also international Erasmus + students arriving from geographically different areas and countries of the EU. The authors have adopted a three-part questionnaire validated by Mihaljević Djigunović and Bagarić in 2007, hoping that the results will give an interesting insight into interlinking motivation, attitudes and language proficiency.

Key words: *motivation, attitudes, EFL, language achievement, success*

1. Introduction

L2 motivation, which is considered to be an indispensable internal cause of successful foreign language learning, has been a very prolific research topic spanning for more than five decades and encompassing the social-psychological phase (1959-1990), the cognitive-situated phase (during the 1990s), the process-oriented phase (turn of the 21st century) and the current socio-dynamic phase, as identified by Ushioda and Dörnyei (2012) in their overview of the field. The first period is characterized by seminal works of two Canadian social psychologists, Robert Gardner and Wallace Lambert, who claimed that L2 motivation did not only encompass an individual's cognitive and psycholinguistic propensity for language development, but it included the learner's interest in the culture and the people of the target language (integrative aspect) and reflected the pragmatic side of acquiring the new language (instrumental aspect). The second stage of L2 motivation aligned with motivational psychology and situated its analysis in particular educational settings (classrooms) and field. The cognitive-situated phase focused more on irregular nature of motivation during the situation-specific learning process. The third stage looked at dynamic structure of L2 motivation, which is divided into pre-actional (initial or choice motivation), actional (executive) and post-actional (evaluation) phases. This cyclical structure unveiled

shortcomings to the previously dominant linear approach and confirmed the volatile nature of motivation. It also indicated that once motivation was generated in its initial stage it needed to be retained and protected during the executive phase in classroom environment where a lot of internal and situation-specific distractors (such as off-task thoughts, sense of anxiety, peers, peer pressure, physical conditions etc.) constantly threatened to side-track the initial motivation for learning. In the post-actional phase, often termed “motivational retrospection”, learners reflected and evaluated the outcomes of learning. This segment is really important because “the way students process their past experiences in this retrospective phase will determine the kind of activities they will be motivated to pursue in the future” (Cohen, 2010: 170).

Motivational psychologists have looked into what internal motives make learners learn a second language, whereas social psychologists focused on attitudes perceived as “the functions of the social context and the interpersonal/intergroup relational patterns” (Dörnyei, 1994). They have found positive disposition towards the language and its socio-cultural aspects, values, beliefs and attitudinal factors to be among the most important components of choice motivation as well as instrumental and integrative motivation. The central argument about these two types of motivation was first introduced by Gardner and Lambert in 1959 and was later developed in the social-psychological phase. Gardner’s concept of integrative motivation, which consists of “integrativeness”, attitudes towards the learning situation and motivation has had a central role in theoretical inquiry of L2 motivation for five decades, because there is always “some level of willingness to interact with other communities” even when motivation is instrumental (Gardner, 1985 in Dörnyei, 2012: 399).

“Integrativeness reflects a genuine interest in learning the second language in order to come closer to the other language community. At one level, this implies an openness to, and respect for other cultural groups and ways of life. In the extreme, this might involve complete identification with the community (and possibly even withdrawal from one’s original group), but more commonly it might well involve integration within both communities” (Gardner, 2001: 5, in Dörnyei 2009: 23).

While instrumental motivation refers to practical reasons for learning the language, such as getting a job, integrative motivation includes positive attitude toward the target group and willingness to integrate oneself into the target language community.

These two concepts helped explain the rationale behind the initial motivation for learning the language, but the main downside in this conceptualisation was the fact that it could not offer answers as to what happens in specific educational contexts such as in case of English as an international or global language, which lacks specific L2 community (e.g. English as a lingua franca in the EU), nor outline the behaviour direction of an individual in the process of learning.

Further research into motivational components included intrinsic and extrinsic dimensions, intellectual curiosity, need for achievement, linguistic self-confidence, classroom goal structures and other learning environment factors (Dörnyei, 1994, 275-277). These conceptual systems of cognitive theories of motivation have shown that, generally speaking, the higher subjective perceptions of assurance and trust in oneself, the higher the degree of positive motivation. However, despite positive attitudes towards learning, numerous studies have shown that unless there are other positive conditions and concrete action plans such as learner’s active engagement and motivational components specific to learning setting (e.g. quality teaching and teaching methodology), there will be failure in L2 learning (Nikolov’s study in 2001, and Donitsa-Schmidt and Shohamy in 2001, in Djigunović&Bagarić, 2007: 261; Cohen, 2010: 161).

In relation to theoretical background and motivation research explained in this chapter, our attention is directed towards such concepts as the learner's linguistic self-confidence, the learner's interest toward the L2 target culture, instrumentality and milieu as well as learning experience. Zoltán Dörnyei's theory of the L2 Motivational Self-System will help explain the central components of this study.

2. L2 Motivational Self-System

Understanding that L2 motivation does not occur in isolation nor has a clear delineation of where one learning process starts and ends, but is a complex, comprehensive and dynamic process that occurs in relation to diverse individual's internal, social and contextual factors, is what characterizes the current socio-dynamic phase (Ushioda and Dörnyei, 2012, 397-399). By utilizing previous theorization on L2 motivation and linking it to aspects of the psychological research on the self, eminent Hungarian psycholinguist and author of numerous crucial publications on L2 motivation, Zoltán Dörnyei, generated the new theory entitled "L2 Motivational Self System" (Dörnyei, 2005).

There are two major powerful motivational tools in the L2 Motivational Self-System that centre on people's perception of themselves in the future: possible selves and future self-guides. These two concepts originate in an idea developed by Markus & Ruvolo, about a self-system that provides incentive for future action and goal-directed behaviour. The authors claim that by envisioning actions and desired goals through possible selves we are "phenomenologically very close to the actual thoughts and feelings that individuals experience as they are in the process of motivated behaviour and instrumental action" (Markus & Ruvolo, 1989: 217 in Dörnyei, 2009:13). Imagining future goals through the integration of the self brings an interesting tie between motivational psychology and personality psychology, and an important realization that a traditional view of a person's self-concept does not need to relate to the present view of oneself, but to the "possible self", or to the set of attributes one would like to possess to become *the ideal self* (the best case scenario), what one might or ought to possess to become *the ought-to self* (default scenario), or what one is afraid of becoming (the worst case scenario) in the future (Dörnyei, 2009: 11-13). The best (the ideal) and the worst case (the ought selves) scenarios act as central components of the system of future self-guides and are potent motivational factors in L2 learning, since the acquisition of L2 proficiency is the desired state on one's *ideal self*. Furthermore, in the educational setting, the ideal self, which is defined as *Ideal L2 Self*, is closely connected with L2 mastery because of the learner's motivation to become a competent and proficient user of the language, thus constantly trying to reduce the discrepancy between the actual and the ideal selves. Dörnyei explains that this concept equates with Gardner's notion of integrativeness as it encompasses its central components: instrumentality and attitudes towards members of the L2 community. *Ought-to L2 Self* is connected with extrinsic and instrumental motives (duties and obligations imposed by others) where the learner wishes to possess certain attributes in order to avoid possible negative outcomes (e.g. negative grade) and *L2 Learning Experience*, which includes the immediate learning setting: the curriculum, the teacher, the peer group, the teaching materials, the experience of success, among others.

3. Internationalization of English and Erasmus + exchange mobility

Thanks to an increasing level of academic internationalization and the 20% goal of student exchanges by 2020¹, the European student mobility program Erasmus+ has become one the most imminent international and intercultural training programs in the EU. Among many

¹ As agreed by the EU member governments (*Council conclusions on the modernisation of higher education*, 2011, p.10)

other benefits of this program, promoting and developing foreign or second² language skills is certainly one of its specific priorities, because linguistic and cultural knowledge are perceived to be some of the key tools in strengthening personal competitiveness and knowledge capital. English is not a native language in most of the countries where the Erasmus program is conducted, but it is nevertheless a vital means of achieving communication goals in the academia and elsewhere. Precisely because of the global spread of English as an international lingua franca theorization about the languages' integrative and instrumental motivation has become problematic mainly because it has become impossible to clearly identify the target community and culture that language learners want to integrate with. Tomoko Yashima thus introduced the concept of "international posture", which subsumes an individual's desire to connect with the international community, show an interest in international affairs, and possess readiness to interact with people belonging to other nations (Yashima, 2009: 146). Yashima further argues that international posture might lead to generation of possible selves because envisioning the learner's ideal selves, for example, working in an international company or pursuing an international career might help incite the learner's motivation to become self-confident and a proficient user of English. Our study corroborates Yashima's theory that international and intercultural communication of exchange students makes it easier for them to situate themselves in their possible selves, as opposed to those of Croatian learners who have not yet entered the world of international L2 communities and the only time they do is when it becomes visible through the limited educational context of the English language lessons.

4. Aim of the study

There has been no research, known to the authors of this paper, on differences between Croatian and Erasmus learners in relation to attitudes and motivation towards foreign language learning, so the aim of the study is to understand how both groups of students feel about English as a FL/ L2, how they perceive their language learning, what they think of their immediate learning environment and what motivates them to learn the language. The study was conducted in order to compare attitudes and motivation between non-English-major university students who originate from different socio-educational contexts and represent different linguistic and cultural backgrounds, but find themselves in the same educational setting. Besides looking at these aspects from different cultural perspectives and horizons the paper also engages in investigating attitudinal-motivational components between younger and older Croatian students in comparison to Erasmus students.

Between given heterogeneous groups of participants we specifically wanted to embrace individual motivational factors with the social learning environment and compare 1) individual motivational components such as attitude, desire and interest to learn the language, positive disposition towards learning FL, effort in relation to possible selves; 2) international posture, instrumental motivation and social dimension, such as interest toward targeted community and culture; and 3) L2 Learning Experience within immediate learning situation.

4.1 Sample

A total of 129 students divided into three subsamples participated in the study. The 17 Erasmus + students arriving from different EU countries comprise the first group of respondents. The 102 domestic students belong to the second group of first year Croatian students of Information Technology (66) and Mechanical Engineering (35), and the 11 senior

² Foreign language is the additional language besides mother tongue which is normally not spoken in the area where it is taught (e.g. English in Croatia) while second language is used as lingua franca, e.g. English as the means of international commerce, administration and, in places, education in the EU. Typically, L2 Learning takes place in a naturalistic setting and/or through immersion, while FL occurs in formal classroom environment.

year (3rd year) students comprise the third group at the Department of Professional Studies of the University of Split. All participants took some form of English class: 1st year students were enrolled in Business English I, 3rd year students had Technical English and Erasmus students took Business English II. Participants were not evenly spread across groups as there were only 17 Erasmus + students who spent their one semester mobility period as guest students at the time the questionnaire was conducted. Croatian students are regular and part-time students at the Department.

4.2 Instruments

The questionnaire included the demographic data, 20 statements about motivational-attitudinal, integrative and instrumental factors regarding English language acquisition, 8 statements concerning socio-cultural aspects of the language and 8 other statements about the immediate learning experience such as classroom activity, teacher and teaching materials. The second part of questionnaire (attitudes and motivation) contained a five-point Likert scale of likelihood (1=does not apply; 5=completely applies) and a five-point Likert scale was used to describe the level of agreement (1=strongly disagree; 5=strongly agree) in the third (socio-cultural aspect), and the fourth (learning experience) section of the questionnaire. The adopted questionnaire in use was validated by Mihaljević Djigunović and Bagarić in 2007 on a comparative study of attitudes and motivation of Croatian learners of English and German language.

Mann-Whitney U test was used to compare arithmetic means of sequential size of two basic sets. The hypotheses are:

H0: there is no statistically significant difference in the average values of observed variables between the two populations.

H1: there is a statistically significant difference in the average values of observed variables between the two populations.

The usual level of significance is $\alpha = 0.05$. The hypothesis H0 is accepted if the empirical level of significance is greater than the specified limit values for α . Otherwise it is dismissed.

4.3 Procedure

The questionnaire was administered to the three groups of participants during appropriate regular English classes. It was administered in Croatian language for Croatian students and in English for the Erasmus+ students. Qualitative analysis was performed on the collected data using Mann Whitney U test in SPSS.

5. Results

Besides the usual demographic questions in the first part of the questionnaire we looked at an overall number of years of studying English (in and out-of-school), general students' assessment of their English proficiency as well as their expected semester grade.

Table 1: Statistically significant items in the demographic data of the questionnaire

Question:	Erasmus		Croatian learners (1)			Croatian learners (2)		
	Average	Standard deviation	Average	Standard deviation	P - value	Average	Standard deviation	P - value
ITEM 11: Expected semester grade in English:	4,00	0,84	3,47	0,81	0,018*	2,91	0,67	0,003**

* statistically significant at 0,05

**statistically significant at 0,01

As it can be seen from the table the only statistical difference that we have found was in the expected semester grade (ITEM 11). Even though there was no statistically significant difference, it is important to note that 94% of Erasmus students use English outside the classroom, as opposed to 80% of 1st year Croatian students and 72% of senior year students.

Table 2: Statistically significant results of descriptive statistics for the second part of the questionnaire

Question:	Erasmus		Croatian learners (1)			Croatian learners (2)		
	Average	Standard deviation	Average	Standard deviation	P - value	Average	Standard deviation	P – value
ITEM 1. I like English very much.	4,71	0,57	3,96	1,18	0,010*	3,55	0,89	0,001**
ITEM 3. My parents think it is important that I know English.	5,00	0,00	4,37	0,91	0,002**	4,45	0,89	0,009**
ITEM 8. I often fail while learning English.	1,53	0,92	2,45	1,22	0,002**	2,82	1,40	0,014*
ITEM 9. I am afraid of speaking English in class.	1,53	0,78	2,51	1,27	0,003**	2,36	1,49	0,157
ITEM 10. I want to communicate with someone who speaks English.	4,76	0,55	3,87	1,18	0,001**	3,82	1,03	0,009**
ITEM 12. What I learn in this class will be useful in my life.	4,88	0,32	4,11	1,07	0,002**	4,64	0,48	0,128
ITEM 13. I will go far in life.	4,35	0,68	3,83	0,94	0,035*	4,36	0,64	1,000
ITEM 14. Outside of classroom I almost never think about what we have learned in class.	2,18	0,86	3,01	1,19	0,008**	2,55	0,89	0,253
ITEM 15. Realistically speaking, I do not strive to learn English.	1,76	1,00	2,59	1,22	0,010*	2,55	1,16	0,088
ITEM 18. Knowledge of English is of no great value to me.	1,06	0,24	1,46	0,85	0,040*	2,00	1,28	0,011*
ITEM 19. I want to get a good grade in this class.	4,76	0,42	4,36	0,98	0,124	3,91	1,00	0,014*

* statistically significant at 0,05

**statistically significant at 0,01

The results presented above show that there are 11/20 statistically significant differences in the part of the questionnaire that reflects motivational-attitudinal components. These are:

ITEM 1 (I like English very much); ITEM 3 (My parents think it is important that I know English); ITEM 8 (I often fail while learning English); ITEM 9 (I am afraid of speaking English in class); ITEM 10 (I want to communicate with someone who speaks English); ITEM 12 (What I learn in class will be useful in my life); ITEM 13 (I will go far in life); ITEM 14 (Outside of classroom I almost never think about what we have learned in class); ITEM 15 (Realistically speaking, I do not strive to learn English); ITEM 18 (Knowledge of English is of no great value to me); and finally ITEM 19 (I want to get a good grade in this class). We have also tested the learner's effort, commitment to learning, general feeling towards the language and utilitarian purpose of learning the language, without statistical significance among the three groups.

Table 3: Statistically significant results regarding students' attitudes toward socio-cultural aspects of language

	Erasmus		Croatian learners (1)			Croatian learners (2)		
Question:	Average	Standard deviation	Average	Standard deviation	P - value	Average	Standard deviation	P – value
ITEM 1. I enjoy learning about other cultures.	4,81	0,39	3,95	1,04	0,001**	4,18	0,83	0,033*
ITEM 2. I am interested in people who speak English.	4,69	0,58	3,84	0,97	0,001**	4,18	0,72	0,052
ITEM 3. I'd like to be able to use English in different situations.	4,88	0,33	4,33	0,93	0,015*	4,18	1,03	0,040*
ITEM 4. I use English in my spare time.	4,19	1,01	3,87	1,09	0,260	3,00	1,28	0,020*
ITEM 6. I talk to native speakers of the language.	3,75	1,09	3,26	1,31	0,180	2,73	0,86	0,037*
ITEM 7. I read books in English.	3,50	1,22	2,45	1,35	0,006**	2,55	1,44	0,095
ITEM 8. I read daily and /or online news in English.	4,19	0,73	3,64	1,42	0,311	3,09	1,31	0,027*

* statistically significant at 0,05

**statistically significant at 0,01

The results of table 3 illustrate statistically significant differences in all items but item 5, which tested interest in watching movies and TV programs in English. Significant differences were found in: ITEM 1. (I enjoy learning about other cultures); ITEM 2. (I am interested in people who speak English); ITEM 3. (I'd like to be able to use English in different situations); ITEM 4. (I use English in my spare time); ITEM 6. (I talk to native speakers of the language); ITEM 7. (I read books in English) and ITEM 8. (I read daily and/or online news in English).

Table 4: Statistically significant results about learning experience

	Erasmus		Croatian learners (1)			Croatian learners (2)		
Question:	Average	Standard deviation	Average	Standard deviation	P - value	Average	Standard deviation	P – value
ITEM 1. I enjoy coming to English classes.	4,50	0,61	3,13	1,08	0,001**	3,36	0,88	0,001**

ITEM 2. I find classroom activities interesting.	4,38	0,70	3,47	0,99	0,001**	4,55	0,50	0,618
ITEM 3. I feel the teacher wants me to do well in this class.	4,81	0,39	4,26	0,77	0,005**	4,55	0,50	0,143
ITEM 4. Our textbooks are bad.	1,69	0,85	2,15	1,01	0,080	2,91	0,90	0,003**
ITEM 6. My English classes are boring.	1,69	0,68	2,38	1,06	0,012*	1,82	0,83	0,749
ITEM 8. My English language teacher is motivating.	4,69	0,46	4,17	0,84	0,019*	4,45	0,66	0,381

* statistically significant at 0,05

**statistically significant at 0,01

The results of the table above confirm significant statistical difference in 6 out of 8 items as regards the learning experience. These are: ITEM 1 (I enjoy coming to English classes); ITEM 2. (I find classroom activities interesting); ITEM 3, (I feel the teacher wants me to do well in this class); ITEM 4 (Our textbooks are bad); ITEM 6. (My English classes are boring); ITEM 8 (My English language teacher is motivating). Learning capabilities and willingness to learn were not significantly different among the three groups.

6. Analysis

As the overall results demonstrate the advantage of Erasmus student exchange is clear in the majority of the tested items. Erasmus students expect better grades in English, like English more, consider the language important, fail less while learning, are not as afraid of speaking the language and are more eager to communicate in English. They also believe that what they learn in an English class will be useful in their life, as do their parents, as opposed to younger Croatian students who are less optimistic about their future prospects. Junior Croatian students do not strive to learn English too much, nor find great value in knowing English. They are also afraid of speaking the language. Senior Croatian students think it is important to get a good grade in English and this might be because they are approaching the end of their studies and are more pragmatic and career oriented. Regarding cultural aspects, Erasmus students surpass Croatian students in factors of integrative motivation. They are generally more interested in people who speak the language and they make use of the English language in different forms in their free time (e.g. talking to strangers, tutoring, talking to other exchange students, traveling, working abroad). Similarly, results concerning learning experience go in favour of Erasmus students who enjoy coming to English classes, find classroom activities interesting, feel the teacher wants them to do well and is motivating. On the other hand, younger Croatian students feel that their English classes are boring and senior Croatian students find their textbooks bad.

When taking into consideration the factors we wanted to analyse, we conclude that regarding 1) attitudinal-motivational aspects, generally speaking, Erasmus students show a more positive attitude towards the L2 language. *A propos* section 2), which concerns social-cultural spheres, we infer that Erasmus students show a higher international posture than that of Croatian students. Furthermore, exchange students report larger gains in the classroom experience, as demonstrated in section 3.

7. Discussion

Our analysis has showed that Erasmus students differ in their attitudes and motivation towards the English language from their Croatian peers, especially from younger ones. Of particular importance is the fact that foreign exchange students demonstrate significant statistical differences on majority of tested elements in the three tested areas: attitudes and motivation, instrumental motivation and social dimension and educational setting.

These results raise the question of why the Erasmus students have such significantly different levels of motivation and positive attitude towards learning the L2. We would like to suggest that there are several crucial reasons for that:

1) Erasmus exchange students possess higher propensity for international posture which is stimulating and contributes to students' self-efficacy, linguistic self-confidence and motivation. They also (consciously or unconsciously) understand the instrumental and integrative importance of L2 motivation as they are key tools in achieving the Ideal L2 selves of increased language proficiency. Unlike their Croatian peers, exchange students value the importance of communication in English as it is often the only means of communication between them and the foreign community they are placed in. A critical moment in relation to L2 is the instant when English becomes a means to achieve a communicative goal (as it has become for Erasmus students) rather than a tested and graded school subject (majority of Croatian students).

2) Higher recurrence of English use outside of the classroom context grants a solid platform for exchange students to envision their English using selves communicating in an international arena. Regular and usual participation in an international L2 community makes it easier for learners to imagine themselves as Ideal L2 selves. On the other hand, those students who are not frequently involved in communication in English will find it harder to connect to their Ideal L2 self-image. Furthermore, the Ideal L2 self-image functions not only as a strong incentive for further study and more proficient communication in L2 in various contexts, but helps students conceptualise model image of themselves in interaction with the world.

3) Erasmus students have freely chosen to participate in the learning process and have chosen to take an English course themselves while Croatian students are forced to take English courses as these are an obligatory subject in their field of studies. This could explain the higher level of instrumental motivation of Croatian students in obtaining good grades in the course, junior students' negative attitudes towards the English classes and seniors' towards textbooks. On the other hand, exchange students might value support and motivation obtained by the teachers during the obvious process of their language development.

Even though the present study reveals substantial differences between the three subgroups of partakers, a more thorough research corroborating our thesis that the Erasmus student exchange program endows its participants a higher level of international posture that helps motivate students to enhance English language proficiency and have a more positive attitude towards learning the L2 is still needed. However, one thing is certain: strengthening English language skills and meta-skills within this concept of exchange mobility is the key component of a knowledge society, particularly on an EU scale. By definition, the majority of Erasmus students embrace the globalized world of cultural diversity and transnational shared practices, values, norms, behaviours, cultures and patterns; values which will provide the right framework and be useful throughout their entire life-course including their entry into the labour market. The present study has shown that the positive image of their Ideal L2 selves shapes their engagement in learning and empowers them to mediate their own self-concepts with the world around them.

Having the findings of this paper in mind we should reinforce exchange mobility and provide a greater involvement of Croatian students in Erasmus programs. While the Croatian youth

needs to take a more positive attitude and become active agents of their learning, educators should provide incentives in helping them sustain visions of their linguistic possible selves as well as create such classroom momentum to maintain their motivation for L2 learning. We believe that bringing a positive shift in students' self-perception of themselves as capable language learners, promoting contact with the international community and developing learners' instrumental motivation, all the while preserving national identity and cultural diversity within the European mosaic of cultures, should become a common classroom practice. This study confirms that student exchange is a powerful motivator for L2 learning. It might also prove to be the crucial transformational experience for Croatian students influencing their attitudes and motivation toward the English language.

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Do gender and age impact student success?

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Abstract. The paper presents results from the study investigating impact of gender and age on students' academic success. Students from Department of Professional Studies, University of Split, Zagreb teaching centre, who attended 2008/2009, 2009/2010, and 2010/2011 classes participated in our study. Fischer test and t-test were used to analyse the data in Microsoft Excel. Although results show that female students have higher grade point average in 30 out of 34 subjects, statistically significant differences were found in 8 subjects. The sample was split in younger (under 30 years of age) and older (over 30 years of age) groups and results show that older students have higher grade point average in 28 out of 34 subjects. Statistically significant differences were found in 9 of these subjects.

Key words: *age and academic achievement, gender, age, academic performance, economics students*

1. Introduction

Scientists around the world are trying to determine the parameters that affect the academic performance and thereby improve the education system. Numerous studies indicate the existence of differences in achievement based on gender and age. Results indicate that female students achieve higher academic achievement from young age (kindergarten) to university level studies in all subjects, including mathematics and natural sciences (Mickelson, 1989; Perkins, Kleiner, Roey and Brown, 2004). At the same time, several test of knowledge administrated internationally indicate that boys perform better on standardized math tests while girls achieve better educational results in reading and language tests (Baker and Jones, 1993; Beller and Gafni, 1996; Gallagher and Kaufman, 2005).

Lifelong learning extends through all stages of life and motivation for learning is being triggered by changing mental functions and life priorities. These changes subsequently enhance or inhibit ability to memorize and learn. Researchers have also established certain differences in information processing and memorization between younger and older individuals. In addition, research has identified different levels of motivation for learning that differentiates younger and older individuals (Pastuović, 1999).

After the introduction there is a discussion of differences between male and female students. Next, a discussion of differences between younger and older students follows. This is followed by methods section and then by results. The conclusion offers some implications of research study.

2. The differences between female and male students

According to the results of PISA conducted in 2012 in Croatia, boys achieve significantly better results than girls in mathematics while girls are more successful in reading (OECD, 2012). Studies also suggest that gender differences are the weakest at the beginning of schooling and while boys advance faster in mathematics during their schooling, girls advance faster in literacy and reading ability (Maccoby and Jacklin, 1974; Hyde, Fennema and Lamon, 1990; Willingham and Cole, 1997).

Table 1 below illustrates the distribution of Croatian university alumni by gender. The source of this information is the Central Bureau of Statistics of the Republic of Croatia and their publication *Women and Men in Croatia in 2015*.

Table 1 University graduates

Year	University graduates by gender %	
	Female	Male
1960.	31,8	68,2
1970.	46,1	53,9
1980.	44,6	55,4
1990.	53,7	46,3
2000.	55,6	44,4
2007.	58,1	41,9
2008.	58,7	41,3
2009.	58,6	41,4
2010.	60,8	39,2
2011.	58,5	41,5
2012.	59,5	40,5
2013.	58,9	41,1

Source: Central Bureau of Statistics of the Republic of Croatia

Data shows that in the last 50 years women almost doubled its share of the population who graduated from institutions of higher learning. In 1960 women made up 32% and in 2010 they were 61% of all university graduates. During the last decade women make up about 52% of the total Croatian population (Croatian Bureau of Statistics, 2015) and Table 1 shows that the proportion of female college graduates is greater than female share in the overall population. With this it can be concluded that women are more successful in terms of successful completion of university studies.

There are large gender representation discrepancy based on subject of study at the university level. Table 2 shows the distribution of graduates by gender with an area of study with predominant female participation (social services), an area of study with predominant male participation (computer science), and an area of study encompassing students from this

research study (social science). It is evident that certain areas of studies attract one gender more than other so it could be expected gender-driven tendencies toward individual courses.

Table 2: *University graduates according their area of study – 2013.*

	University graduates by gender %	
	Female	Male
Total	58,9	41,1
Social services	96,0	4,0
Social science	70,0	30,0
Computer science	16,4	83,6

Source: Central Bureau of Statistics of the Republic of Croatia

3. The differences between younger and older students

Studies show that older adults are less successful in storing information than younger adults. In addition, older adults do not organize information as efficiently as younger adults (Craik, 1979; Craik & Rabinowitz, 1984). In terms of time management, some studies have shown that older students have better time management skills (Trueman and Hartley, 1996). Another fact that goes "in favor of" older adults is the amount of prior knowledge. The amount of prior knowledge grows throughout life and improves cognitive abilities so that older adults use their knowledge and skills in solving everyday problems better than younger adults (Tversky and Kahneman, 1981; Neimark, 1982).

Department of Education shows that only 0.6% of people over the age of 35 take part in some form of professional development in Croatia while the EU average for the same age group is about 10 times more. Such numbers lead to the conclusion that Croatian citizens are not inclined to change professions.

The results regarding labor survey "Croatia 2014 - Europe 2014" show the percentage of adults age 25-64 participating in professional development and training. Table 3 shows the results of three countries: Croatia, Denmark – due to the largest percentage of the population participating in professional development and training and Romania – due to the lowest percentage of population participating in professional development and training.

Table 3: *Life-long learning(adult age 25-64 participation in education and training)*

Country	Total %		
	2012	2013	2014
Romania	1,3	1,8	1,5
Croatia	2,8	2,9	2,5
Denmark	31,6	31,4	31,7

Source: Bureau of Statistics of the Republic of Croatia

Individuals in this report participated in professional development and training within four weeks of the survey.

4. Data and research method

The subject of this research study is the influence of gender and age on the success of male and female students in mastering the material from 34 subjects. Success was measured by examining test scores students received in these 34 subjects. The study was conducted in 2013 and the data collected was from students enrolled in Department of Professional Studies, University of Split, teaching center Zagreb in the academic year 2008/2009, 2009/2010, and 2010/2011. Students were majoring in Accounting and Finance, three year study.

The main objectives of research are to:

- establish whether different genders (male vs. female) perform differently in any of the 34 subjects examined and if these differences are statistically significant.
- establish whether different age groups (younger vs. older) perform differently in any of the 34 subjects examined and if these differences are statistically significant.
- establish whether gender of students contributes to difference in success in different academic years

In this study there are used null hypothesis:

H1: There is no statistically significant difference in the academic success of students of different genders.

H2: There is no statistically significant difference in the academic success between older (over 30) and younger (under 30) student groups.

The differences between groups were tested with t-test which aims to establish any significant difference between the measured variables. F-test (Fisher's exact test) is used first to test the hypothesis of equality of two population variances.

5. Results

5.1. The influence of gender on student success

87 female and 38 male students were randomly selected to participate in this study. All of them were students at the Department of Professional Studies, teaching center Zagreb, enrolled in classes in 2008/2009, 2009/2010, and 2010/2011. They all majored in Accounting and finance. Gender breakdown is shown in the Figure 1 below.

Only students who received passing grades for their classes were included in the study. Students who failed the exam or failed to take the exam were excluded from the study. Three elective courses (Business Communication, Entrepreneurial Strategy, and Stock Market Management) were excluded from analysis due to the small number of students who attended courses.

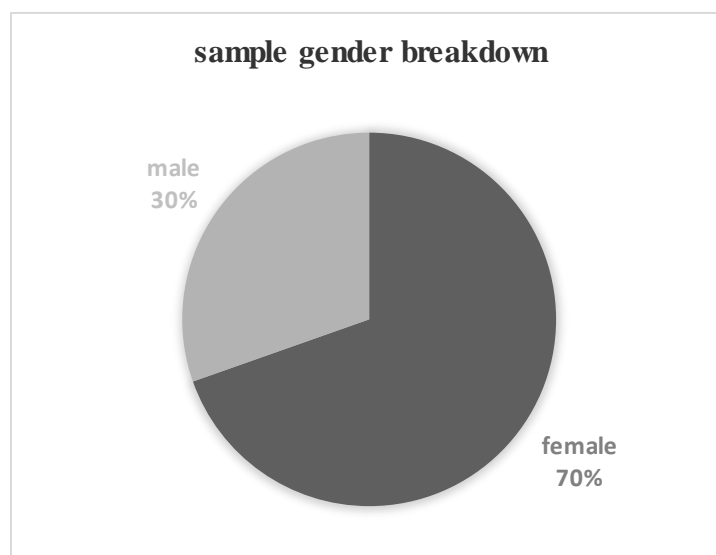


Figure 1 Sample gender distribution

Source: Authors

After the completion of the F-test and t-test the following results have been received:

Table 4 Combined display of the differences in academic success between female and male students

	Subjects (classes)	p-value	Grade point average	
			Male	Female
1	Introductory accounting	0,0608	2,89	3,25
2	Introductory economics	0,0138*	2,76	3,33
3	Business mathematics	0,0030*	3	3,94
4	Computer information systems 1	0,7713	3,64	3,71
5	Management	0,4334	3,15	3,42
6	Business English 1	0,5041	4,03	4,17
7	Accounting	0,0071*	2,63	3,48
8	Introductory finance	0,2741	2,77	3,11
9	Business statistics	0,1166	3,11	3,58
10	Commerce Law	4,71E-05*	2,56	3,45
11	Computer information systems 2	0,1100	3,8	4,15
12	Business English 2	0,2003	4,04	4,31
13	Financial accounting 1	0,3665	3,11	2,69
14	Managerial accounting	0,0217*	3,53	4,14
15	Cost accounting	0,8713	4	4,07
16	Finance for businesses 1	0,3082	3,33	3,59
17	Revision	0,4633	2,86	3,04
18	Finance for businesses 2	0,4475	3,21	3,46
19	Payments	0,2085	3,27	3,70
20	Bank accounting	0,0022*	3,21	4,30
21	Accounting information systems	0,0008*	3,29	4,24
22	Business marketing	0,0004*	3,18	4,21
23	Entrepreneurial design	0,5107	4,33	4,55
24	Entrepreneurial infrastructure	0,8238	3,5	3,64

25	Internship	0,1425	4,67	4,87
26	Financial accounting 2	0,7073	3,5	3,25
27	Entrepreneurship	0,4815	4,25	4,46
28	Income tax	0,1829	4,57	4,06
29	Cash flow accounting	0,5841	2,88	3,12
30	Italian language	0,9610	4,88	4,87
31	German language	0,7310	4,67	4,78
32	Public procurement	0,4793	4,25	3,96
33	Insurance and reinsurance	0,3141	3	3,70
34	Value added tax	0,5675	4,67	4,41

* statistically significant difference ($p < 0.05$)

Source: Authors

It is evident from Table 4 that female students had a higher average score in 28 out of 34 classes, however, statistically significant difference ($p < 0.05$) between genders were found in 8 courses: Introductory economics, Business mathematics, Accounting, Commerce law, Managerial accounting, Bank accounting, Accounting information systems, and Business marketing. For those 8 classes it may be rejected the null hypothesis and conclude that the female students performed better academically. Male students had a higher average score in 6 out of 34 classes, however, none of these 6 cases was significantly different from female student group. Consequently, it can be concluded that female students performed significantly better in 8 classes while in the remaining 26 there is no difference found between male and female student performance.

5.2. The interaction between gender and year of study

After the division of all classes by the year when students are enrolled in them and separated students by gender the average grade was calculated for each gender and for each academic year. It was done to examine whether gender differences in academic performance depend on student's year of study.

Table 5 Interaction between student's gender and year of study

	First year		Second year		Third year	
	male	female	male	female	male	female
Number of successfully finished classes	253	726	135	505	55	351
Grade point average	3,26	3,69	3,37	3,80	4,13	4,12
T-Test	$p < 0,05$		$p < 0,05$		$p > 0,05$	

Source: Authors

Results from Table 5 indicate that grade point average rose from year to year for both genders.

Based on the results of the t-test it can be concluded that first- and second-year female students performed significantly better academically than their male colleagues. There are no significant differences between genders for the third-year students. Another interesting issues that's illustrated by the table is the diminishing number of classes male students finished successfully as a percentage of all finished classes. As a first year students males finish 26% of all finished classes and as a second-year this number goes down to 21%. Finally, as third-

year student males finish only 14% of all completed classes. This leads to conclusion that males give up on university studies more often than females. On a positive note, the ones who stay committed to their studies perform equally well as their female colleagues.

5.3. The influence of age on student success

In order to evaluate whether age contributes to differences in academic success student sample was divided in two groups. The first group included students who are 30 or younger. The second group consisted of individuals who were 31 and older. 74 students were part of group one (30 or younger) and 51 students were in the second group (31 or older).

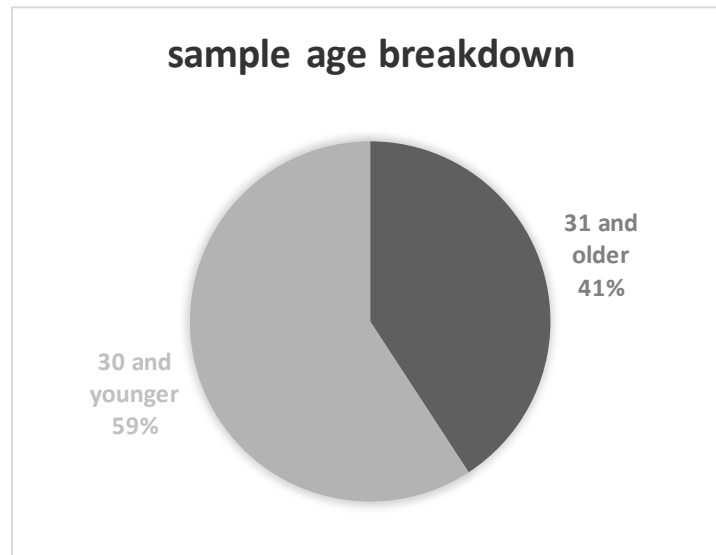


Figure 2 Sample age distribution

Source: Authors

After conducting F-test and t-test results displayed in Table 6 emerge.

Table 6 Combined display of the differences in academic success between younger and older students

	Subjects (classes)	p-value	Grade point average	
			30 and younger	31 and older
1	Introductory accounting	0,1280	3,05	3,30
2	Introductory economics	0,0303*	3	3,42
3	Business mathematics	0,1867	3,55	3,87
4	Computer information systems 1	0,8142	3,67	3,72
5	Management	0,0009*	2,91	3,89
6	Business English 1	0,0890	4,27	3,93
7	Accounting	0,0723	3,05	3,55
8	Introductory finance	0,0118*	2,72	3,39
9	Business statistics	0,0288*	3,21	3,77
10	Commerce Law	0,0761	3,02	3,42
11	Computer information systems 2	0,0000*	3,73	4,47

12	Business English 2	0,3294	4,31	4,13
13	Financial accounting 1	0,3225	2,91	2,65
14	Managerial accounting	0,000*	3,62	4,43
15	Cost accounting	0,6926	4	4,11
16	Finance for businesses 1	0,0746	3,36	3,73
17	Revision	0,5519	3,05	2,94
18	Finance for businesses 2	0,0110*	3,09	3,76
19	Payments	0,0697	3,38	3,86
20	Bank accounting	0,0407	3,72	4,35
21	Accounting information systems	0,0693	3,82	4,27
22	Business marketing	0,0662	3,67	4,21
23	Entrepreneurial design	0,8000	4,55	4,5
24	Entrepreneurial infrastructure	0,3763	3,44	3,86
25	Internship	0,3102	4,77	4,88
26	Financial accounting 2	0,1804	2,93	3,48
27	Entrepreneurship	0,0057*	4,17	4,71
28	Income tax	0,1058	3,9	4,36
29	Cash flow accounting	0,0270*	2,68	3,39
30	Italian language	0,1152	4,8	4,95
31	German language	0,5490	4,67	4,83
32	Public procurement	0,3161	3,82	4,11
33	Insurance and reinsurance	0,9913	3,64	3,63
34	Value added tax	0,1531	4,18	4,58

* statistically significant difference ($p < 0.05$)

Source: Authors

It is evident from Table 6 that older students had a higher average score in 28 out of 34 classes, however, statistically significant difference ($p < 0.05$) between age groups were found in 9 courses: Introductory economics, Management, Introductory finance, Business statistics, Computer information systems 2, Managerial accounting, Finance for businesses 2, Entrepreneurship and Bank accounting. Since older students had better grades in these 9 classes it may be rejected null hypothesis. Younger students had a higher average score in 6 out of 34 classes, however, none of these 6 cases was significantly different from older student group. Consequently, it can be concluded that older students performed significantly better in 9 classes while in the remaining 25 there is no found difference between older and younger student performance.

Another age division was explored to evaluate the impact of age on academic success. To evaluate previous results the students were separated in younger group (35 and younger) and older group (36 and older). 96 students were in the first group and 29 were in the second group.

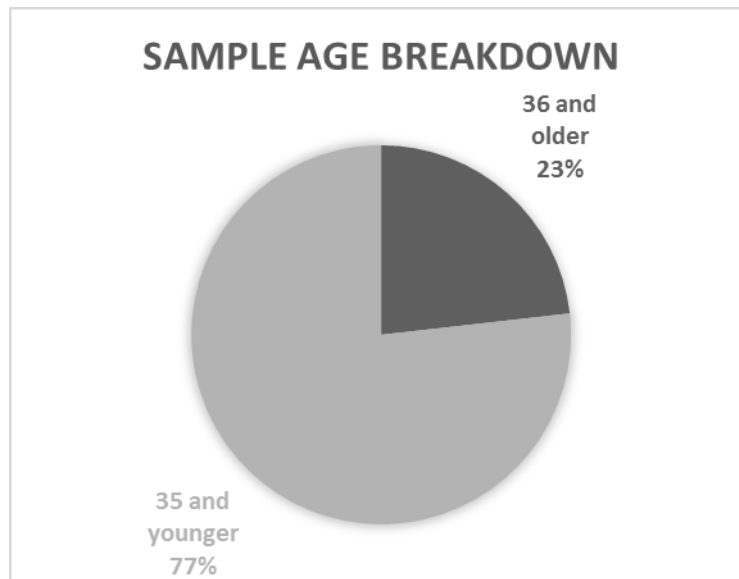


Figure 3 Sample age distribution 2

Source: Authors

Results from this additional comparison of younger and older age group support earlier results. Older group had a higher average score in 26 out of 34 classes, and once again, statistically significant difference ($p < 0.05$) between age groups were found in 9 courses: Introductory economics, Management, Computer information systems 2, Managerial accounting, Entrepreneurship, Introductory accounting, Commerce law, Finance for businesses 1, and Business marketing. Students 35 and under had a higher average grade in 7 out of 34 classes, however, none of these 7 cases was significantly different from older student group. Subsequently, it can be concluded that younger student group did not outperform older student group in any of the subjects, while older student group did outperform younger group in 9 classes. Although composition of classes slightly changed in two different age-driven split of the sample, older student group showed consistently higher academic success compared to their younger colleagues.

6. Conclusion

This research finds that female students performed better in 8 courses: Introductory economics, Business mathematics, Accounting, Commerce law, Managerial accounting, Bank accounting, Accounting information systems, and Business marketing. Male students did not significantly outperform their female colleagues in any of the 34 classes.

Women are on average more sensitive and more introvert than members of the male population. As there is no difference in the average intelligence between genders, superior academic performance of women can be explained by better attendance of classes, maintaining better attention during classes, and studying regularly (Pastuović, 1997). Character of the person plays a major role as well.

Research conducted by the Scandinavian scientists with students of business administration did not find any evidence of gender differences in academic success except in statistics where female students outperformed their male colleagues (Busch, 1995). In some other studies research finds significantly better performance of female students in classes saturated by verbal content (Geffen, Moar, O'Hanlon and Clark, 1990).

Additionally, this study shows that students age 31 and older perform significantly better than their younger colleagues in 9 classes: Introductory economics, Management, Introductory finance, Business statistics, Computer information systems 2, Managerial accounting, Finance for businesses 2, Entrepreneurship, and Bank accounting. Similar results emerge from dividing sample in 35 year olds and younger group and an older group. Once again older group of students performed better in 9 classes: Introductory economics, Management, Computer information systems 2, Managerial accounting, Entrepreneurship, Introductory accounting, Commerce law, Finance for businesses 1, and Business marketing. This finding refutes conventional wisdom that older students lack learning skills and are unable to master new materials. Similar results are found by Richardson (1995). He concludes that the older students achieve significantly better results in understanding the material, while they were weaker in material reproduction.

Knox (1977) concluded that the majority of middle-age adults can learn as successfully as younger adults, assuming equal motivation for education. Since motivation is the driving force behind human behavior it is possible to achieve better results when motivation is higher. Motivation differs between younger and older students since they differ in where they are in their life cycle. Needs and motivation change over life time and are driven by cognitive, social, and emotional factors.

Some motives driving adult education are career development, expectations of others (eg, the employer), and economic motivation. Younger adults are mostly motivated by professional reasons while middle aged adults develop various pragmatic motives (Pastuović, 1999). The study analyzed the impact of gender and age on academic success without including factors like socioeconomic status and environmental drivers which should be addressed by future studies and is a limitation of this research.

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The models of analysis of the media industry and Croatian media modernism

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Abstract. The aim of this paper is to compare the trends in the development of the modern media industry with the development trends of Croatian media companies. The rapid development of the media industry is linked to the end of Keynesianism and the liberalization of the global economy. Scientists from the fields of media approached the study of media in two fundamental aspects. The model study is divided into a critical approach, a closer study of the media from the perspective of political economy, and economic approach, closer to studying media from the position of political economy, and an economic approach, closer to studying media from the aspect of media economy and media management. With the development of a post-industrial society and the globalization of the media industry, the firm borders between various categories of the media industry have disappeared. The convergence and digitalization of production processes enabled the distribution of content to several different platforms. The technological development also enabled a process which became known as fogged borders, and the firm borders which bordered corporations, markets and entire industrial branches began to fade. All of this has resulted in a phenomenon which scientists recognize as a society of media spectacle. The Croatian media industry followed the initial trends of technological development. The digitalization of production processes developed the assumption of the distribution of factors that create the effect of society spectacle. The global financial crisis and recession stopped further positive trends of technological advancement in Croatia.

Key words: *financial management, communication studies, media industry, publishing, postmodern*

1. Introduction

The development of the media industry, in its early days, is associated with Gutenberg's invention of the printing press and the development of publishing. The Industrial Revolution and the adaptation of the steam engine to a table with movable letters would cause a revolution in publishing. Radical Innovation in printing technology will mark the end of the scholastic and the beginning of modernity. At the same time Enlightenment will develop and bring irreversible changes in social relations. The media industry was born in the cradle of modern, but its full maturity is achieved in the twenty-first century and the era of postmodernism.

Approaches to the study of the phenomenon of the media industry in the twenty-first century will make a sharp shift from the practice in modern. Such an approach will be especially emphasized after the 1990's and the digitization of manufacturing processes. Kung (2013: 6)

points out that the 1980's and 1990's were characterized by liberalization of the market, deregulation and globalization, and scientists were most focused on researching industrial structure and the rapid growth of corporations. Digitization and the convergence of production processes realized conditions for the distribution of the same content to different media. Smith and Hendricks (2010: 5) point out that technology has always been closely associated with the world of media. New technological solutions and devices were simply what people must have.

At the same time, the environment of the media industry is constantly expanding and opening new horizons that are becoming a market target of media corporations. Stacey (1991: 125) notes that only part of the boundary or fence between the organization and the environment created from the organization itself, which implies that the borders are not fully defined and sharp and are partially obscured. This created conditions for the development of media corporations whose borders of business activities cannot be clearly defined. Problems that are put before the management of media corporations require comprehensive knowledge ranging from finance and management to knowledge of specialized technology skills. In addition, the problem of management and leadership require special management skills of management teams comprised of experts from completely different fields of science. Daft (2015: 274) notes that this leads to blurred boundaries and hierarchical power and authority in making management decisions

When placing content on the market, the media industry has a specific impact on society and social processes as a whole. The study of media from social relations gives it a whole new dimension. McLuhan, in the mid-twentieth century, saw the media as an extension of the human senses. Marchand (1989) points out that McLuhan was more than original in his provocative attitudes. The basis for this claim came from the famous McLuhan's dictum "the medium is the message". The media create new patterns of thinking and behavior. Looking at the past, McLuhan observed that individuals and the communities were designed by the dominant media of the time.

With the development of a comprehensive media market, conditions were created with blurred boundaries between the real world and the one that is formed under the influence of media. The media industry will give a dominant contribution to the creation of a spectacle society in the postmodern. McLuhan's saying "media is a message" suggests that the fundamental role of the media is not its content, but the way it shapes our perception of the world around us. Baudrillard has developed this theory with a very pessimistic accent, and in "the theory of simulacra," pointed out that the media forms the way society works, perceives events and defines the general culture of the society. According to Baudrillard, what we see, hear or learn in the media, becomes our everyday life (BAU 2014: 245).

The primary task of the management is to increase the value of organizations and thereby create added value for owners, shareholders and other interested parties in the business process. The management of organizations must anticipate and align the processes of environment with the resources of the organizations so the final product, and with media organizations this is the content, would find its way to the consumer who buys it. According to financial results that are cited in this part of the business process, the US media corporations are convincingly the best. However, in addition to financial results, as well as performance indicators to shareholders, American corporations have a dominant influence on the creation of media images on the geographical areas where they operate.

2. Approach models for studying the media industry

The basic model approach to the study of the media industry is between two basic approaches of the study of the media phenomena. On one hand, the emphasis is on the study of economic factors that determine the operations of media organizations. On the other hand, the emphasis

is on the study of power and the creation of influence through the media on social groups and society as a whole. The model is shown in Figure 1.

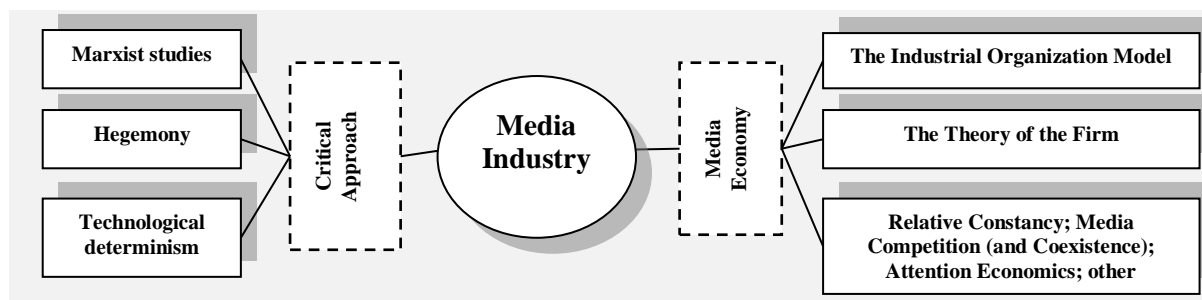


Figure 1: Approach models for studying the media industry

Source: Albarran, 2010, 22 (own illustration)

Models that are based on the study of the media industry through the analysis of financial data and economic performance of business media organizations are theoretical and applied models. The theoretical model was created by traditional neoclassical economics and analyzes the behaviour of consumers, businesses and relationships within the given market through supply, demand price level, flexibility, concentration in the industry and so on. The applied model is built on a theoretical model, it is expanded and analyzes the strategy of the organization its implementation within the industrial framework. They are divided into two basic research approaches and several smaller ones as derivatives to the fundamental approaches. Two basic approaches are: a model of industrial organization and the theory and model enterprises, and derivatives of the existing are: the model of relative stability, media competition (and cohabitation), the economic model of attention and other models (Albarran, 2010: 21).

Models that are based on theoretical and applied approach emerged on positivist tradition. They have developed mainly in Anglo-Saxon countries and traditions were created on the basis of the mathematical statistical approach to the study of the media industry. The model approach to the study of the media on the basis of tradition of political economy moves its focus of study from a purely positivist approach to a critical approach to the study. A critical approach is based on a study of the impact of media on the target audience, the creation of media monopolies of global media corporations, on the impact that the media has in different social groups, different cultural influences in society and the like. Albarran (2010: 27) divides them into: a tradition of Marxism, hegemony and technological determinism.

2.1. The model of an industrial organization

The model of an industrial organization is a traditional model by which scientists determined the relations within various industrial markets. With the development of the media industry, the model began to be applied to this industry as well. The model consists of determining the various parameters which indicate the number of competitors within selected markets and their mutual relations.

The model of industrial organization is known as the S-C-P model (Structure-conduct-performance). It was first mentioned by Bain (1959) in the book *Industrial Organisation*. Bain's market analysis was directed towards the study of monopolies and oligopolies and efficiency of business performance in given conditions. To get an answer to these questions, it was necessary to analyze the structure of the market, the performance of individual businesses and results of operations in order to compare the results of individual business entities within the set framework (Harris, Hunter, Lewis 1995: 98). Somewhat later, Bain and Maisson developed the S-C-P model, and connected the oligopoly theory with the theory of differentiation of businesses. Based on the results of empirical research of a large number of

businesses, they have proven that the structures and relationships in the market are dominant in the business decisions of individual participants in the market and they do not have the strength to counteract the dominant role of the market (Hovenkamp 2015: 214). The S-P-C model has been developed and supplemented over the years. Several important authors participated in the development of the model, and the most famous of them was Michael Porter. An already existing model was the framework within which Porter was to develop: 1. A model of five competitive forces; 2. A model of generic strategies; 3. Model of maps of strategic groups (Barney, Hesterly 2006: 128).

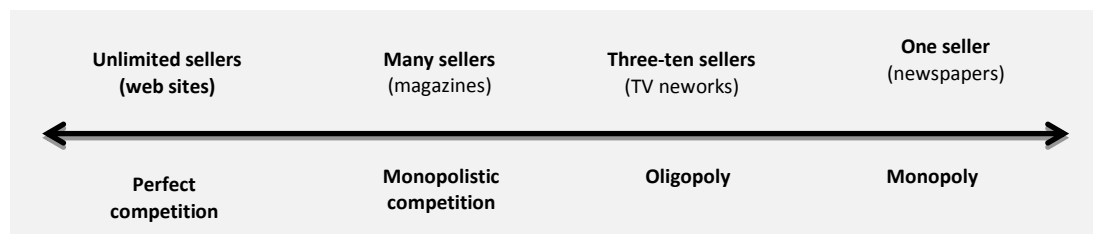


Figure 2 The Theory of the Firm – Market Structure
Source: Albarran, 2010., 23.

Figure 2 shows a simplified model of industrial organization for the media industry. The model ranges between two extremes: perfect competition on one side and monopolies on the other side. The principal objection to this model is that it simplifies relations on the market too much. The model was developed at a time of relatively stable relations in the market and it relies on an equal or relatively predictable number of competitors within the model. After the fundamental relationships in the market are determined, the study of the behavior of buyers and sellers in the market is then approached. Studying the process in the market concentrates on five basic factors: pricing policy, product strategy and advertising, research, investment and compliance with legal legislations (Albarran 2010: 22).

The performance of the market is defined as coordinating the offer of the supplier in relation to the demands of the customer. The four basic criteria are: production efficiency in relation to the size of the organization, the amount of profit, the ratio between production costs and marketing costs, advances in research and development (Harris, Hunter, Lewis 1995: 98). The final step in using the model of industrial organization includes an analysis of the overall performance of the market. In measuring performance, the emphasis is on financial performance, usually comparing competitors within the same market or the overall industry. Financial variables obtained by analyzing the performance of businesses are used to analyze the performance of the overall market (Albarran 2010: 22).

Figure 2 shows only four categories of the media industry which are viewed separate from each other. Today it is difficult to separate different categories of the media industry because of the development and distribution of the same content through multiple platforms. Another fundamental objection to this model is its static nature. Especially after the 90's and digitization, the changes in the media market, in terms of the number of competitors within certain categories of the media industry, were constant and very dramatic. With the development of vertical media organization, through vertical integration and diversification, especially after the great wave of takeovers and mergers, there have been frequent changes of attitude in certain markets and the redistribution of the total market

2.2. The company theory model

The previously mentioned weaknesses of the model of industrial organization have led scientists to further develop the model. The company theory model, in its essence, is a continuation of the model theory of industrial organization. The static nature of the model of industrial organization, as one of its fundamental weaknesses, was particularly emphasized in

the process of digitizing and the completion of convergence of the media industry. Vertically integrated media corporations changed the initial structure of distribution and, within their own value chains, developed different categories of the media industry.

The company theory model was created as a product of efforts used to determine the primary objectives and reasons for the existence of production organizations. With time, the theory of companies adapted to the changes of the environment and changed the focus of the study. Cantillon already in 1755 opened the first discussions of the tasks of organizations, but the focus of his study was more focused on the entrepreneurial process than a company organized as a production operator. Adam Smith will be remembered as the most important pioneer of research in this area. He was the first to point out the benefits that division of labour and specialization within an organization brings to the total community. According to Smith, the reason for the existence of an organization is to coordinate and motivate the specialization of human economic activity (Mantysaari 2012: 6).

Marx will follow Smith's theory of labour division in order to turn the focus of the study on the distribution of work results. The classical economic theory from the Smith period will then give room to neoclassical theories of the late 19th and early 20th century. Behavioural models and the system theory will be developed through the achievements of Taylorism to the theory of excellence. What is common to all these developmental theories is that they come from modern and study the organization as a manufacturer of physical products with a clear boundary of the production activities. The post-modern and post-industrial society will delete the clear boundaries of organizations and their environment. The company theory model will experience drastic changes, especially if this is reflected in the case of media organizations.

Modern media corporations through the process of taking over and merging have created new relationships in the media market. Time Warner is the result of the merge of Time Inc. and Warner Communications. The publishers of the magazine, as part of the media industry which was already in its mature stage, joined up with a company providing high technology services. The complete business operation resulted in a completely new form of business strategy. Everything was moved to the network, a joint effort developed a whole range of new categories of media industry within the associated corporations. While the theory of industrial organization model built its foundation on the macro approach, the company theory model moved its focus of observation to a micro approach.

2.3. Marxism and the critical theory

The model of political economy, in the tradition of Marxism, is moving away from the tradition of classical and neoclassical economic doctrine. According to the tradition of Marxism, the focus of the study is moving away from studying the results of the system, towards the causes and consequences of the operation of the system. In search of a better understanding of how the capitalist system is developed and what will happen to it in the future, Marx lays the foundation two key theories, historical and dialectical materialism. The first seeks to explain the laws of historical development, and the second to explain the law of international contradictions of capital (Dewdney, Ride 2014: 19).

The Marxist political economy provides a historical analysis of the development of capitalism, including the development of production forces and production relations, the production of surplus value, including the legality of the distribution of that surplus, the production of goods, analysis of social classes and their relationships (Hardy 2014: 6). The approach to the analysis in the context of the political economy involves the research of social relations, the specificities of relations of power, which in interaction affect the production, distribution and consumption of resources (Mosco 1996: 25). Marx's work, primarily capital, but also its entire scope, will be a source of inspiration for generations of philosophers, and scientists from other fields. Attention to the Marxist approach was directed to analyzing

questions of how the economic base of society produced social superstructure, and was particularly focused on the ideological role of the media in a capitalist society (Dewdney, Ride 2014: 20).

The tradition of political economy in the field of media and communication, and on the traditions of Marxism, was continued in the middle of the twentieth century by German philosophers gathered in a Frankfurt School. The founders of the school, which were later joined by Jurgen Habermas as well, continue to develop the tradition of Marx's historical materialism. Their fundamental work and orientation, which will later receive the title of "critical theory", directly referred to the role of media and media technology in the capitalist society of mass production and subsequently became a reference point for a discussion about digital media (Dewdney, Ride 2014: 20). The critical theory assumes that the media (in all forms) are symbolic forms of expression. Like other forms of symbolic expression (literature, theatre, painting and other forms of cultural expression) the media communicate values, beliefs and attitudes of the structural manner. Thus the media assign a particular meaning to an event, an individual or a selected topic (Fourie 2007: 133).

The basic idea of this approach is its orientation toward analyzing the relationships that are formed between the base and the superstructure of society, where economic circumstances determine cultural development. In other words, the extent of the cultural superstructure of individuals is determined by their economic status, or how much does technological development and economic prosperity determine the development of ideology in society. Hardy (2014: 9) lists three basic fields of analysis which deals with the critical political economy of media:

1. How does the communication industry function, with emphasis on the ownership structure, financing and other forms of income and support (advertising system), and what impact on the media do policies and state institutions have.
2. Organizational system of production within media organizations and the control system. Analysis is oriented towards media freedom in a way that it is independent of environmental conditions that may be reflected in the financial results, level of advertising, the reaction of government authorities and other bodies or a combination of different forms of environmental impacts.
3. The relation between media content production and its distribution on the one hand, in relation to the audience that it is intended for the other hand. In other words, the way individual content in the media intended for certain groups in society is produced and distribute.

With the development of capitalism, some new social circumstances occurred which created completely new relations in society, but also relations among different classes in society. In the seventies, poststructuralists accept the fundamental Marxist-related settings for the media and media culture and adapted them to the new conditions of production and distribution in society. Under the influence of Marxism, this new route is named *cultural materialism*.

Cultural materialism has tried to uncover and understand how cultural significance and value is created in practice and claimed that the ratio of base and superstructure does not have the meaning it had at the time Marxism began. By changing the social circumstances, the old argument was not adequate to the new conditions of economic and cultural production (Dewdney, Ride 2014: 20). Poststructuralists accept cultural materialism, and the most significant in this was Michael Foucault. Cultural materialism, as a direction of scientific study of the media and the media industry, continues to analyze the balance of power within the media industry, ownership structure and influence, uneven standards and the opposites to the development of the cultural industry, and seeks to explain the situation and directions of

development of the cultural industry at a global level under the predominant role of neoliberal ideas.

2.4. Hegemony

Lipowitz (2000) points out that the concept of hegemony is a part of the Marxist concept, and it was first introduced by the Italian philosopher Antonio Gramsci. He was the first of the philosophers to introduce the concept of cultural hegemony and study how the ruling class remains in power in capitalist countries. Gramsci was the first to use the word hegemony, which comes from the Greek word that could be translated as the lead. He refers to the concept of hegemony to explain the way in which economic and cultural "leadership" shows their dominance in society, the way it happens and a situation approved by the remaining majority in society (Long Wall 2013: 356). In Gramsci's work is a strong influence of Marxism and some of his theories today have lost that edge they once had. The concept of civil society, known since the time of Aristotle, under the influence of Marxism translated as a bourgeois society. This emphasizes the Marxist approach to the division of society into classes in which the classes of owners rule over the classes of workers.

Gramsci stressed that hegemony is imposed by the ruling class. Hegemony is not just an ethical-political, but also an economic phenomenon. It is defined as a system of governance and domination which is imposed. Economic interests are reflected through ideological consciousness. At the beginning it is created as articulation of narrow economic interests that later evolve into the development of the ideological class consciousness (Gundogan 2008). Referring to Gramsci, Fourie (2007: 132) points out that hegemony is created and maintained as a structural force in society. A structure that supports the hegemony of the school (education), government (politics and politicians), church (religion), the judiciary system and mass media. Through this structure we learn how to think about particular topics and even what to think. The hegemonic culture was created by those who have control and manage the system - in other words, they are those who have access to structures that through this approach have the power to influence other people. Gramsci states (Wall, Bennett, Slater 2008: 103) that some of the elite in society have a dominant position because others allow it. In doing so, one can notice the ideological conception of media that serves to convince the society that it is in their best interest to accept the dominance of the ruling structures. Marx in *German Ideology* wrote that the thoughts of the ruling class in every epoch are the ruling thoughts or class that dominates the material levers of society and at the same time dominate as a ruling class as well as a spiritual class.

The American philosopher Noam Chomsky says that popular cultures can serve to divert the attention of society and individuals from actual situations, from the real issues, such as issues of employment and livelihoods. Only the intellectual elite and the educational part of the society, as well as most of the professional specialists, should urge acceptance with the values and arguments of the ruling class (Wall, Bennett, Slater 2008: 103). For example we can use a global and television show called "Big Brother" with exceptional ratings. It originated as an idea from the writings of George Orwell in the book 1984, and quickly proved to be a real and global phenomenon.

2.5. Technological determinism

The intellectual heritage of technological determinism can be traced through the enthusiasm and faith in technology as a liberating force since the eighteenth century and the Enlightenment. With such a tradition they are connected by at least two different directions, one enthusiastically, the other critically which contributes to the development of technological determinism. Both views support the theory that technology and science is the most important driver of social change (Smith, Marx, 1994: 2). The concept of determinism implies a

situation where one factor determines all other aspects of life (Fourie 2007: 151). Technological determinism is a reductionist theory which assumes that technological development defines social progress. Technological Determinism observes technology as the foundation of society at all levels in the past, present and future (Nogaršek, Vintar 2011: 455). Economic determinism implies that the economy determines all social and cultural processes. Biological determinism implies that biological factors determine all other behaviours. With technological determinism it is assumed that innovation and technological development determines all social processes, culture, economy and politics (Fourie 2007: 151).

One of the best theories of technological determinism in the media is the theory from Marshal McLuhan where "the medium is the message" with what his mentor Harold Adam Innis agreed with (Fourie 2007b: 250). Both Canadian scientists see the media as the essence of civilization. Innis believed that the social, political, cultural and economic development of all historical periods is directly linked to the development of the means of mass communication in that period (Fourie 2007: 151). The pre-historic period is marked by drawings in caves. The transition to a new era, especially the developed Egyptian culture already knew about papyrus and leaving permanent records. Greece and Rome had a highly developed tradition of record on scrolls. Modern times will bring print and electronic media. The digitization and convergence of the media industry and media will open the door to postmodern. Media corporations will use strategies of diversification and vertical integration to develop business models that will include many different forms of content distribution of media content. The industrial era will blur the strict and sharp boundaries between different forms of production and the distribution of media content.

3. The global media industry in the context of global changes

Already in the introduction we pointed out that modern media and technological advancements are very closely linked. Smith and Hendriks (2010: 5) note that we are surrounded by media from the moment we get up in the new day and until late at night when we go to sleep. Media and media content have been served to us, but we are not even aware of it at all times. The media industry and content distribution achieves profits, but at the same time create a media environment that influences the perception within the community and forms opinions through creating the culture of a society.

Six mega corporations control 90% of the total media market in the United States. They control and dominate the market of news and entertainment in the United States (Tay 2015; Dwayne, Jin 2011; Bettig, Hall 2012). According to turnover, the six largest media corporations are: Time Warner, Disney, News Corporation, NBC - Universal, CBS and Viacom (Dwayne, Jin 2011: 181). Six of the largest, except for News Corporation, are originally American while News Corporation was founded in Australia. Albertazzi and Copley (2013: 72) add to this group another two European companies, Bertelsmann and Vivendi, and Japanese Sony. Six of the largest media corporation are also owners of the biggest Hollywood film studios (Wall, Long, 2013: 247).

The rapid growth of global media corporations emerged after the 1990's, and the strong momentum in this process is directly linked to the digitization of the production process. Digitization will enable the convergence of production and distribution of media content which will lead to the flourishing of the process of takeovers and mergers in the global media market. Jin and Frasers agree with this statement (2011: 180) and they complemented the research in 2010 which showed that media corporations are entering the process of de-convergence and downsizing to cut costs and focus only on the most profitable parts of the corporation. According to the financial indicators, the US media industry achieves the best returns on assets (ROA) of 12.1% compared to its global competitors. Corporations from the

Asian and Pacific region with 6.3% and European corporations with 5.7% are below the global average of 7.5% return on assets (ROA) (Lozić et. al., 2015).

4. The Croatian media industry in the context of global changes

Unlike global trends in the media industry, the Croatian media industry did not follow the processes of consolidation and expansion in the market environment. The process of convergence and takeovers in the market, which started in the United States, at the beginning of the century was conveyed first to Europe and later in Asia, did not happen in Croatia. Indeed, while the US is already going process of de-convergence, the Croatian media industry had not moved from the modern and modernist approach in the management of media companies.

Financial results of Croatian news organizations are more than worrying. In the analysis we took nine Croatian media companies. Seven publishing houses (Novi list, EPH, Večernji List, Školska knjiga, Profil, Mozaik and Algoritam) and two television organizations (Nova TV and RTL). All media companies in Croatia have a negative return on assets in the period from 2009 - 2013, other than Školska Knjiga which made a return of 0.9%. In addition, Nova TV has made a rate of indebtedness of 129.2% in the five year period (Lozić et.al. 2015).

Table 1 Recapitulation of viewing audience of television channels in Croatia(2015)

	Target segment	4+ (October)	18-54 (October)	4+ (November)	18-54 (November)	4+ (December)	18-54 (December)
	Channel	SHR (%)	SHR (%)	SHR (%)	SHR (%)	SHR (%)	SHR (%)
Whole day	HTV 1	14,11	11,22	15,75	12,65	15,05	11,71
	HTV2	7,78	7,92	6,89	7,12	7,07	7,27
	HTV3	1,72	1,51	1,64	1,31	2,40	2,08
	HTV4	3,08	1,99	3,72	2,54	4,38	2,74
	Nova TV	23,39	22,94	24,06	23,60	23,50	23,32
	Doma TV	5,11	5,27	4,81	5,43	4,70	5,30
	RTL	17,62	18,46	16,04	17,08	14,15	15,18
	RTL2	4,34	5,43	4,52	5,60	4,63	5,64
	RTL Kockica	2,82	2,99	3,42	3,91	3,24	3,72
	CMC	1,27	1,57	1,20	1,50	1,49	1,76

Source: Agency for Electronic Media in Cooperation with AGB Nielsonom (own illustration)

By researching the viewership of TV programs, for the last three months of 2015 it was found that Nova TV had the highest viewership, in front of the RTL and the first channel of the state television. The viewership was made according to the results of the Agency for Electronic Media in cooperation with AGB Nielson. Display in Table 1. The results of viewership were divided into two categories according to the age of the viewer: from 4 years or more, and 18 to 54 years of age. In both distributions, Nova TV had the highest viewership. In second place is RTL, and the third is the first channel of the state television. RTL Television has achieved financial ratios of 90.1% debt and return on assets of -13.4% (Lozić et. al. 2015).

Table 2 Viewership of television shows in Croatia (2015)

Rank	October (4+)			November (4+)			December (4+)		
	Channel	Show	SHR (%)	Channel	Show	SHR (%)	Channel	Show	SHR (%)
1.	Nova TV	The News	41,32	Nova TV	The News	46,42	Nova TV	The News	43,02
2.	HTV2	Football	39,14	Nova TV	Your Face Sounds Familiar	42,93	Nova TV	Soap	42,05
3.	Nova TV	Your Face Sounds Familiar	38,62	Nova TV	Farm	40,34	Nova TV	Happy New 2016	43,58
4.	Nova TV	Farm	38,76	HTV1	Sport	56,18	Nova TV	Farm	41,00
5.	HTV 1	Weather Report	54,10	RTL	Box	50,65	Nova TV	Soap	39,60

Source: Agency for Electronic Media in Cooperation with AGB Nielsonom (own illustration)

According to the viewership ratings of television shows, The evening news of Nova TV holds first place in the ratings in all three months. Display in Table 2. In addition, according to the

report of the Agency for Electronic Media, the show *Your face sounds familiar* of Nova TV, made by far the largest share % in viewership since television viewership has been monitored in Croatia. The same broadcaster has the show *Farm* which is located within the five most popular shows in the three analyzed months. In December, all of the five most watched television shows based on the criteria share (%) were broadcasted by Nova TV.

In Table 2 there is a relatively small representation of the shows of RTL, but it should be noted that the percentage of viewership rises sharply when the category 18-54 years is observed. Viewership rises sharply due to the contribution of *Big Brother*, which appears regularly in the top ten according to the share (%). The highest viewership of the program state television is associated with broadcasts of sporting events and news programs related to weather forecasts, shows for agriculture and short news through the morning.

5. Open questions for discussion

By analyzing the domestic media from different angles and value aspects, it can be concluded that there are significant differences between the various aspects of development and operations. On one hand, the Croatian media industry has followed technological developments and trends dictated by technologically developed media corporations, as well as trends that have dominated the developed media markets. Production and technological progress has not significantly lagged behind the global development trends. This goes side by side with the production of entertainment shows that are broadcast live, and the contents are simultaneously broadcast on several different media. From terrestrial television, through cable operators all the way to social networks which allow interaction of the audience and the show's participants.

On the other hand, television companies that achieve the highest viewership also had the greatest losses. Two analyzed television stations (Nova TV and RTL) produce contents that, individually speaking, surpass by far the viewership of content produced and broadcast by the state television. The biggest viewership does not also mean financial security from the aspect of financial management. It remains an open question on how much funds can realistically be collected from advertising and how that contributes to the costs of content production. With publishers of newspapers and books there is an apparent crisis in decreased readership, and also a decrease in sales of advertising space.

Taking into consideration all the models which can be accessed by the analysis of the media market, we remain open to discussion with questions relating to the national media market:

- How long can the current governance model to media companies in Croatia survive due to the steady decline in revenue, an increase in operating costs, and retail and an impoverished market in Croatia?
- How are the management of media companies in Croatia ready to change management paradigm that is inherited from the era of modern? While at the global level, in all industries, sharp boundaries are deleted between the corporation and the environment, and corporations diversify business and vertically integrate, in Croatia the media companies are still dominated with modern styles of management that do not allow the demolition of solid fences and barriers between different forms of media content production.
- How long will investments last in the technological progress of Croatian media companies with regard to the losses they achieve?
- How are we as a society aware of the fact that the most popular shows on television are soap operas and direct transfers of the "Orwellian type", and will such content be increasingly sought for in the future? At the same time, all publishers of books other than Školska Knjiga are falling, and newspaper circulation is at historically low levels.

- How much can a society develop in the future when it predominantly consumes soap operas, sitcoms of questionable quality, sports and "light music"?

6. Conclusion

By using the model of studying the media industry on the Croatian media industry, we obtained results that partially agree with global trends while the second part shows the specifics of the development of Croatia, but partly also the regional media industry. Part of the results following global trends regards the study of media from a critical approach or political economy. The results of the analysis, which refer to the economy of the media, show disturbing results of business operations of the Croatian media industry.

By studying the Croatian media industry in the context of cultural materialism, we can notice how global trends were transferred and affirmed in the Croatian media. The domestic media industry is dominated by television and contents it emits. Regardless of the often repeated *mantras* of culture and cultural heritage, the local media is dominated by programs associated with soap operas and realty shows. The ownership of the media who control the media space and production of media content introduces us to another important determinant of the media market in Croatia, and that is the hegemonic influence and culture that is created through the media. The influences coming from foreign media markets, through the culture of watching soap operas and active participation in realty shows opened the debate in the direction of creating a global media village that has left very deep roots in Croatia as well. McLuhan's theory that assumes that media is dominant in the message he is sending gives the explanation of creating a global community of media spectacle. The technological development and more developed electronic devices for content distribution increasingly dominate the content being broadcast. The Croatian media industry followed the trend of technological development, while at the same time it becomes part of the global media market. Benjamin's claims about the technical reproducibility of art, and the continuation of these statements later appeared in studies of mcdonaldization, hollywoodization or disneyization of the global media market are completely true in the Croatian media industry. Just as Horkheimer and Adorno confirmed in the *Dialectic of Enlightenment* that culture is produced industrially just as consumer goods, and it can no longer take critical thinking except as product consumption, Croatian media contents with the largest audience shares are products without a true cultural content.

When analyzing the Croatian media industry in the context of the economy of the media, there are significant differences and deviations from global trends. By studying the Croatian media industry through the model of industrial organization theory and the company theory model, the greatest difference was observed in the field of newspaper publishing and magazines. While global trends in the newspaper industry are based on the monopoly of the newspaper industry in certain geographic areas, in our country this process has not yet come to an end. In Zagreb we have two daily newspapers, while in the late 1960s the process of monopolization of the newspaper industry in major US cities such as New York, Washington and Los Angeles began. The market of magazines in Croatia has a process of financial collapse for magazine and newspaper circulation which is decreasing year to year. Organizational modernism and ossified management practices, with the assistance of the state, stopped the changes in the market of printed books in the Croatian market. At the same time, technological development has enabled the emergence of several television operators as well as unlimited access to the Internet which creates the assumption of perfect competition.

The modernist way of managing newspaper publishers takes us to the area of analysis in the context of the company theory. Processes that are known in the global market since the 1980s and the end of Keynesianism did not have an impact in the domestic media market. Media organizations have remained unchanged watching borders organizations or borders of their

business activities. While American, and later the corporations from other continents, spread to new markets and took over smaller media corporations, the Croatian media industry has ignored the changes adopted by the post-modern and post-industrial society.

Research of the media industry on a global level, but also in each country individually, requires a holistic approach to problem analysis. Comparing the media industry in the context of critical theory in relation to the global media industry, we conclude that there is substantial similarity in the development of global and national markets. The Croatian media market follows the trends of certain television content, while publishing activities, according to income, are increasingly lagging behind broadcasting. At the same time media companies follow technological development in order to distribute global media content.

In the context of the economy of the media, the Croatian media market has worrying financial results in all categories of the media industry. Not only that most publishers in the process are heading towards bankruptcy but also television operators do not achieve profit margins that are at least approximately equal to global trends. The question is what is the way of phasing out of this situation and if there is a way out of such a small, poor and static market? The combination of different factors that have a strong impact on the Croatian media industry, lead the overall situation to a rather chaotic state.

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Vocabulary Learning Strategies at the Tertiary Level

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Abstract. In order to achieve full academic and professional potential, experts in different professional fields need to be highly proficient in English. This implies full mastery of vocabulary as an essential part of language knowledge. The present study explores most and least frequently used vocabulary strategies employed by 120 business and engineering students from the University Department of Professional Studies, University of Split, Croatia. Further, the relationship between vocabulary learning strategy (VLS) use and students' vocabulary knowledge is analyzed together with differences in VLS use and vocabulary proficiency across disciplines. The results of the study suggest that the most frequently used are context-based vocabulary learning strategies, and least employed are self-initiated independent vocabulary learning strategies. The findings reveal a statistically significant negative correlation between formal VLS and receptive vocabulary knowledge and positive correlation between context-based VLS and productive vocabulary knowledge. The study also suggests that there are statistically significant differences in the level of students' proficiency on vocabulary tasks as well as in their VLS use. In conclusion, the importance of providing students with VLS instruction should be emphasized to make them aware of appropriate strategy use. Consequently, students would be able to self-direct their language learning.

Key words: *vocabulary learning strategy use, receptive vocabulary knowledge, productive vocabulary knowledge*

1. Introduction

In order to be able to communicate effectively in a foreign language, language learners need not only to increase their vocabulary size, but also to use the acquired vocabulary fluently across all four language skills (Nation, 2001). According to Schmitt (2008), it has been estimated that 98% text coverage is needed to function normally in written and oral discourse. In other words, knowledge of 8000-9000 and 6000-7000 word families is required to communicate effectively in speech and writing respectively. Since lexical items carry the meaning and limitations in vocabulary knowledge may inhibit the exchange of information, the question of facilitating vocabulary acquisition has often been an issue for language teachers (Read, 2004). Owing to the shift of focus and responsibilities from teachers to learners in the last few decades, learners have been encouraged to develop VLS and select those strategies that seem to be the most appropriate for them. As a result, a number of studies on VLS have emerged so far targeting a number of research questions and providing different VLS taxonomies (Gu and Johnson, 1996; Lawson and Hogben, 1998; Pavičić, 1999; Pavičić Takač, 2008; Schmitt, 1997). There is no doubt that language learners on average use different VLS, as has been indicated by aforementioned research studies, but it is still not possible to reach any definite conclusions in this area (Pavičić Takač, 2008). For example, Lawson and Hogben (1996) found that VLS most frequently used by both top-scoring and bottom-scoring groups of Australian students learning Italian were repetition strategies. The

results further indicated that the use of simple repetition strategies, together with paraphrasing and the use of some mnemonic devices, facilitated word recall. Similarly, Schmitt (1997) revealed that VLS used most frequently by Japanese learners were mechanical repetition and bilingual dictionaries. According to the results of the study conducted by Gu and Johnson (1996) Japanese students seldom use one single strategy. A very small group of high achievers reported learning vocabulary above all through extensive reading, whereas the second best group reported using a variety of strategies, such as guessing, dictionary strategies, note taking, and even memorization strategies. The least proficient group was in favour of memorization strategies. The findings of the study that involved primary school learners in Croatia indicated a rather extensive use of VLS, among which the most frequently used ones were listening to songs, remembering words from films and TV programmes, translating words into L1 and remembering words if they are written down (Pavičić Takač, 2008).

The present study explores the relationship between vocabulary learning strategy (VLS) use employed by 120 business and engineering students from the University Department of Professional Studies, University of Split, Croatia, and their vocabulary knowledge. The following research questions are put forth:

1. Which strategies are most and least frequently used by students included in this study?
2. What is the relationship between VLS use and learners' vocabulary test scores?
3. Are there any differences in VLS use and learners' vocabulary test scores across disciplines and among low-, middle- and high-scoring students?

The following hypotheses will be tested:

H1: Students will generally prefer using strategies for formal vocabulary practicing whereas strategies for self-initiated independent vocabulary learning will be least employed.

H2a: There will be statistically significant positive correlation between formal vocabulary practicing strategies and receptive vocabulary knowledge.

H2b: Statistically significant positive correlation will be found between context-based vocabulary learning strategies and productive vocabulary knowledge.

H3: There will not be any major differences across disciplines. High-scoring students will use the most strategies.

2. Method

2.1 Participants

The sample comprised 120 (64 males and 56 females) first- and second-year students from the University Department of Professional Studies, University of Split, Croatia. The age ranged from 18 to 24 ($M=20.13$, $SD=1.39$) years. Participants consisted of 60 business students and 60 information technology students. All students were native Croatian speakers. They have been learning English in elementary and high school from nine to fourteen years ($M=12.43$, $SD=1.29$). Their mean high school grade in English was 3.83 ($SD=0.89$). Apart from learning English formally, 28% of the participants learned English as an extracurricular activity as well. Finally, 71% of the participants revealed that they had never been exposed to vocabulary strategy learning instruction. Those participants who had been instructed on how to use vocabulary learning strategies reported that the instruction actually helped them in learning new words. All the participants were full-time students who were attending a credit-bearing 30-lesson English course.

2.2 Measures

2.2.1 VLS questionnaire

Since a number of researchers, such as O'Malley & Chamot, McDonough, and Cohen (as cited in Kudo, 1999) believe that learning strategies are culture-specific, the pilot version of the Vocabulary Learning Strategy Questionnaire developed by Pavičić (1999) was used in the research on the grounds that it is especially applicable in the Croatian setting. Although it was later refined, the author herself recommended this pilot version "as a more comprehensive inventory of VLS suitable to various levels and ages of learners" (Pavičić Takač, 2008:151). The questionnaire consisted of 69 items (with responses presented on a three-point-Likert scale, ranging from *never*, *sometimes* to *often*). On the basis of factor analysis, five categories of strategies were formed as follows: *self-initiated independent vocabulary learning* (VLS 1), *formal vocabulary practicing* (VLS 2), *surface approach to vocabulary learning* (VLS 3), *context-based vocabulary learning* (VLS 4) and *association-making vocabulary strategies* (VLS 5).

2.2.2 Vocabulary test

In this study, a vocabulary test, rather than a final grade, was applied as an outcome measure. It was developed specifically for the purpose of this study in order to measure students' vocabulary knowledge. Four tasks were included in the test: matching task, multiple-choice task, gap-filling task without any clues and sentence-building task where students had to use a given word in a meaningful sentence. Scores obtained on the first two tasks revealed students' receptive vocabulary knowledge whereas students had to show their productive vocabulary knowledge in the third and fourth tasks.

2.3 Procedure

Business students had 4 lesson hours of Business English whereas Information Technology students had 2 lesson hours per week. Vocabulary learning strategies were administered at the beginning of the course during regular classes. Each student completed the Croatian version of VLS questionnaire (Pavičić, 1999) in 15–20 minutes. After the main purpose and the significance of the study were explained to the students, they voluntarily took part in the research. A vocabulary test was applied to assess students' receptive and productive vocabulary knowledge. It took them 35–45 minutes to complete the test. Data collected by means of a questionnaire were matched with the results on the vocabulary test. Demographic profile (age and gender) as well as data on participants' previous foreign language learning experience and their attitudes to vocabulary learning strategy instruction were collected by a background questionnaire.

2.4 Data Analysis

In the first step the reliability of the instruments was calculated. The VLS questionnaire had an alpha reliability coefficient of 0.90 ($\alpha=0.90$). A statistical data analysis was performed by using SPSS 21.0 for Windows. Descriptive and inferential statistics were employed in order to analyze the data. Firstly, mean scores, frequencies and standard deviations of the VLS were computed and vocabulary test scores calculated. Secondly, VLS strategies were factor analyzed using the principal component analysis with Varimax rotation. Principal component analysis in the sample resulted in 20 components with the eigenvalue greater 1. Items were then Varimax rotated to five factor solution which explained 39% of the total variance. Thirdly, the relationship between the frequency of VLS use and vocabulary test scores was investigated using Pearson product-moment correlation coefficient. Further, the independent-sample t-test was used to determine whether there were any differences in VLS use and vocabulary test scores across disciplines. Finally, one-way analysis of variance (ANOVA)

with post-hoc tests was performed to find out if low-, middle- and high-achieving students differ in their VLS use.

3. Results

3.1 Descriptive data

Table 1 reports the descriptive statistics for five categories of VLS items obtained by factor analysis, labelled as follows: *self-initiated independent vocabulary learning* (VLS 1), *formal vocabulary practicing* (VLS 2), *surface approach to vocabulary learning* (VLS 3), *context-based vocabulary learning* (VLS 4) and *association-making vocabulary strategies* (VLS 5).

Table 1 Descriptive statistics for VLS categories

	Min.	Max.	Mean	SD
VLS 1	14	36	20.70	4.852
VLS 2	10	30	21.22	4.205
VLS 3	6	17	10.03	2.586
VLS 4	12	24	20.49	2.638
VLS 5	10	27	20.00	3.336

In order to obtain more detailed insight into the VLS use, the mean scores for individual items were calculated. The results presented in Table 2 show most and least frequently used strategies.

Table 2 Descriptive statistics for most and least frequently used individual VLS

Most frequently used VLS				
Item	M	SD	Mode	Percentage
41	2,73	0,480	3	75%
47	2,62	0,651	3	70,8%
9	2,67	0,491	3	67,5%
69	2,63	0,533	3	65,8%
45	2,58	0,545	3	60%
Least frequently used VLS				
28	1,14	0,455	1	90%
29	1,28	0,621	1	81,7%
18	1,26	0,558	1	80%
59	1,33	0,568	1	72,5%
20	1,42	0,656	1	67,5%

Note: M=Mean, SD=Standard deviation; 41.I remember a word if I encounter it many times; 7. I listen to songs in a foreign language and try to understand it; 9. If I cannot remember a word in conversations, I use another one with a similar meaning; 69. I pick up words from the Internet; 45. I try to guess the meaning of a new word from the context; 28.I tape record the words and then listen to the tape; 29. I write down words when I watch films and TV programmes; 18. I make word cards; 59. I ask somebody to test me on words (e.g. parent, sibling, friend); 20. I plan for vocabulary learning in advance.

As shown in the Table 2, all most frequently used strategies reported by the students in this sample are *context-based vocabulary learning strategies* (VLS 4). In contrast, four strategies least preferred by the students are included in the category labelled *self-initiated independent vocabulary learning* (VLS 1).

3.2 Correlations

Correlations between five categories of VLS items and tested vocabulary knowledge are presented in Table 3. As for the vocabulary test, four different tasks were included: matching, multiple choice, gap-filling and sentence-building. Since matching task is not significantly correlated with any of the VLS category on the one hand, and VLS 5 category does not correlate with any task in the vocabulary test on the other, they are not included in this table.

Table 3 Correlations between VLS categories and vocabulary test tasks

VLS categories	Tasks		
	Multiple choice	Gap-filling	Sentence-building
VLS 1	-.127	.379**	-.248**
VLS 2	-.318**	.217*	-.250**
VLS 3	-.217*	.287**	-.245**
VLS 4	.057	-.045	.261**

Note. N=120; *p < 0.05; **p < 0.01

As shown in Table 3, scores on multiple choice task were significantly and negatively correlated with categories VLS 2 and VLS 3, namely with formal vocabulary practicing and surface approach to vocabulary learning. Next, scores on the gap-filling task are significantly and positively correlated with VLS 1, VLS 2 and VLS 3 categories indicating that those students who perform better in the gap-filling employ more frequently self-initiated independent vocabulary learning strategies, formal vocabulary practicing strategies and surface approach to vocabulary learning strategies. Furthermore, there is a significant and negative correlation between sentence-building task scores and VLS 2 and VLS 3 categories, but significant and positive relationship with VLS 4 category that includes context-based vocabulary learning strategies. This suggests that those students who tend to rely on the context and use media in learning a foreign language are better in building sentences. These findings partially supported hypothesis 2b (H2b).

3.3 T-test

In order to determine whether there were any differences in vocabulary test scores and VLS use across disciplines, *t*-test was used.

Table 4 Proficiency on vocabulary tasks across disciplines

Proficiency on vocabulary tasks across disciplines					
	Business studies		Information technology		t
	M	SD	M	SD	
Matching	93.00	13.992	79.88	23.945	-3.664***
Multiple-choice	64.98	22.724	74.78	16.610	2.697**
Gap-filling	74.90	22.875	60.23	25.461	-3.319***
Sentence-building	47.67	21.657	63.33	29.736	3.300***

Differences in VLS use across disciplines					
	Business studies		Information technology		t
	M	SD	M	SD	
VLS 1	22.47	5.338	18.93	3.555	-4.268***
VLS 2	22.08	4.200	20.35	4.062	-2.298*
VLS 3	11.15	2.673	8.92	1.951	-5.227***
VLS 4	19.68	2.931	21.30	2.028	3.513***

Note. N=120; *p < 0.05; **p < 0.01, ***p < 0.0005, M=Mean, SD=Standard deviation, t=T-test value

Firstly, the results of the *t*-test presented in Table 4 indicate statistically significant differences in proficiency on vocabulary tasks between business and information technology students. It was found that business students scored better results in matching (M=93.00; SD=13.992) and gap-filling tasks (M=74.90; SD=22.875) while information technology students performed better on multiple-choice (M=74.78; SD=16.610) and sentence-building tasks (M=63.33; SD=29.736). Secondly, the results reveal statistically significant differences in VLS use across disciplines. Business students used VLS 1 (M=22.47; SD=5.338), VLS 2 (M=22.08; SD=4.200) and VLS 3 (M=11.15; SD=2.673) significantly more frequently (p=0.000, p=0.023 and p =0.000, respectively) than information technology students (VLS 1 - M=18.93; SD=3.555; VLS 2 - M=20.35; SD=4.062 and VLS 3 - M=8.92; SD=1.951). With reference to VLS 4 use, the results suggest that information technology students (M=21.30; SD=2.028) used them significantly more frequently (p=0.001) than business students (M=19.68; SD=2.931).

3.4 One-way analysis of variance (ANOVA)

Finally, a one-way analysis of variance (ANOVA) with Tukey post-hoc tests was used to explore potential differences in the frequency of VLS use and in language learning beliefs among high-, middle-, and low-scoring groups on four vocabulary tasks. Only those values that show statistically significant differences are presented in the tables below.

Table 5 VLS use by proficiency on vocabulary tasks

Levels of proficiency on the matching task								
	Low		Middle		High		F	p
VLS categories	M	SD	M	SD	M	SD		
VLS 2	22.38	4.048	18.90	4.582	21.58	3.973	4.315	0.016
Levels of proficiency on the multiple-choice task								
VLS 2	23.26	3.783	20.81	3.669	19.84	4.571	7.016	0.001
Levels of proficiency on the gap-filling task								
VLS 1	18.29	2.408	20.20	4.445	23.02	5.594	11.395	0.000
VLS 2	19.69	4.945	21.83	3.644	21.87	3.811	3.408	0.036
VLS 3	9.17	1.636	9.55	2.320	11.13	3.035	7.440	0.001
Levels of proficiency on the sentence-building task								
VLS 1	21.73	5.235	19.33	3.942	18.63	3.218	4.746	0.10
VLS 2	21.82	4.282	21.11	4.051	19.00	3.480	3.568	0.031
VLS 3	10.38	2.652	10.30	2.569	8.32	1.565	5.354	0.006

Note: VLS 1=self-initiated independent vocabulary learning; VLS 2=formal vocabulary practicing; VLS 3=surface approach to vocabulary learning

The results shown in Table 5 indicate that there are significant differences in matching task between low- and middle-scoring students ($p=0.032$) as well as between middle- and high-scoring students ($p=0.023$) in the use of *formal vocabulary practicing strategies* (VLS 2). Students with low and high scores on the matching task use these strategies significantly more frequently than middle-scoring students. The results further reveal that students scoring low on the multiple-choice task use *formal vocabulary practicing strategies* (VLS 2) more frequently than middle-scoring ($p=0.020$) and high-scoring students ($p=0.01$). A different pattern of results emerged for productive vocabulary tasks. Those students with high scores on the gap-filling task use *self-initiated independent vocabulary learning strategies* (VLS 1) more frequently than low-scoring ($p=0.000$) and middle-scoring students ($p=0.012$). Similarly, *surface-approach vocabulary strategies* (VLS 3) are significantly more frequently used by high-scoring students in comparison with low-scoring ($p=0.002$) and middle-scoring ones ($p=0.010$). Compared to their low-scoring peers, they also employ *formal vocabulary practicing strategies* (VLS 2) statistically more frequently ($p=0.053$). A statistically significant difference among the groups was found in the use of *surface-approach vocabulary strategies* (VLS 3) for the sentence-building task. These strategies are significantly less frequently used by students scoring high on the sentence-building task in comparison to both, low-scoring ($p=0.005$) and middle-scoring students ($p=0.025$). Students scoring low on the sentence-building task employ *self-initiated independent vocabulary learning strategies* (VLS 1) and *formal vocabulary practicing strategies* (VLS 2) statistically more frequently than high-scoring students ($p=0.031$; $p=0.024$, respectively).

4. Discussion

The findings of this research indicate that business and information technology students generally use different vocabulary learning strategies. Out of fourteen most frequently used strategies, those with the highest mean score relate to *remembering a word encountered many times*, *listening to songs in English language*, *picking up words from the Internet, films and TV programmes* and *guessing the meaning from the context*. Although the first hypothesis (H1), according to which students would most favour formal strategies, is not confirmed, our findings related to the frequent use of *context-based vocabulary learning strategies* (VLS 4) are in line with most previous studies (e.g. Atay & Ozbulgan, 2007; Fan, 2003; Gu & Johnson, 1996; Pavičić, 2000; Schmitt, 1997). The use of these strategies may be attributed to the extent to which children and young adults in Croatia are exposed to authentic English language input via different media. This input-rich environment, that provides opportunities for encountering and acquiring new vocabulary on a subconscious level, is strikingly similar to an English as a Second Language (ESL) environment (Kojic-Sabo & Lightbown, 1999). Further, students reported being much in favour of *using a word with similar meaning if the target word cannot be remembered in conversations*. Namely, students seem to have acquired an extensive vocabulary that makes it possible for them to access synonyms rather quickly.

Furthermore, consistent with the previous findings (e.g. Schmitt, 1997; Pavičić, 2000; Kudo, 1999), students in this study sometimes tend to use some *formal vocabulary practicing strategies* (VLS 2), such as *bilingual dictionary use*, *translation of the target word into L1*, *repeating a word in order to remember it* as well as *asking for help* indicating that this subset of formal practicing strategies seems to be fairly frequently applied in the Croatian educational setting. It may be concluded that this attitude toward formal learning seems to be the result of teaching practices in general, and teachers' approaches to error correction and testing that the students have been exposed to in the course of their education.

The strategies least frequently used by students are, not surprisingly, found among those classified as *self-initiated independent vocabulary learning strategies* (VLS 1) and *formal vocabulary practicing strategies* (VLS 2). The finding that *recording words and listening to*

the tape, writing down words while watching TV and reading, making word cards, "acting out" the meaning of new words, reading and leafing through a dictionary and planning learning in advance are the least frequently used strategies, is completely in agreement with the findings presented in the study conducted by Pavičić (2000). It seems that some of these strategies are age-dependent, i.e. more appropriate for younger learners (e.g. *making word cards, "acting out" the meaning of new words*). The others, on the other hand, appear to integrate incidental learning and self-initiated activities (*writing down words while watching films / TV programmes and while reading books*). This probably implies that these incidental learning situations, typical for the input-rich Croatian setting, are related to enjoyable leisure time activities during which students are not likely to invest additional cognitive efforts into the vocabulary learning process.

The second research question deals with the relationship between VLS use and vocabulary test scores. In contrast to our hypothesis (H2a) that there will be a positive correlation, the results indicate a statistically significant negative correlation between *formal vocabulary practicing strategies* and receptive vocabulary knowledge tested by using the multiple-choice task. Unlike the study conducted by Kojic-Sabo and Lightbown (1999), our results reveal that making conscious efforts to memorize certain vocabulary items, does not necessarily expand students' receptive vocabulary knowledge. A negative correlation between a multiple-choice task and VLS 2 suggests that the more students practise decontextualized words formally, the more likely it is that they will not be able to identify the correct word among distractors. The H2b hypothesis, implying a positive correlation between context-based vocabulary learning strategies and productive vocabulary knowledge, is confirmed. Our findings may well point to the fact that the exposure to the authentic English language input via movies that are subtitled and not dubbed, the use of the Internet, playing computer games and listening to songs has a positive effect on the development of students' productive vocabulary knowledge.

The third research question focuses on differences in students' VLS use and vocabulary test scores across disciplines. Contrary to our expectations stating that there will not be any major differences between two groups of students (H3), the results of the present study reveal that there are statistically significant differences in the level of students' proficiency on vocabulary tasks as well as in their VLS use. It was found that business students were significantly better on matching and gap-filling tasks which could be explained by their preference to study for exams by formally practicing and making self-directed and conscious efforts to memorize certain vocabulary items. The results revealed that business students are significantly more frequent users of the above mentioned strategies in comparison to information technology students. This is in agreement with findings of some previous studies (e.g. Peacock & Ho, 2003; Gu, 2002) indicating that students from different disciplines employ strategies in a different way. Favouring context-based vocabulary learning strategies seems to be discipline-specific for information technology students who scored better on multiple-choice and sentence-building tasks. This is, not surprisingly, probably due to their daily exposure to the English language not only in leisure time but also for the purpose of their professional courses.

Finally, with reference to differences in vocabulary strategies used by business and information technology students, the third hypothesis (H3) is not confirmed. High-scoring students do not use all the strategies significantly more frequently than low- and middle-scoring students. The research results indicate that the largest number of vocabulary strategies are used only by those students who gained the highest scores on the gap-filling task. This means that the extensive use of strategies does not necessarily result in better vocabulary acquisition.

5. Conclusion

The results of this study indicate that students on average use an extensive inventory of VLS. The majority of strategies reported to be most frequently used were *context-based vocabulary learning strategies* and the least employed were mostly *self-initiated independent vocabulary learning strategies*. Further, it can be concluded that some strategies are universally accepted, e.g. bilingual dictionary use, repetition strategies, or contextual guessing. Some are socio-culturally-specific since children and young people in Croatia are extensively exposed to authentic English language through media, but not elsewhere. Some strategies may be characterized as discipline-specific because in some disciplines they are more frequently used than in others. Moreover, the study also indicated that formal, self-directed and conscious and context-based learning might enhance vocabulary acquisition. However, not all vocabulary strategies employed by students seem to be appropriate for all task types. Therefore, it seems particularly important to provide students with VLS instruction so that they could become aware of the relevance of strategy use in vocabulary learning and consciously employ those strategies they find the most appropriate in terms of their effectiveness for the given task. As a result, they would become able to self-direct their learning and start reflecting on their learning process.

6. Implications for further research

Results of this study provide preliminary indication that students are in favour of using a variety of strategies. However, further research should explore those strategies, or combination of strategies, used by the most proficient students (Peacock and Ho, 2003) as well as consider the effectiveness of VLS use in relation to different task types. Moreover, another issue related to vocabulary learning emerged from this study. Since the use of some VLS categories was negatively correlated with vocabulary test scores. It seems safe to assume that some other factors besides strategy use (e.g. personality, students' beliefs, motivation, extracurricular time devoted to vocabulary learning, etc.) have a great impact on vocabulary learning outcomes, which is another issue that should be further investigated.

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Some Issues in the Elaboration Course Theory of Probability and Mathematical Statistic on E-learning Platform MOODLE

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Abstract. The paper presents the university course Theory of Probability and Mathematical Statistics created on the electronic platform MOODLE at Trade Co-operative University of Moldova (TCUM) for distance learning. This e-course is presented in three sections: Random events; Random variables; Elements of Mathematical Statistics. Topics include a brief summary of the theory (Lecture Notes - LN). Subsequently the exposed Lecture Notes are accompanied by multiple problems and worked examples with explanations (Exercises Solved - ES). All themes end with a series of problems to be solved (Suggested Exercises - SE). The answers to all outstanding issues (Answers - A) and tables needed to solve some of them are provided in the latter part of the paper. Self-Assessment Tests are provided at the end of each topic and are structured in three levels of learning the material studied: knowledge, implementation and integration. The Base of Questions has the same structure as the Self-Assessment Tests, and it also oversees the completion and operational processing of its contents. A Summative Evaluation of Knowledge Tests is provided at the end of each compartment. Finally, consulting the connections, readers will find many other titles of books and electronic sources that will effectively serve to strengthen and deepen the knowledge acquired from studying this course. In the Questionnaire option, users have the opportunity to express their opinions on the usefulness and effectiveness of this instrument and the means of training and learning the proposed course, which is always welcome and expected by the authors of the opposite present.

Key words: *probability, mathematical statistics, E-learning, MOODLE*

1. Introduction

This paper describes the conceptual landmarks of creation and development of the university course Probability Theory and Mathematical Statistics (TP and MS), on-line created for distance learning on electronic platform Moodle. The ideas and the main directions of the development of its architecture, this electronic course has formulated in [1]. Its contents are adjusted and made on the site of Trade Co-operative University of Moldova (TCUM): HYPERLINK "http://www.uccm.md/" www.uccm.md/. The course is based on:

1. The traditional university course TP and MS, for students at the TCUM. During its implementation on the electronic platform Moodle the manual of the course was perfected, completed and updated at current conditions and was reissued as manual [2] in 2013.
2. The experience gained is a result of participation in traineeships in *e-learning*, organized within the project TEMPUS 516597 - Tempus 1- 2011-1-FR Creating a Thematic University Networks in Applied Sciences and Economic Sciences in Moldova.

The course is presented in three chapters: I. Random events. II. Random variables. III. Elements of Mathematical Statistics. Chapters integrate the next 12 themes:

1. Classical and geometric probabilities;
2. The addition and the multiplication of probabilities;
3. The total probability formula. Bayes's formula;
4. Repeated experiments;
5. Discrete random variables;
6. Continuous random variables;
7. Classical random variables;
8. Two-dimensional discrete random variables;
9. Two-dimensional continuous random variables;
10. Statistic population. Selection;
11. Parameter estimation;
12. Correlation. Regression lines.

Topics include a brief statement of the theory (*Lecture Notes - LN*). Subsequently the exposed *LN* are accompanied by problems and worked examples with explanations (*Solved Exercises - SE*). All themes ends with a number of issues proposed for solving (*Suggested Exercises - SE*). At the end of the topics are given answers to all unsolved issues (*Answers - R*).

Self-Assessment Tests (S-AT). *S-AT* are presented at the end of each topic and are structured as follows:

1. *S-AT 1.1, ..., S-AT 12.1 (true / false)*. Here each question has two answers: true or false. These test questions provide the first level of assimilation of the material studied, so knowledge of basic definitions and concepts.

2. *S-AT 1.2, ..., S-AT 12.2 (mathing)*. This test contains two or more questions and here it is necessary to indicate the correct answers from a given list of answers. The test is intended to contribute, using the analogy, the symmetry, the comparison etc., to acquire deeper knowledge of the studies and is considered to be the second level.

3. *S-AT 1.3, ..., S-AT 12.3 (multiple choice)*. In this test are presented questions that have multiple answers, which must be determined. Using deduction and induction, is oriented to observe and study deeply the basic properties and the features, with some more special shades of the notion studied. It is considered the second level.

4. *S-AT 1.4, ..., S-AT 12.4 (calculated simple)* and *S-AT 1.5, ..., S-AT 12.5 (calculated)*. This includes questions and problems which classifies the test of third level: to answer the question asked we perform a calculus, solving some problems and presenting numerical answer of the question. Calculus is carried out by a formula indicated in *Base of Questions*, where data is chosen randomly from a specified domain. The domain is common, if the test is of *calculated* type and is individual, if the test is of *calculated simple* type.

5. *S-AT 1.6, ..., S-AT 12.6 (calculated multiple choice)*. The test can contain one or more questions and a list of answers from which to be given the answer to every question (they, answers, may be more to each question). Missing correct answer is penalized. The answer is not presented numeric, in some numbers. It is presented algorithms for calculating of problems with true or false segments of them. These algorithms do not containing variables or textual parameters, but random numerical values of the data of problem. The test may be considered as level two or three, depending on the complexity of the proposed question.

Game-Test are presented in each 12 themes and are used for training and self-assessment, using the animated games.

Base of Questions (BQ). So it is organized the *BQ* and it has the same structure as the *S-AT*, which also facilitates the completion and operational processing of its contents. At the end of each compartment are proposed summative assessment tests of the knowledge, organized on the basis of *S-AT*.

Primarily, the course it is addressed to students of higher education institutions. So, it can be used by high school students, as well of economists, engineers, which use probabilistic and statistical methods in their work.


2. The architecture of the PT and MS course on electronic platform Moodle

The *General* compartment include the following components: *Forum*, *Annotation* of the E-learning course TP and MS, *Curriculum* of the course TP and MS at TCUM, the *Manual* of the course reissued [2] in 2013, *Glossary*, *Chat*, *Initial Test* for the initial evaluation, *Questionnaire* where users have the opportunity to express their opinions on the usefulness and effectiveness of this course and which are always welcome and expected by the authors of this E-learning course presented.

General

Theory of Probability and Mathematical Statistics (TP and MS)


Teoria Probabilităților și Statistica Matematică (TP și SM)



Forum - Știri

Announcements and general news


Anunțuri și știri cu caracter general



Annotation - Adnotare

Annotation of the E-learning course TP and MS


Adnotare a disciplinei TP și SM, pentru studiu electronic




Curriculum

Curriculum presentation of discipline TP și MS in the specialties at TCUM.


Prezentare Curriculum a disciplinei TP și SM în cadrul specialităților la UCCM.




Manual




TP and MS.Introduction - TP și SM. Introducere




TP and MS. Contents - TP și SM. Cuprins




TP and MS Glossary - TP și SM Glosar



Chat-Discuții



Initial Test - Test de evaluare inițială



Questionnaire - Chestionar

Attention !!! The questionnaire can be completed only once!

Do not push **Submit questionnaire** until answer all your questions!

Atenție !!! Chestionarul poate fi parcurs doar o singură dată!

Nu apăsați **Submit questionnaire** pînă nu răspundeți la toate întrebările!

Figure 1 The *General* compartment of E-learning course TP and MS

TP.Theme 1: Classical and geometric probabilities - TP. Tema 1: Probabilități clasice și geometrice

LN - Lecture Notes, *SE* - Solved Exercises, *SE* - Suggested Exercises, *A* - Answers

NC- note de curs, *ER*- exemple rezolvate, *EP* - exemple propuse pentru rezolvare, *R* - răspunsuri









-  TP. Theme 1: LN+SE --- TP. Tema 1: NC+ER
-  TP. Theme 1: SE --- TP. Tema 1: EP
-  TP. Theme 1: A --- TP. Tema 1: R
-  TP. Theme 1. Glossary --- TP. Tema 1. Glosar
-  Self-Assessment Test. TP.Theme 1 --- Test de autoevaluare. TP.Tema 1
-  Game - Test. TP. Theme 1 --- Test - Joc. TP. Tema 1
-  Chat at TP.Theme 1 - Discuții la TP.Tema 1
-  Assessment Test. TP.Theme 1 --- Test de evaluare. TP.Tema 1

Figure 2 TP. Theme 1: *Classical and geometric probabilities* of E-learning course TP and MS

Each of the 12 themes of the course TP and MS, developed on the Moodle platform contains the following components: *Lecture Notes (LN)* - contains the theory, *Solved Exercises (SE)* - are presented the solved issues and exercises, *Suggested Exercises (SE)* - contains problems to be solved, *Answers (A)* - are given the answers to all outstanding issues, *Glossary* - contains a list of terms with their definitions, *Self-Assessment Tests* - for training and self-assessment, *Game-Test* - for training and self-assessment using the animated games, *Chat* - for conversations on the topic, *Assessment Tests* - for estimating knowledge on the topic.

At the end of the course themes TP and MS are presented the Tables and Bibliography, which are necessary to solve problems and further documentation in the field.

Tables. Bibliography - Tabele. Bibliografie

Table 1. Laplace local function values - $\varphi(x)$

Tabelul 1. Valorile funcției locale Laplace - $\varphi(x)$

Table 2. Laplace integral function values - $\Phi(x)$

Tabelul 2. Valorile funcției integrale Laplace - $\Phi(x)$

Table 3. Poisson function values - $P(m)$

Tabelul 3. Valorile funcției Poisson - $P(m)$


-  Table 1. Laplace local function values --- Tabelul 1: Valorile funcției locale Laplace
-  Table 2. Laplace integral function values --- Tabelul 2: Valorile funcției integrale Laplace
-  Table 3. Poisson function values --- Tabelul 3: Valorile funcției Poisson
-  Bibliography --- Bibliografie

Figure 3 Tables and Bibliography of E-learning course TP and MS

The *Base of Questions (BQ)* is organized and has the same structure as the *Self-Assessment Tests (S-AT)*, which also facilitates the completion and operational processing of its contents.

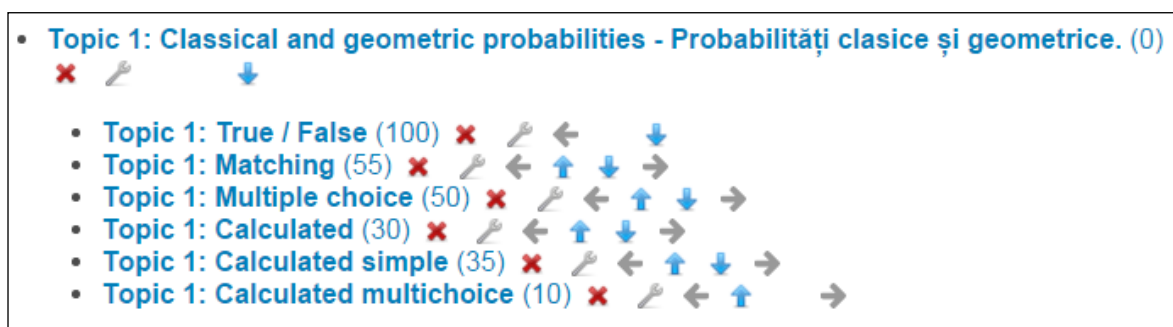


Figure 4 TP. Topic 1: *Classical and geometric probabilities* - category of *Base of Questions*

At the end of *BQ* is organized the category *Probation*, which allows to facilitate the work with tests. Here tests are analyzed and prepared for introduction in *BQ*.

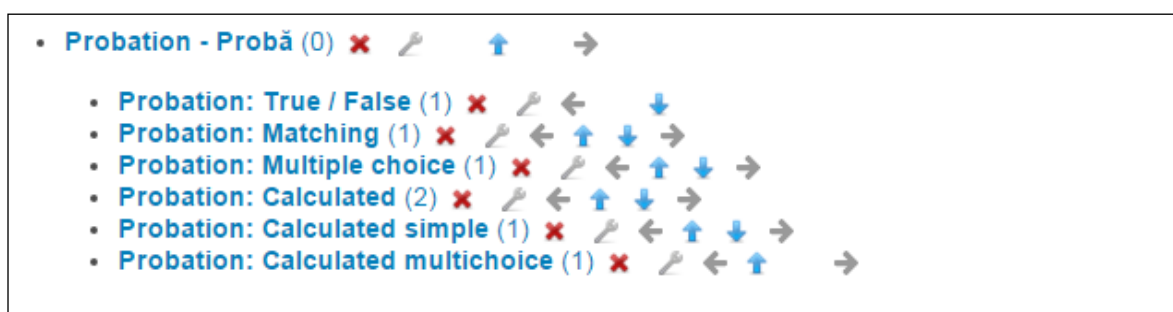


Figure 5 *Probation* - category of *Base of Questions*

3. The creation and development of cognitive tools on e-Learning platforms

Next we expose the possibilities of creation and development of tools for mobile devices with the impact in education and economics, hereinafter referred to as "*Games*". Due to the development of modern information technology, nowadays it is possible to create cognitive applications in relatively short time with modest resources by users who are not professionals in the field of computer science. This possibility is the first due to the fact, that nowadays on the market appeared instruments and programs which can offer enthusiasts the chance to develop such applications. Currently, because of technologies, video games of the medium level can be created by one user, including mobile devices equipped with *Android OS* and *iOS* operating systems. They are well suited instruments for teaching students of the disciplines placed on e-Learning platforms. These kind of video games contribute to the development of interest in the field of study, because they are attractive and cognitive. The possibility of placing mobile games in the courses presented on electronic distance learning platforms, resulted that the discipline of study is easily accessible anywhere, anytime and to anyone. The creation of these cognitive tools, *Games* named, with desire to diversify the training process, adjusting it to the today requirements, presents one of the main reason of the work described in the paper.

3.1 Game Design Software Tools and Stages of Development

A user who wants to build video *Games* must have some experience in the application of modern technologies and programs for their development, namely:

1. Knowledge of the game graphics editing.
2. Knowledge sound editing game.
3. Programs building game.
4. Exporting and testing platforms for the game.

Knowledge listed is sufficient for a beginner, but not enough for an advanced informatics specialist.

Editing graphics of the game can be performed with universal graphic editor Photoshop or/and 3D editors that allows developing three dimensional graphics.

Sound Editing can be done with the editor Audacity. This is a free software that allows editing and converting audio in any format.

Building programs of the game. There is a range of programs for developing games. A powerful and called software package is Scirra Construct2.

Exporting and testing the game developed. At this stage will use different software tools, that export and platform game ported their numbers of end-user equipment, for example, Google Android. Please, note that some platforms may be used Online. They allow exporting the easiest way. After testing device occurs, the tested game can be launched on Internet.

Short exposure of the main benchmarks of the concept of creation and development of games in autonomous meaning and /or in distance E-learning courses are sketched in Fig. 6.

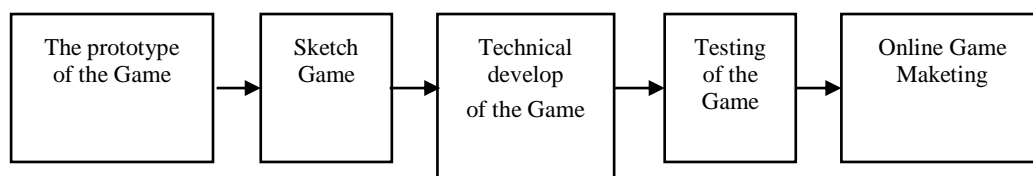


Figure 6 Flow chart of creation and realization of the Game

The prototype of the game is the essence and core of the whole creative process both conceptually and de facto for the final software product, is the start key of this research and implementation in the disciplines and autonomous. At this stage is projecting architecture of the game, its design and functionality, deciding what actions will spend in the game, the impact on the end user, how the user will interact.

Sketch game includes elements, characters and figures which will be presented in the game. Here decides how it will be presented an element or another, sounds, animations, buttons, control methods, etc. *Sketch game* can be seen as a *logical scheme* what is meant to make *the prototype of the game*.

Technical development of the necessary elements of the game. This stage is the most complex part, where each *element* of the game is designed. At this stage fully manifests the knowledge, skills and experience of the *creator* which is called *developer*, and / or other persons involvement occurs by mutual agreement establishing the necessary elements. This step is crucial, because the game is created exactly here, it needs to demonstrate quality, performance and attractiveness.

Testing the game is the next step after the *Technical development* and consists of adjustment and debugging of the programs and components of the game. Testing the game takes place on the device predestined, or on those devices running operating system that were developed for the game (in our case can be Android, iOS, Windows Phone). The purpose of testing is misconfiguration detection and correction, debugging, providing constructive process of completing the game in context with the requirements that inevitably arise as a result of interaction between the *developer* and the *end user*, etc. After testing, the game, can be *loaded* on the electronic platform that, for example on Google Play, for further use.

3.2 Autonomus applications of the Games

Following the steps described above, the authors has done a lot of games: Arcade Games, Run and Jump, Puzzle, Platform video games etc., they all are adjusted to minimum resources and time short record of achievement. These games have been designed to platforma Google

Android and can be *downloaded* for free virtually on any mobile device. The developed play Games can be used free and with payment, respecting the copyright of their creator. Free applications enjoy the greatest popularity and as a result have more downloads, allowing charging them through advertising and that it is a very effective way to popularize them.

Development time. Those mentioned above are practically ineffective, if not taken into account the time in which the steps are developed. Time of preparation is the key factor that can put us in advantage or disadvantage. In this case, the advantage is the use of technologies, tools and methods allowing product development in a shorter - record time. Using the methods and steps described in the paper, a Game can be developed from two weeks to two months, depending on the capabilities, speed and discipline working of the *elaborator*.

It is worth mentioning, that by applying technologies and steps described above, tools and personal experience, record time of creation of such a game was 14 hours. In this record time the stages were achieved: *the prototype of the Game, sketch Game, the technical development of the Game, testing of the Game*, followed by the publication of the game, including the promotion of the free initial level.

Basic tools that lead to creation of these Games, with performing the steps described above are:

1. *Adobe photo shop* - graphic editor. Here were created and processed images, colors, including two- types dimensional *sprite* graphics, scanning, removing faults and exporting the necessary extensions.
2. *Audacity-free* - software applied to the processing sounds, extremely useful when editing, modifying and optimizing sound objects exported.
3. *Construct 2* - Main program for creating games, in which were developed techniques and were imported all the frames of the project needed to finish the game.
4. Beyond the *testing phase* of the game, followed uploading Online game platforms. It allows the millions of users to download and install the Game created on the desired device. At this stage was used platforma *Google Play Store*. Here we show how an account will be opened and how to load the Game, extensions and other necessary details.

3.3 Applications of the Games on e-Learning Platform Moodle

The created games can be successfully achieved, if they will be implemented on the open distance learning platforms Moodle, Claroline, Docheos, Ilias etc. One of these applications is the university course PT and MS, on-line created for distance learning on electronic platform Moodle at TCUM. *Game-Test* are presented in each 12 themes and are used for training knowledge in a more attractive manner. We present below one of theme: Game - Test TP. Theme 1.

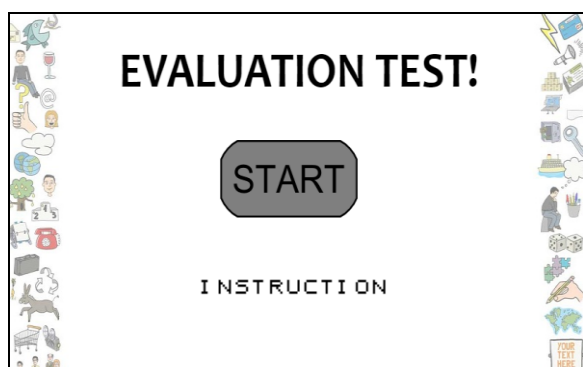


Figure 7 Release Game - Test

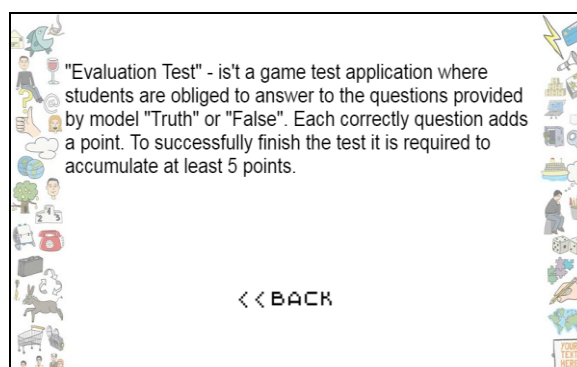


Figure 8 Testing Rules

In Fig. 7 we have buttons, *Start* and *Instruction*. The option *Start* launches the *Game-Test* and the option *Instruction* displays Testing Rules, submitted in Fig. 8. Next, see Fig. 9, on every page of game shows up three questions accompanied by the buttons *True*, *False*. By pressing one of buttons we give the answer, which may be true or false. After pressing the button, they both disappear and this excludes repeating the answer. The correct answer is accompanied by a pleasant sound, a mascot who smiles and announcement *Correct Answer*.

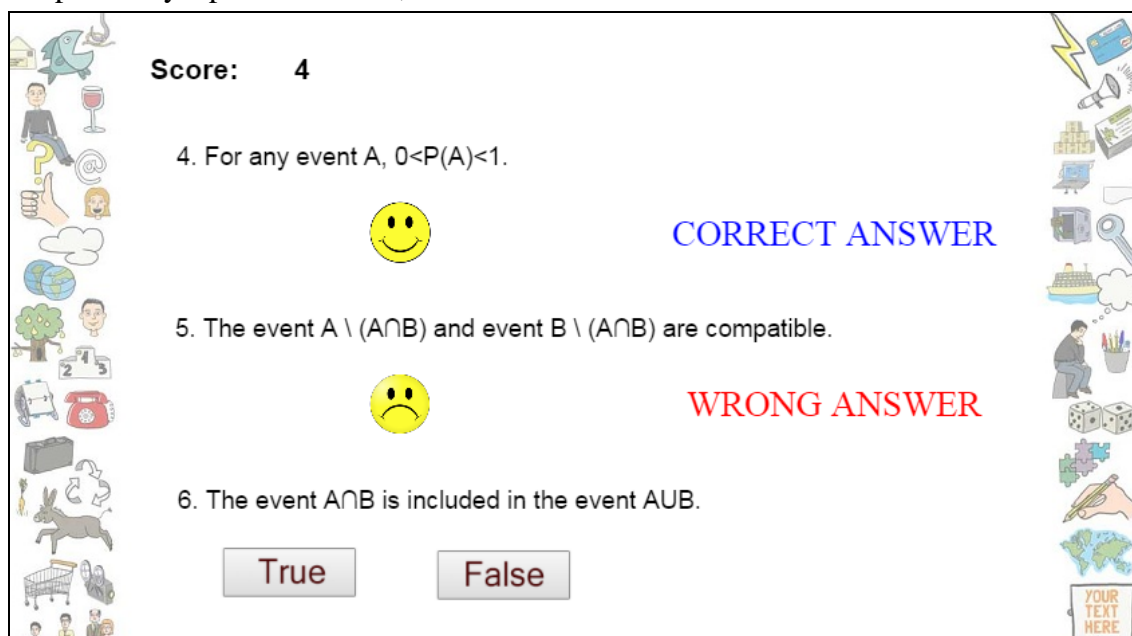


Figure 9 The execution of the Game - Test

The incorrect answer is accompanied by an unpleasant sound, a sad mascot and announcement *Wrong Answer*. At the end of the test appears the final results, presented in Fig. 9 and Fig. 10.

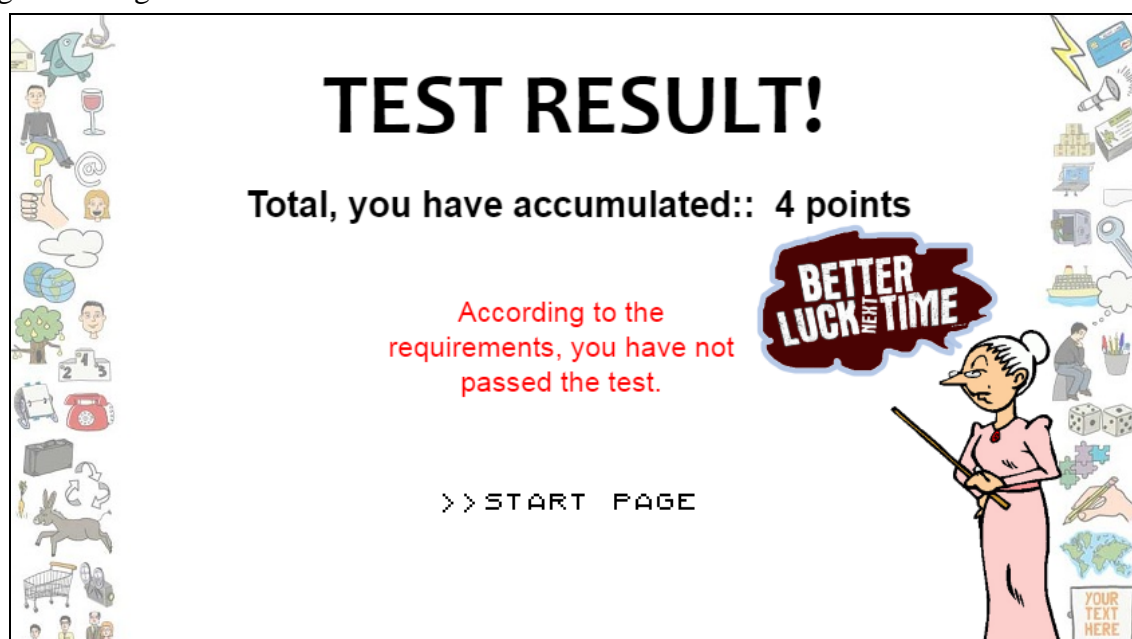


Figure 10 Display negative result

If final result is negative, then appears the image from Fig. 10. Here is announced their accumulated points and an invitation to return to the test. If the result is positive, then we have the image from Fig. 11. Here, also, we have announced their accumulated points and

congratulations that I passed the test. Test conditions can be modified depending on the testing needs.

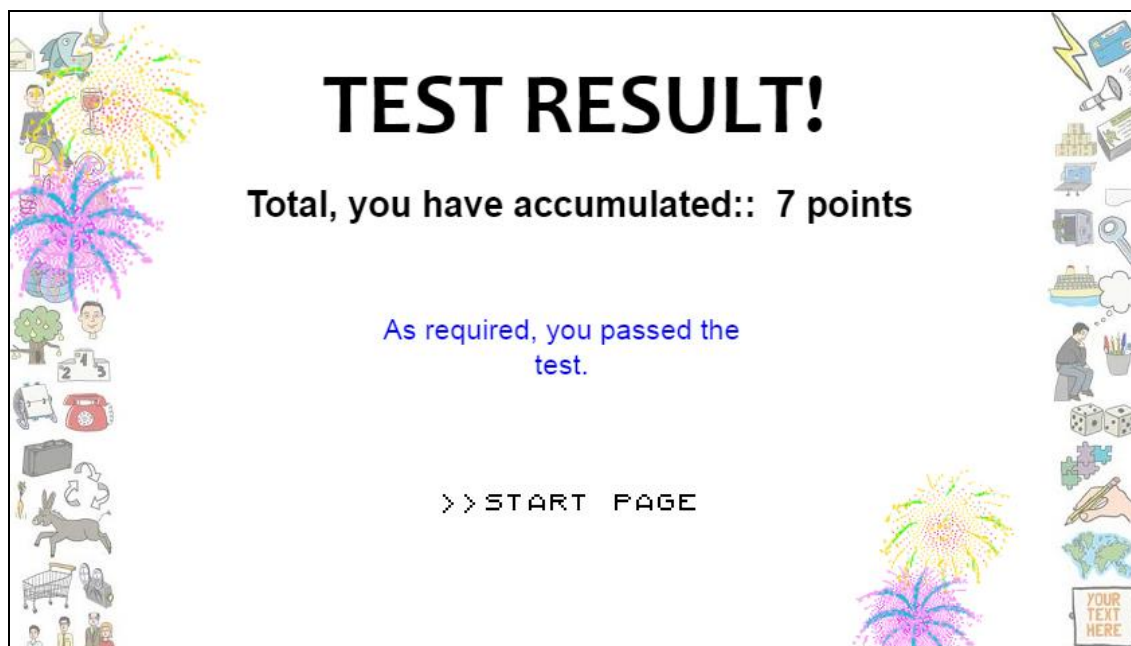


Figure 11 Display positive result

4. Conclusions

The creation and development of university courses on electronic platforms is a purely academic field, very actual today. Nevertheless, creating games is very appealing and as results is a more attractive domain. The tandem of these two areas, at first sight are quite different but can lead to good results in training activities of the young generation. This interesting interactive process require patience, passion and perseverance. It is a creative activity with its own history, from the 80's of last century and currently continues to develop quickly, being one of the most popular activities in the computing market.

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Twitter and Teaching: to Tweet or not to Tweet?

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Abstract. As increasingly more new skills are necessary for graduates entering the workplace or seeking employment, business leaders, politicians and educators suggest that if students are to succeed in today's world, they will require 21st century skills. However, there is no single agreed-upon set of skills. We argue that social media skills are becoming ever more important for employment and society should class them as important 21st-century skills from maintaining well-rounded social media profiles to more advanced data science and analytic skills. At the same time, such a demand affects the teaching process since teachers have to acquire new knowledge about the available tools. Twitter as a microblogging platform is definitely one of the tools that is a part of 21st-century social skills. Thus, by integrating it into the teaching process, Twitter can generate new experiences for both sides, the students and the teachers. In this paper, we conduct a descriptive review of the recent literature that covers Twitter use in teaching. We reviewed results from the top 100 retrieved research results in Web of Science on Twitter and teaching in the domains of social science, science technology, and arts and humanities. We analysed the results quantitatively in terms of content, methods, and methodologies and qualitatively as the description of results found in selected papers that meet certain criteria. This paper also discusses different research departure points for use in further research of the topic.

Key words: *Twitter, teaching, social media, learning, collaboration*

1. Introduction

There is no single set of 21st-century skills although the hundreds of suggestions include life skills such as agility, flexibility, and adaptability; workforce skills such as collaboration, leadership, initiative, and responsibility; applied skills such as accessing and analysing information, effective communication, and determining alternative solutions to problems; personal skills such as curiosity, imagination, critical thinking, and problem solving; interpersonal skills such as cooperation and teamwork; non-cognitive skills such as managing feelings [1]. The National Science Teachers Association [2] believes the 21st-century skillset includes “core subject knowledge, learning and innovation skills, information, media and technology skills, life and career skills, adaptability, complex communication and social skills, non-routine problem solving, self-management/self-development and systems thinking”.

Effective use of social media or, more broadly speaking, sensible use of Web communication technologies is also an important 21st-century skill. Since it is important to use both social media accounts such as LinkedIn, Twitter, or public Facebook to generate interest and further a career, it is equally important that users screen their social media profiles, enable privacy

settings, and ensure that if or when employers search for a prospective employee there is nothing about the candidate that casts them in a negative light to a hiring committee. However, social media, especially Twitter when used correctly, has tremendous benefits within the field of education and more widely, especially within the field of teaching.

The overall research aim of this paper, therefore, is to develop a better understanding of how Twitter is used within teaching. The objectives of the study are to:

- Explore methods of researching the extent to which the teaching world uses Twitter
- Develop a better understanding of current research examining Twitter and teaching
- Develop a better understanding of the theoretical frameworks used in research articles related to Twitter and teaching
- Examine the availability of research articles examining Twitter within teaching.

The primary findings of this paper will interest teachers across higher education by exploring the possibilities of using Twitter in their lectures, researchers interested in teaching and pedagogy methods, and to universities and faculty management. The next section presents the methodology.

2. Methodology

For the purpose of this research, we searched using keywords Twitter + Teaching in the Web of Science database in the domains of social science, science technology, and arts and humanities. We retrieved the first 100 for analysis and selected them according to the publication date, newest to oldest. We also collected a list of the articles and searched for availability of the papers on Google Scholar and other sources (such as the University of Sheffield's Primo Central index). For this particular analysis, we were limited to the papers that were freely and legally available to the researchers conducting research. The researchers could use only the papers that were available via university subscriptions, but a large number of papers were accessible and freely available. We conducted an analysis using a framework that is reported elsewhere [3]. This is a descriptive literature review, descriptive because it focuses on the methodology, methods, findings, and interpretation of each reviewed paper (as opposed to integrative reviews that attempt to find common ideas and concepts from the reviewed material). We divided the presentation of the results in two parts; the first is quantitative in nature (showing distributions of availability, methods and methodologies), and the second is qualitative (presenting results of findings from the studies we analysed).

3. Results

3.1 Quantitative results

The table below displays the distribution of papers grouped by category:

Table 1—Distribution of papers

Groups of papers	Number of Papers
Not available	32
Twitter + student teachers	22
Social media in learning, including Twitter	22
Not relevant	8
Scientific conference	3
e-learning	2
ICT education	1
Teachers engagement on Twitter	1

Sina Webo (Chinese microblogging service)	1
Scientific journals	1
Scientific research impact	1
Student data mining	1
Technology Acceptance Model used	1
Twitter used in research (mobile app)	1
Total	97

There are 97 papers (out of 100 initially retrieved) we analysed further, because we found that some of them were not scientific papers, for example, theses, data sets, and repeated papers. Table 2 below displays the papers that cover only Twitter in teaching.

Table 2—Twitter used solely within teaching research

Methodology	Count	Methods
Quantitative	10	Online questionnaire, questionnaire, survey, Twitter data, online questionnaire, Twitter -based network of interactions, survey
Qualitative	9	Literature review, tweets analysis, content analysis, Twitter data, literature review, exercise presentation, case study on Twitter data, Twitter data content analysis
Mixed	3	Case study + survey, virtual ethnography + quantitative analysis of the tweets produced, action research

3.2 Qualitative descriptive analysis

In this section, we present findings from the 22 papers in which the use of Twitter within the teaching process was the main focus of the study. Our results, outlined below, are presented in order of retrieval, i.e., articles published more recently are reported on first.

Knight & Kaye [4] set out to understand how students use social network sites (SNS) with a primary focus on Twitter. The article explored how it facilitates the academic-student relationship and disparity between them. One of the main issues raised is the problem that SNS come and go, and teachers have to adapt to the dynamics. This study shows that Twitter is mostly used for information seeking and sharing, to follow famous people and to network with friends. It was also found that there are different uses between teachers and undergraduates. Teachers mostly use it for information sharing and students for information seeking. In terms of academic use, students use Twitter to contact specific tutors to ask specific questions and ask course-specific questions. The first five of the students' perception of usefulness was that Twitter provides details on practical issues, posts course-related updates, reminds them about upcoming assignments, posts questions related to courses, and provides specific assignment reports. For the faculty staff members, the most perceived usefulness is to advertise university activities, share research ideas and publications, advertise department activities, ask course-related questions, and post related updates.

Purdam [5] analysed how people use Twitter in the task-based learning (TBL) process. The results of the paper point to the importance of critical data skills in the age of big data, how Twitter data are a new form of data and how it is possible to implement Twitter within a TBL learning framework. The challenge is to develop tasks for students before the course starts.

Gonzalez and Gadbury-Amyot [6] in their paper pointed out that students viewed the use of Twitter positively and found it helpful with their courses. They also reported they were open to using Twitter in the future, that its use increased student engagement in the course and they

found Twitter an excellent resource for question and answer sessions. The challenge of using Twitter related to the teachers' social media skills; however, it could increase the interaction between students and instructor, facilitate prompt feedback from the instructor, and encourage active learning, which are all considered best practices for teaching and learning.

In another paper [7] students showed great interest in Twitter, in particular when they improved, advanced and gained familiarity with the tool. In the final phase, they became aware of the development of their competence acquisition. Implementation of using Twitter in teaching was not a problem for teachers since it promotes a pleasant and motivating learning environment. The first phase was rich and conducive to students, who easily shared the new content generated between them. Some tweets turned students to resources available on the Internet. Such actions point to student interest in a wide integration of materials into their learning. Problems related to setting up an online community around hashtags. So, guidance provided by teachers played a useful role in increasing interaction within a group with the aim of developing a class learning community.

In another study the authors [8] indicated that Twitter represents an educational resource, which is truly multi-disciplinary and breaks down boundaries between professional groups. It could be useful in conferences, and there is an opportunity to reach out to trainees and others seeking continuing professional development and to provide both reliable resources and somewhere to foster debate and discourse on topical themes.

Another paper identified [9] four key success factors for faculty who wish to incorporate Twitter in their pedagogical toolset: 1. Strong initial faculty presence on Twitter. 2. Justification for technology and Twitter in the classroom. 3. Mandatory Twitter participation. 4. Rewards for active professional tweeting versus social tweeting or reactive retweets.

Within another paper, the authors [10] provided tips and suggestions on uses of Twitter in sports-related teachings. They are:

- Use Twitter within the classroom
- Use Twitter to communicate outside of the classroom
- Retweet
- Reply and retweet favourite student responses
- Use Twitter to connect with organizations and businesses
- Use Twitter to connect with coaches, athletes, and sports media
- Assign students to follow Twitter during a live athletic event
- Have students search for examples of class discussion topics outside the classroom
- Interact with alumni
- Archive tweets to create a class story
- Incorporate grades or offer extra credit in order to increase Twitter participation.

In one study [11], the authors elaborated and proposed reasons why teachers should tweet while in the classroom. Twitter promotes active participation, allows more reserved students to participate in class discussions, engages learning, and helps students who are introverted. It is engaging and interactive; it is more engaging than posting comments on a forum; it is less formal. It encourages students to speak up when class size is large and can make the class much more interesting. It is a good tool to communicate and share ideas. It allows soft-spoken students to share their thoughts. Professors can even read the tweets after class and address the questions raised.

Class participation is not limited by time, and Twitter provides a new platform for students to interact and share knowledge with each other. It could be useful as another avenue to participate in class; it is innovative and an interesting learning method, and tweeting provides more opportunities for students to share anytime during the class and encourages students to discuss actively. It supports knowledge exchange between classmates. Live feeds also make participation dynamic and simultaneous and enhance classroom interaction virtually. Students can post ideas or supplementary materials (links, pictures, articles, videos, etc.), and students like unconventional ways of learning. Twitter speaks the language of the young students and adds variety and interest for students, and students can compete for the sake of the grade. It adds quality to the discussion, rejuvenates the idea of class participation, where class participation is no longer just about receiving marks, but about interacting with other students, thereby breaking the barrier of groupthink.

One study [12] showed that online media tools can integrate into daily educational practices and augment learning and collaboration. One of the problems is that students want to keep their social media identities personal rather than integrate them into their professional lives. Its novel use of social media, however, is a useful educational tool, allowing ease of access to a repository of presentations. Students using the Twitter feed found it easily and accessible and useful and felt its use should continue.

In another study [13], the authors proposed a model for how to develop lectures using Twitter, how to focus on engagement strategies, lectures, extensions, and assessment.

In one more broadly positive study, the authors [14] proposed Twitter as a tool for evaluating classes. It gives the possibility of expressing views freely and taking part in the process of improving teaching the subject. It is a powerful and effective tool thanks to its spontaneity and immediacy. It should be complementary with final deeper and more rigorous assessment, its formative and continuing value allows teachers to approach the perspective of students, their views and interests, enabling faculty to act, change, and improve the course at any time during the process. Using Twitter motivates the student and creates a sense of belonging and effective integration into the subject; students are active in the process and identified with the results. Twitter is a positive and beneficial experience, a popular and novel means that is usually well-received by students. Part of the success depends on perceiving clearly the goal of using the tool. To achieve this, it is necessary to democratize the classroom; the student should have equal status and freedom with the teacher, and teachers should promote an evaluation for improvement and learning that overcomes the sanctioning and hierarchical model that still prevails in the university classroom.

In another study [15], the top ten nodes with the highest in-degree were primarily hashtags, suggesting that people were connecting around thematic markers of common interest, referring to them and making them popular. Another study of the same datasets [16] confirms that the learners were more focused on the topics of interest than on those suggested by course facilitators, and that those topics emerged in the course and groups of people who adopted them maintained them.

According to the authors [17] of one particular study, Twitter allows one to connect, engage, learn, and educate oneself and others in real time on a global scale. This paper had an interesting list of potential pitfalls of Twitter. Here are selective pitfalls that apply to a wider audience since this paper dealt with medical education. Twitter is susceptible to misinformation, and to combat lack of trust, it is important to follow reputable individuals to overcome this pitfall. Students should only retweet links and information that are from reliable sources. Another aspect is sharing research results over Twitter since it is easy to lose meaning in the 140 characters. It is also important to recognize that online behaviour becomes a part of a user's permanent Internet identity. Whatever is written on Twitter stays on Twitter

and Google indexes it so we have to take care about what we tweet. Another aspect is an employer's policy for tweeting, and before engaging in tweeting, consult the employer and policies. This study's authors pointed to Twitter Chat as a highly valuable tool that bonds and connects individuals on a specific topic. Twitter Chat is a discussion that takes place in real time at a pre-arranged time on a pre-arranged subject. Twitter allows one to connect, engage, learn, and educate oneself and others in real time on a global scale.

This research [18] shows the more class participants are familiar with Twitter, sessions run more efficiently and effectively. Students and teachers can discuss questions outside the lecture time and can integrate discussion in after-class sessions. Sometimes questions are for specialists in the domain that can broaden the number of participants in the class. Also, research shows that student-tutor relationships have benefited, and students perceived tutors as more approachable both in person and online. However, using Twitter could increase demand of the tutor's time outside the class.

Below, we present a figure from a research paper [19] based on the results of research conducted on using Twitter within the classroom:

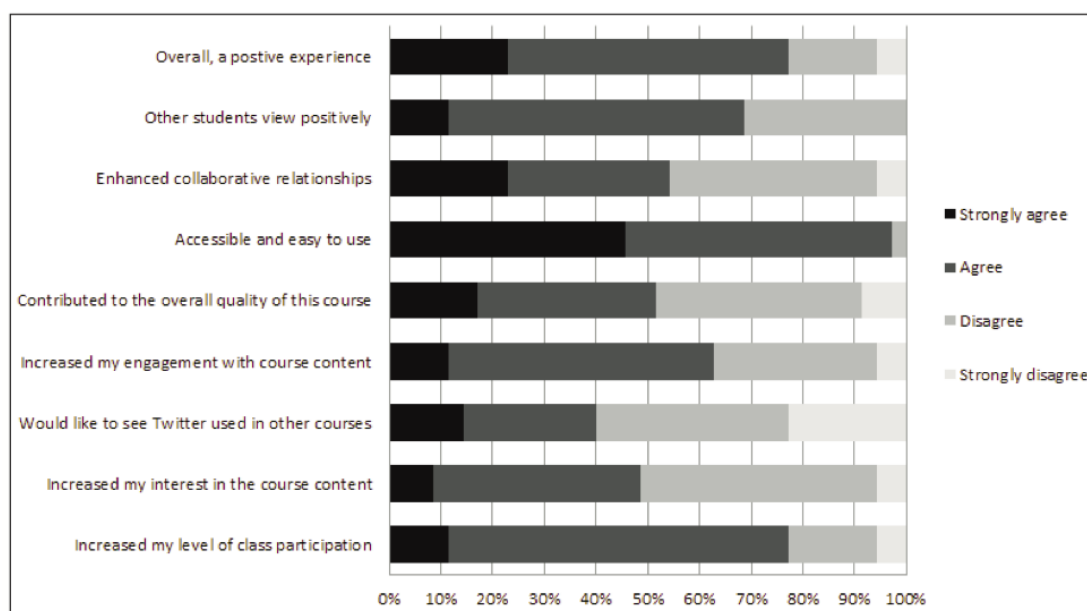


Figure 1—Student perception of Twitter use (from [19])

The results of one particular research article [20] brings the following findings: the amount of Twitter usage was associated with increased student engagement, including organizing social lives and sharing information; course-related tweeting showed no evidence of a relationship to interpersonal relations between students and their tutors. Additionally, Twitter usage also did not relate to class attendance. This research points out that using Twitter for teaching does not in itself improve the relationship between a tutor and learners. The authors suggest that the medium might best be exploited to increase connections between students themselves, students and their tutors, and students and educational resources. Also, they call for careful consideration about whether tweets should become educational or personal since they could have different effects.

Another article [21] analysed Twitter as mandatory backchannel. A backchannel is defined as an electronic discussion that occurs simultaneously in real time during a lecture or conference where students may post questions, comments, or respond to other posts. The authors point out that for a backchannel to succeed, students have to have the devices in the classroom

(mobile, PC, laptops, tablets), and at the start of the course, an instructor should evaluate their skills. For successful incorporation of Twitter as a backchannel, it is important that the faculty member commits to implementing it in the education and learning process. Also, to make Twitter as backchannel work, lecture designs should support Twitter interaction in the class (to allow for periodic consistent backchannel check-in, which is also supported by best pedagogical practices). The overall experience of the authors is positive towards using Twitter in education processes.

In one research article [22], the authors argue that Twitter could serve as a scaffold for developing reading comprehension and writing skills required for reading and composing various genres of scientific text. In the disciplines that have large quantities of complex materials to learn from, Twitter could provide entry to the domain. Also, because of its participatory and multimodal text nature that is constantly updated, Twitter can serve as a more engaging text for adolescents than traditional science textbooks.

One particular study [23] points out that by using Twitter, teachers could interact with a much wider audience. This provides numerous opportunities for outreach of various kinds.

They are presented in Table 3, below.

Table 3—Different ways to use Twitter in teaching (from [23])

Blog writing	Spread awareness about the subject and domain and reach an audience that is much wider than your class and reach new potential readers.
Interaction with students	Usually, dedicated Twitter users from the faculty will use Twitter to interact with students. To overcome oversharing, it is possible to use multiple accounts, one for tweets that students will see, and one for private posts.
Creating public awareness	Promote external events relevant to classes
Addressing social issues/being a citizen-scientist	Through Twitter, students could interact and find out about relevant topics more in-depth and from different perspectives, such as work-life balance, the demands of tenure, and bias against women/minorities)

Another paper [24] raised interesting concerns related to publishing research results on Twitter. It is possible for someone to “steal” an idea or research since these results are important to an academic career. There are two possible answers: First, the concept of plagiarism is not new, and chances of it happening increase as researchers publish more material, and second, publishing research results on the Internet can actually reserve the rights because it has the time and date stamped when published. So actually, it secures output from plagiarism or at least gives the opportunity to pursue the plagiarists. The paper’s research showed 72 percent of respondents in the survey thought Twitter helped learning, but used during the lecture, it had a tendency to distract and intrude. But it could be useful between lectures (as pointed out already in some of the research presented above). Also, scientists who teach can use Twitter to interact with their professional colleagues, so they have a more up-to-date and wider network that will enhance the quality of their lectures.

Another research article [25] points out that Twitter makes following course notifications easier and relevant information more informally received. It could strengthen communication with the other students since they can receive education whenever they want. Also, it strengthens communication between student and teacher. The students’ willingness to learn

increases and courses became more interesting. Students have the opportunity to benefit from knowledge of other people by using the hashtag (#) about subjects they do not understand.

Also as one of the benefits is that students can keep up-to-date and can comment on the current issues. By integrating Twitter with Dropbox, a cloud storage site, it becomes easier to reach course materials and develop joint projects. Sharing course materials in this environment enriches and provides great convenience on sharing homework and projects. It creates positive effects on students' opinions, but it also contributes to students' social and cultural development, and it provides a platform for collaborative studies. Students observed in this research expressed that it helped improve their ability to make comments about course content, and it helped reach educational materials through Dropbox, We Video, an SaaS video editing program, and ThingLink, an image sharing site, mobile applications that show that integrating Twitter with other platforms could boost teaching productivity.

In Table 4 below, we present two main streams of proposed strategies of using Twitter in working with students and as a research tool proposed by the authors in [26]. One stream of strategies is dealing with student engagement and another with how research uses it.

Table 4—Strategies for using Twitter in work with students and as a research tool (from [26])

Strategies for engaging students	Twitter as a research tool
Establish a course profile and use hashtags and, by doing so, keep tweets organized.	Use #hashtag search to find about phenomena.
Collate classroom views and provide instant feedback	Use advanced search functions provided by Twitter and find specific phrases and words, names of people, locations, and hashtags
Create a bulletin board and update students with relevant information (assignment deadlines, seminar topics, and further reading)	Save searches and visit them later in the research process
Reinforce learning activities by using Twitter to set course-related tasks	The discover function on Twitter uses connections to display shared stories and provides updates on new content
Promote knowledge sharing and understanding by getting students to tweet about what they learn while the course is continuing	Add relevant tweets to favourites that are accessible at a later date. Also, looking into favourites of other people can provide a rich source of information.
Get students to share books, journals, and online materials	
Share links to websites	
Foster peer support mechanisms and extend classroom discussion. By doing so, break down barriers between students and develop a sense of belonging to community of the class	
Provide a recap at the end of each class to reinforce key learning points	
Establish flexible office hours and use Twitter to provide quick responses and clarifications on student concerns	

Engage with professional communities and find interesting figures to follow	
Map trends and get students to map views and find out what people are discussing	

In this section, the authors presented findings from a qualitative analysis of a collection of papers. The aim was to describe findings from different research projects objectively and follow suggestions that descriptive literature reviews focus on describing individual studies/papers as proposed in [27]

4. Discussion

In the studies presented above, social media and learning theories prevail as departure points in the research. In our view, there is a lack of variety in the theoretical background within the identified studies that could limit research findings. We would like to discuss different theoretical departure points that could be employed in the research of how Twitter is used in teaching. To start with, we would like to point to the framework proposed by Spiranec and Banek [28], which covers different approaches in information literacy as shown in Table 5.

It is possible to define information literacy as the ability to recognize information needs and identify, evaluate, and use information effectively as stated by [29]. The description includes information technology experience, information sources experience, information process experience, information control experience, knowledge construction experience, knowledge extension experience, wisdom experience [29]. All of them are applicable in the findings. Different approaches presented in Table 5 can help us establish a better understanding of potential avenues of research.

Table 5—Different approaches in information literacy education (Source: [28])

Source approach	The focus is on information sources and bibliographical tools and takes the information system and not the user as its point of departure.
Behavioural approach	The main teaching interests are still bibliographical tools and information sources, but they also provide a generalized structure for information seeking, which users can apply in various situations, practices, and contexts.
Process approach	It covers different aspects of information seeking from the user perspective, focusing on how users experience information seeking and create meaning.
Communication approach	This approach largely consists of an awareness of the importance of understanding the socio-cultural conditions for the production, mediation, and consumption of information and emphasizes the social and communicative aspects of information processes, which are context-sensitive

In the same paper, Spiranec and Banek proposed as a concept Information Literacy 2.0 that has the following features. The accent in teaching is in interpretations and a negotiation, in terms of content focus, on recognizing information contexts, addressing authority, reliability, and accuracy issues. Characteristics are that solutions are nonexclusive solutions and multiple information paths exist. Perception of the information system is on the personal level, and it is

subjective. Information spaces are of unorganized structures, and users are creators of the content and need education to do so.

Methodologically, Information Literacy 2.0 is integrated; it is happening in e-learning and a hybrid environment with a strong focus on Web 2.0 services. We prove that most of the features proposed under the framework of Information Literacy 2.0 are presented in the research findings. So, we would like to propose Information Literacy 2.0 as one of the theoretical departures that are useful to find out more about using Twitter in teaching.

Another departure point we could see in the theory of information behaviour could be defined through these often-used four terms: information behaviour, information-seeking behaviour, information-searching behaviour and information-use behaviour. The definition based on Wilson [30] is in Table 6.

Table 6—Four Terms Used in information behaviour research (source [30])

Information behaviour	Totality of human behaviour in relation to sources and channels of information, including both active and passive information-seeking, and information use
Information-seeking behaviour	Purposely seeking for information as a consequence of a need to satisfy some goal. In the course of seeking, the individual may interact with manual information systems or with computer-based systems
Information-searching behaviour	Behaviour the searcher employs in interacting with information systems of all kinds. It consists of all the interactions with the system, whether at the level of human computer interaction or at the intellectual level, which will also involve mental acts, such as judging the relevance of data or information retrieved.
Information-use behaviour	Consists of the physical and mental acts involved in incorporating the information found in the person's existing knowledge base. It may involve, therefore, physical acts such as marking sections in a text to note their importance or significance, as well as mental acts that involve, for example, comparison of new information with existing knowledge.

Other than information behaviour, we could explore possibilities of approaching phenomena from the perspective of information systems research. Lee and colleagues proposed going back to basics, going back to a socio-technical systems paradigm. They point out that an information system consists of social, technological, and informational components, which are not separate but interrelated [31]. As a useful framework for information systems analysis, we would like to propose the Delone and McLean model of IS success [32] that proposes information, system, and service quality as variables that influence intention to use and user satisfaction with IS. They are correlated, and they will influence net benefit of the IS success. Those variables provide very powerful and an often-used framework for IS analysis.

We would like to also mention an activity theory used in human computer interaction research [33]. The main phenomenon of the research is activity. And, as we see in the above research, finding most of them report on the activities conducted in the class and between classes. As

Kuutti [33] put it, “An activity is a form of doing directed to an object, and activities are distinguished from each other according to their objects. Transforming the object into an outcome motivates the existence of an activity”. “Tools” mediate the relationship between subject and object; “rules” mediate the relationship between subject and community, the “division of labour” mediates the relationship between object and community. Those six variables (subject, object, tool, rules, division of labour, and community) enable rich analysis of Twitter usage in the classroom and between.

5. Conclusion

In this paper, we have provided an overview of research that focused on examining Twitter use in the classroom. The descriptive nature of this paper will provide a valuable resource for those considering using Twitter in the classroom. We found that the main obstacle is that usage of Twitter within teaching is left to the individual teachers and their interest in developing their own skills in social media and using it to improve their teaching process. At the same time, social media skills are important for the students’ professional development. Obligatory top-down implementation of Twitter use in the classroom from the universities’ governance bodies sounds extremely difficult to achieve. However, students need to acquire such knowledge whilst they are studying. In the end, it is the teacher’s responsibility whether to use Twitter in the classroom. However, the extra efforts teachers put in are not usually recognized by the educational system they operate in. As Albert Einstein once put it, “It is the supreme art of the teacher to awaken joy in creative expression and knowledge”.

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Track 1

Finance & Accounting

Mirovinske dvojbe i financijska pismenost

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Sažetak. Iako je prva mirovinska reforma u Republici Hrvatskoj provedena prije više od jednog desetljeća, točnije 2002. godine, ni danas većina obveznika uplate mirovinskih doprinosa ne zna što u budućnosti mogu očekivati od svojih mirovina. Financijska pismenost građana Republike Hrvatske, po mnogim provedenim istraživanjima, nije na prihvatljivoj razini. Postoji čitav niz programa kojima se pokušava popraviti sadašnje stanje, ali to je proces koji zahtijeva dosta vremena. U međuvremenu, građani donose upravljačke odluke koje će odrediti njihovu financijsku budućnost.

Uredbom o izmjenama i dopunama Zakona o obveznim mirovinskim fondovima (NN 93/15) donesenoj na sjednici Vlade Republike Hrvatske održanoj 26. kolovoza 2015. godine, pred djelatne vojne osobe, policijske službenike i ovlaštene službene osobe mlađe od 40 godina stavljena je mogućnost odabira. U roku od 15 dana trebali su donijeti odluku o ostanku u drugom mirovinskom stupu ili izlasku iz njega. U ovom radu na praktičan način izradit će se projekcija budućih mirovinskih prihoda za oba odabira.

Ključne riječi: mirovinski fondovi, mirovina, financijska pismenost

1. Uvod

U posljednje vrijeme se sve češće može čuti kako je mirovinski sustav u Republici Hrvatskoj neodrživ te da su reforme istog neizbježne. Svima je više manje poznata činjenica da je broj zaposlenih i broj umirovljenika u Hrvatskoj skoro pa izjednačen, a ako ćemo biti potpuno objektivni, realno bi bilo reći da je omjer čak i nepovoljniji uzme li se u obzir činjenica da je velik broj ukupno zaposlenih u javnom sektoru. Iz svega navedenog jasno je da je pitanje dana kada će ovako ustrojen mirovinski sustav doživjeti krah te da je nužno, što je prije moguće, pristupiti reformama mirovinskog sustava.

Već neko vrijeme se kao jedna od mogućih reformi spominje zamrzavanje uplata u drugi mirovinski stup i prebacivanje sredstava u prvi mirovinski stup, tj. u proračun. Brojni ugledni ekonomisti zaziru od ove ideje te smatraju da bi rezultat bio upravo suprotan onome što je potrebno za trajno stabiliziranje proračuna i snižavanje javnog duga.

S druge strane, javnost nije upoznata s mogućim posljedicama i učincima ovakvih reformi i općenito nema dovoljno znanja o davanjima državi i koristi od istih pa stoga nemaju ni predodžbu što bi za njih bilo bolje u budućnosti.

Temeljem prethodno navedenog proizlazi i glavni cilj rada, utvrditi isplativost ulaganja u drugi mirovinski stup naspram prelaska u prvi mirovinski stup te postojanje znanja i vještina i općenito financijske pismenosti osiguranika prilikom donošenja odluka koje znatno mogu utjecati na kvalitetu života.

Rad se sastoji od 5 poglavlja. U ovom poglavlju napisano je nekoliko uvodnih rečenica o temi i ciljevima rada. U drugom poglavlju opisan je mirovinski sustav kakav je na snazi u Hrvatskoj danas. Treći dio odnosi se na financijsku pismenost građana i na nedavnu izmjenu zakona o prebacivanju sredstava iz drugog u prvi mirovinski stup za određene osiguranike spomenute u sažetku rada (NN 93/15). U četvrtom poglavlju prikazana je praktična projekcija budućih mirovinskih prihoda. Peto je poglavlje rada zaključak.

2. Mirovinski sustav Republike Hrvatske

Mirovinski sustav važan je dio sustava socijalne sigurnosti svake suvremene države pa tako i u Republici Hrvatskoj. Hrvatska ima otprilike milijun i četristo tisuća obveznika koji plaćaju mirovinsko osiguranje, a s druge strane njih preko milijun i dvjesto tisuća ostvaruju pravo na mirovinu na temelju davanja iz plaće za vrijeme trajanja radnog vijeka.

U Hrvatskoj je, nakon Drugog svjetskog rata, na snazi mirovinski sustav međugeneracijske solidarnosti koji podrazumijeva da aktivni osiguranici, tj. njihova poduzeća i druge pravne osobe plaćaju doprinose kojima se financiraju mirovine aktualnih umirovljenika. Krajem 20. stoljeća, u većini država pa tako i u Hrvatskoj, mirovinski sustav utemeljen na generacijskoj solidarnosti zapao je u probleme. Razlozi tome, za većinu zemalja, su uglavnom negativni demografski trendovi, sve starija populacija, sve manja stopa fertiliteta.

U Hrvatskoj je ipak rat bio glavni uzrok problema. Posljedica rata i tranzicije od socijalističkog ka tržišnom gospodarstvu bila je bitno smanjenje broja osiguranika s jedne strane i povećanje broja umirovljenika s druge strane. Kada tome dodamo loše oblikovan mirovinski sustav jasno je da su promjene bile nužne. Stoga se 1998. donosi Zakon o mirovinskom osiguranju (NN 102/98) kojim započinje reforma mirovinskog sustava u Republici Hrvatskoj kojom se mijenja i dorađuje postojeći prvi stup temeljen na generacijskoj solidarnosti, ali se istovremeno uvodi i drugi mirovinski stup temeljen na kapitaliziranoj štednji te treći mirovinski stup, dobrovoljno osiguranje (oba se počinju primjenjivati od 01. 01. 2002. godine).

Ciljevi hrvatske mirovinske reforme bili su: transformirati i srediti pravno i financijsko stanje mirovinskog sustava, smanjiti priljev novih osiguranika, usporiti rast mirovinskih izdataka, povećati ovisnost mirovina od doprinosa, pojačati individualnu odgovornost građana za sigurnu starost, dugoročno stabilizirati i učiniti održivim mirovinski sustav.

2.1 Mirovinska reforma - prva faza

Hrvatska mirovinska reforma provedena je u dvije faze. Prva faza bila je racionaliziranje postojećeg mirovinskog sustava međugeneracijske solidarnosti i to pomoću parametarske mirovinske reforme što znači da se ciljalo na smanjenje mirovinskih troškova i njihovo prilagođavanje gospodarskim mogućnostima. Neke od značajnijih parametarskih mjera koje su uvedene u Hrvatskoj su: podizanje dobi odlaska u mirovinu i to svake godine, počevši od 1999. za šest mjeseci pa je tako već 2008. godine stupilo na snagu pravilo da muškarci odlaze sa 65 u mirovinu umjesto ranijih 60, a žene sa 60 umjesto sa 55 godina. Podizanjem dobi odlaska u mirovinu smanjuje se priljev novih umirovljenika i financijski pritisak na mirovinski fond.

Druga važna mjera je povećanje razdoblja zaposlenosti koje ulazi u obračun mirovine. Prema starom zakonu za obračun mirovine uzimalo se 10 najpovoljnijih godina staža u kojima je zaposlenik imao najviše plaće. Novim zakonom uređeno je da se svake godine razdoblju

obračuna mirovine dodaju tri godine pa tako već od 2010. godine u obračun mirovine ulazi cijeli radni vijek osiguranika. Povećanje razdoblja obračuna uzrokuje smanjenje mirovinske osnovice pa time i niže mirovine.

Treća važna inovacija u mirovinskom sustavu odnosila se na način indeksacije (usklađivanja) mirovina. Do reforme se indeksacija mirovina svake godine vršila prema plaćama zaposlenih pa se, zahvaljujući tome, održavala približno ista zamjenska stopa mirovina u odnosu na plaće. Budući da plaće zaposlenih u pravilu rastu brže od cijena (troškova života), pri povećanom broju umirovljenika i smanjenom broju zaposlenih bilo je teško održati indeksaciju prema plaćama zaposlenih. Na kraju je, kao kompromisno rješenje, usvojena tzv. švicarska formula prema kojoj se usklađivanje vrši 50 % prema troškovima života, a 50 % prema plaćama.

Neki od ključnih poteza još su bili i pooštavanje uvjeta za odlazak u prijevremenu starosnu mirovinu, propisani su teži uvjeti odlaska u invalidsku mirovinu, a izmijenjen je i postupak utvrđivanja invalidnosti. Pored opće, uvedena je i profesionalna invalidnost što znači da osoba koja izgubi radnu sposobnost za određene poslove može obavljati druge poslove primjerene njenim radnim sposobnostima. Ukinuti su neki instituti koji su prije bili pri mirovinskom sustavu itd.

Sve navedeno doprinijelo je financijskoj održivosti mirovinskog sustava te je došlo do stabilizacije broja umirovljenika i poboljšanja omjera umirovljenika i zaposlenih. S druge strane, parametarska mirovinska reforma donijela je pad mirovina umirovljenih osiguranika nakon 1999. godine i još neke probleme koji, kako vrijeme odmiče, sve više vane za rješavanje.

2.2 Mirovinska reforma - druga faza

Druga faza mirovinske reforme počela se primjenjivati od 01. 01. 2002. godine i bila je nešto radikalnija. Donijela je promjenu strukture mirovinskog sustava. Dakle, u drugoj fazi uveden je drugi mirovinski stup, tj. kapitalizirana individualna štednja u koju se izdvaja jedna četvrtina doprinosa. Sve osobe mlađe od 40 godina (2002. godine) bile su obavezne pristupiti drugom mirovinskom stupu, a osobe između 40 i 50 godina mogle su birati žele li ili pak ne žele biti osiguranici i drugog mirovinskog stupa.

Osiguranici drugog mirovinskog stupa mogu slobodno birati mirovinski fond u koji će ulagati svoje doprinose. Doprinosi osiguranika, akumulirani na osobnim računima, kapitaliziraju se u različitim poslovnim akcijama. Cilj je ostvariti što veću dobit, povećati ulog odnosno kasniju mirovinu osiguranika. Riječ je dakle o individualiziranim mirovinama koje ovise o uloženim doprinosima osiguranika i ostvarenoj dobiti u fondovima.

Treći stup mirovinskog osiguranja uveden je za one koji bi željeli dodatno ulagati i osigurati bolje primitke u starosti te u slučaju invalidnosti ili smrti hranitelja. Ova je vrsta, za razliku od prije spomenutih, potpuno dobrovoljna, a i financijski je potpomognuta od države što daje dodatan motiv za štednju.

Dodatnu mirovinu ostvarenu uplatama u dobrovoljni mirovinski fond isplaćuje izabrano mirovinsko osiguravajuće društvo neovisno o ostvarenoj mirovini iz I. i II. mirovinskog stupa, a jedini uvjet za isplatu je navršeni 50 godina života.

Državnim poticajnim sredstvima država stimulira ulaganje u dobrovoljni mirovinski fond i to u iznosu od 15 % na uplaćeni godišnji iznos.

Dobrovoljno mirovinsko društvo ulaže sredstva članova fonda u različite vrijednosne papire te na taj način oplođuje uloge osiguranika.

2.3 Izmjene u obveznom mirovinskom osiguranju - model A, B i C

U veljači 2014. godine na snagu stupa novi Zakon o obveznim mirovinskim fondovima (NN, 19/14). Najvažnija izmjena spomenutog zakona je mogućnost odabira tri različita portfelja od

strane osiguranika koji dio plaće odvajaju u II. mirovinski stup individualne kapitalizirane štednje. Portfelji se označavaju slovima A, B i C, a razlikuju se po rizičnosti ulaganja pa samim time i po visini prinosa na ulaganje.

Portfelj A je agresivniji portfelj koji je po strukturi imovine većinom izložen hrvatskim i stranim dionicama i to maksimalno do 55 % neto imovine pojedinog mirovinskog fonda. Ovaj portfelj je najpogodniji za mlađe osobe kojima je do umirovljenja ostalo preko 30 godina pa mogu bit tolerantniji na eventualne oscilacije u kretanju prinosa.

Drugi, B portfelj, je manje rizičan od prvog. Kod ovog modela minimalno 50 % imovine fonda mora se ulagati u nisko rizične obveznice, a maksimalno 35 % imovine fonda može se ulagati u dionice.

C portfelj je najmanje rizičan. Ovaj portfelj uopće ne smije biti izložen dionicama pa je time i najpogodniji za one koji nisu skloni riziku. Za portfelj C važnija je sigurnost od ostvarivanja većih zarada.

Iako su osiguranici ti koji odlučuju koji portfelj će odabrati, sukladno odbojnosti prema riziku, ipak postoje određena pravila npr. ako je osiguraniku preostalo 10 godina do umirovljenja mora odabrati ili će automatski biti prebačen u portfelj srednjeg rizika odnosno portfelj B. Također, ako je osiguraniku ostalo 5 godina do umirovljenja automatski se prebacuje u nerizični portfelj C.

Oni mlađi koji imaju više od 10 godina do umirovljenja mogu birati između sva tri portfelja, a osiguranike koji se ne odluče sami Regos će automatski svrstati u portfelj srednje rizičnosti - portfelj B.

3. Financijska pismenost građana

Financijska pismenost važna je kako bi građani mogli donijeti ispravne financijske odluke koje će u konačnici rezultirati pozitivnim ekonomskim rezultatima. Financijska pismenost predstavlja kombinaciju informiranosti, znanja, vještina, stavova i ponašanja potrebnih za donošenje ispravnih financijskih odluka. U promicanju financijske pismenosti najveći su utjecaj imale međunarodne organizacije kao što su OECD, Svjetska banka i Europska komisija.

Nekako se ne možemo oteti dojmu da naše financijske institucije profitiraju od financijske nepismenosti velike većine građana. Kada se tome još doda i asimetrija informacija između financijskih institucija i građana, problem postaje još i izraženiji. Nužno je stoga jače promicati svijest i pismenost potrošača s ciljem boljeg razumijevanja financijskih proizvoda. O tome je studiju napravila i Svjetska banka još 2010. godine ("Hrvatska – Dijagnostički pregled zaštite potrošača i financijske pismenosti") u kojoj su zaključili da u Hrvatskoj i ne postoji adekvatna kampanja promicanja pismenosti potrošača. Zbog toga je Ministarstvo financija 2012. godine započelo pripremati strateški dokument za unaprjeđenje financijske pismenosti građana Republike Hrvatske koji je svijetlo dana ugledao tek 2014. godine pod nazivom "Nacionalni strateški okvir financijske pismenosti potrošača za razdoblje od 2015. do 2020. godine" (NN 11/15). Dokument je usvojen od strane Vlade Republike Hrvatske skupa s prijedlogom Akcijskog plana unaprjeđenja financijske pismenosti potrošača za 2015. godinu.

Razna istraživanja pokazala su da je financijska pismenost važna za sve zemlje, bez obzira na razvijenost zemlje, ali isto tako pokazala su i da financijska pismenost ne ovisi o razvijenosti zemlje, dapače, iznenađujući su bili rezultati jednog istraživanja na stanovništvu SAD-a prema kojemu spomenuti i nisu baš pokazali zavidnu financijsku pismenost.

Također je interesantna činjenica da su, prema istraživanjima, žene manje financijski pismene od muškaraca. Starija populacija zaostaje za mlađom populacijom, a izražena je i povezanost obrazovanja i visine prihoda sa financijskom pismenošću.

Istraživanje provedeno u Hrvatskoj pokazalo je da je najniža razina znanja kod građana iz manjih mjesta, mlađe dobi, nižeg obrazovanja, ženskog spola i nižeg dohotka te nezaposleni na koje bi politika financijskog opismenjivanja prvenstveno trebala biti usmjerena.

U Hrvatskoj je 2006. godine GfK - Centar za istraživanje tržišta d.o.o. proveo anketu o financijskoj pismenosti potrošača o bankovnim uslugama i poslovanju banaka općenito. Rezultati su bili poražavajući. Od 22 ponuđena proizvoda ispitanici su za čak dvije trećine njih odgovorili da su im potpuno nepoznati, odnosno poznati tek po imenu. Drugo istraživanje iste agencije u 2011. godini o ulaganjima u životna osiguranja pokazalo je da samo 15 % hrvatskih građana ulaže u taj oblik štednje.

Općenito se moglo uočiti da je štednja za starije dane tek na trećem mjestu po važnosti, iza štednje za hitne slučajeve i izvanredne okolnosti te štednje za djecu. Dakle, planiranje štednje za budućnost je na vrlo niskoj razini, a u značajnoj mjeri ovisi o informiranosti i povjerenju u pojedine oblike štednje. Stoga se može zaključiti da je potrebna promjena ponašanja pojedinaca, veća informiranost i pojačana edukacija kako bi imali primanja koja priželjkiju u budućnosti, a realno ih ne mogu očekivati samo na temelju obvezne mirovinske štednje.

Planiranje ulaganja važna je komponenta mirovinske pismenosti kao dijela financijske pismenosti. Prema OECD-u mirovinsko opismenjivanje je „proces u kojem se budući korisnici mirovina informiraju i poboljšavaju razumijevanje obveznog mirovinskog osiguranja i karakteristika mirovinskog sustava zemlje općenito da bi postali svjesni ograničenja tog sustava te razvili vještine i znanje o mogućnostima privatne štednje pomoću koje mogu povećati primjerenost mirovinskih primanja te se time osposobiti za poduzimanje učinkovitih mjera za poboljšanje svoje dobrobiti u trećoj životnoj dobi“.

S obzirom na prilike u našoj zemlji, mirovine koje se mogu ostvariti ulažući samo u obvezna mirovinska osiguranja ograničene su, čak štoviše, u većini slučajeva nedostatne za osnovne životne potrebe. Nužno je stoga podučiti osiguranike da postoje mogućnosti za dodatna primanja u starosti te na koji način do njih doći.

Važnost financijske pismenosti leži i u tome što ona smanjuje rizike individualnih pogrešnih odluka te time smanjuje i pojedinačno, ali i ukupno siromaštvo u zemlji.

Ciljevi mirovinske pismenosti nisu toliko različiti od ciljeva u drugim područjima financijske pismenosti. Kod mirovinske pismenosti naglasak je više na dugoročnom planiranju štednje kako bi se izbjeglo siromaštvo u trećoj životnoj dobi.

3.1 Mirovinske dvojbe za određeni broj osiguranika u Hrvatskoj

U Republici Hrvatskoj prije nepunih godinu dana donesena je reforma koja je zahtijevala financijsku odnosno mirovinsku pismenost o kojoj je bila riječ u prethodnom poglavlju. Naime, pred djelatne vojne osobe, policajce, pirotehničare, manji broj vatrogasaca čije se mirovine isplaćuju prema posebnim propisima stavljena je, takoreći preko noći, obveza da se odluče žele li i dalje ostati osiguranici i prvog i drugog mirovinskog stupa ili će svoja sredstva iz drugog mirovinskog stupa prebaciti u prvi mirovinski stup generacijske solidarnosti.

Tu obavijest dobilo je nešto manje od 40 000 osiguranika sa beneficiranim radnim stažem. Imali su dvije mogućnosti ili se izjasniti da ostaju ili se oglašiti na poziv što bi značilo da pristaju na reformu i prebacivanje njihovih sredstava iz drugog mirovinskog stupa u prvi.

Većina spomenutih osiguranika na poziv se oglašila. Je li to zbog neinformiranosti ili su pak racionalno sagledali situaciju i zaključili da im je to isplativije, nije poznato.

Onima koji su odlučili oglašiti se na poziv tj. prebaciti štednju u prvi mirovinski stup država će mirovine obračunavati prema posebnim propisima. S druge strane, oni koji su odlučili ostati u drugom stupu u mirovinu će prema općim propisima što bi značilo da će raditi do 65 ili 67 godine života.

Po posebnim se uvjetima u nekim situacijama s beneficiranim stažem može u mirovinu čak u 42. godini života pa se, uzimajući to u obzir, zaključilo kako individualna kapitalizirana

štednja zbog umirovljenja u ranijoj životnoj dobi ne može generirati dovoljno sredstava koji bi omogućili veće iznose mirovina te da je isplativije uplaćena sredstva prebaciti u prvi mirovinski stup generacijske solidarnosti.

Je li uistinu tome tako te što bi bilo isplativije za osiguranike obraditi će se u sljedećem poglavlju kroz projekciju budućih prihoda od mirovina ako je osoba bila osiguranik samo prvog mirovinskog stupa te, ako je uz prvi uplaćivala i kapitaliziranu individualnu štednju, tj. drugi mirovinski stup.

4. Projekcija budućih mirovinskih prihoda na primjeru hipotetskog osiguranika I i II stupa obveznog mirovinskog osiguranja koji mirovinu ostvaruje po povoljnijim uvjetima

Na sjednici Vlade RH održanoj 26. kolovoza 2015. godine, pred djelatne vojne osobe, policijske službenike i ovlaštene službene osobe mlađe od 40 godina koji prema Zakonu o pravima iz mirovinskog osiguranja djelatnih vojnih osoba, policijskih službenika i ovlaštenih službenih osoba (NN 128/99, 129/00 – Zakon o policiji 16/01, 22/02, 41/08, 97/12 i 118/12) mirovinu ostvaruje pod povoljnijim uvjetima odnosno ostvaruje staž osiguranja s povećanim trajanjem, stavljena je mogućnost odabira; u roku od 15 dana trebali su donijeti odluku o ostanku u drugom mirovinskom stupu ili izlasku iz njega.

U ovom poglavlju će se na hipotetskom primjeru izračuna mirovine osiguranika obveznog mirovinskog osiguranja pokušati dati odgovor na pitanje da li će uredba Vlade RH o izmjenama i dopunama Zakona o obveznim mirovinskim fondovima (NN 93/15) imati utjecaja na visinu mirovine i koliki bi taj utjecaj trebao biti.

Prvotno će se dati uvod u sam način (formulu) izračuna mirovine, a onda će se u drugom dijelu poglavlja izraditi projekcija mirovinskih prihoda za dva slučaja osiguranika; prvi za slučaj ostajanja u II. stupu (u tom slučaju osiguranik ostvaruje mirovinu iz oba stupa mirovinskog osiguranja) i drugi u slučaju izlaska iz II. stupa, odnosno prebacivanja sredstava u I. stup (u tom slučaju osiguranik ostvaruje mirovinu samo iz prvog stupa mirovinskog osiguranja)

4.1 Izračun mirovine¹

Svota mirovine računa se tako da se osobni bodovi pomnože s mirovinskim faktorom i aktualnom vrijednošću mirovine. U svotu mirovine uračunava se, odnosno sastavni je dio mirovine, dodatak na mirovinu, određen na način i pod uvjetima propisanim Zakonom o dodatku na mirovine ostvarene prema Zakonu o mirovinskom osiguranju (NN 19/07 i 114/11), koji iznosi 27,0 %.

Osobni bodovi ovise o mirovinskom stažu i plaćama koje je osiguranik ostvario za vrijeme radnog vijeka, a izračunavaju se tako da se prosječni vrijednosni bodovi² pomnože s ukupnim mirovinskim stažem i polaznim faktorom i jednako se računaju za sve vrste mirovina.

Mirovinski staž je skupni naziv za razdoblja provedena u obveznom mirovinskom osiguranju i produženom osiguranju (staž osiguranja) i razdoblja provedenih izvan osiguranja koja se pod određenim uvjetima priznaju u mirovinski staž (posebni staž)³.

¹ Prikaz izračuna mirovine se odnosi na izračun tzv. osnovne mirovine koja predstavlja novčano primanje iz mirovinskog osiguranja koje pod određenim uvjetima stječu osiguranici koji su od 1. siječnja 2002. osigurani i u obveznom mirovinskom osiguranju na temelju individualne kapitalizirane štednje.

² Prema članku 81. Zakona o mirovinskom osiguranju vrijednosni bodovi utvrđuju se na temelju plaća i osnovica osiguranja ostvarenih od 1. siječnja 1970., tako da se plaća, odnosno osnovica osiguranja utvrđena za svaku kalendarsku godinu podijeli s prosječnom godišnjom plaćom svih zaposlenih u Republici Hrvatskoj za istu kalendarsku godinu. Plaće ili osnovice koje su u bruto svoti dijele se s prosječnom bruto plaćom, a ako su u neto svoti s prosječnom neto plaćom. Prosječni vrijednosni bodovi utvrđuju se tako da se zbroj vrijednosnih bodova podijeli s razdoblje za koji su obračunati

³ Zakon o mirovinskom osiguranju (NN 157/13, 151/14, 33/15 i 93/15), članak 8

Polazni faktor ovisi o dobi osiguranika na dan stjecanja prava na mirovinu. Polazni faktor određuje u kojem se opsegu uzimaju vrijednosni bodovi pri određivanju mirovine. Vrijednosni bodovi uzimaju se u punom opsegu (polazni faktor 1,0):

- a. za invalidsku mirovinu
- b. za privremenu invalidsku mirovinu
- c. za obiteljsku mirovinu nakon smrti osiguranika
- d. za starosnu mirovinu
- e. starosna mirovina za dugogodišnjeg osiguranika iz članka 35. Zakona⁴
- f. za prijevremenu starosnu mirovinu iz članka 36. Zakona

Polazni faktor za određivanje starosne mirovine osiguranika, koji prvi put stječe mirovinu nakon navršene 65. godine života i ima 35 godina mirovinskog staža, utvrđuje se tako da se polazni faktor iz stavka 1. članka 85. Zakona o mirovinskom osiguranju povećava za 0,15 % po mjesecu za svaki mjesec nakon navršenih godina života osiguranika propisanih za stjecanje prava na starosnu mirovinu, a najviše za pet godina.

Mirovinskim faktorom određuje se u kojem se opsegu uzimaju osobni bodovi pri izračunu mirovine. Mirovinski faktor iznosi 1,0 za starosnu, prijevremenu starosnu i invalidsku mirovinu zbog opće nesposobnosti za rad.

Aktualna vrijednost mirovine (AVM) utvrđena je svota mirovine za jedan osobni bod.⁵

AVM koja se primjenjuje od 1. siječnja 2014. godine i 1. srpnja svake kalendarske godine određuje se tako da se AVM uskladi po stopi koja se dobije kao polovica zbroja stope promjene prosječnog indeksa potrošačkih cijena u prethodnom polugodištu i stope promjene prosječne bruto plaće svih zaposlenih u Republici Hrvatskoj u prethodnom polugodištu u odnosu na polugodište koje mu prethodi, tzv. „fiksna formula“ $50 \% : 50 \%$).

Konačna stopa usklađivanja AVM-a koja se primjenjuje od 1. siječnja svake kalendarske godine, počevši od 1. siječnja 2015., određuje se u visini razlike između stope godišnjeg rasta mirovine („rotirajuća formula“ 70:30, 50:50 ili 30:70, ovisno što je povoljnije) i stope usklađivanja mirovina utvrđene šest mjeseci prije toga dana, tj. od 1. srpnja kalendarske godine („fiksna formula“ $50 \% : 50 \%$).

AVM utvrđuje Upravno vijeće Zavoda na temelju podataka Državnog zavoda za statistiku, najkasnije tri mjeseca nakon isteka svakog polugodišta. Odluku o usklađivanju donosi Vlada Republike Hrvatske. Mirovine se usklađuju ako je realni rast bruto društvenog proizvoda prema podacima Državnog zavoda za statistiku u svakom od tri prethodna uzastopna tromjesečja najmanje 2,0 % u odnosu na isto tromjesečje prethodne kalendarske godine i ako je deficit državnog proračuna u istom razdoblju manji od 3 %.

Dodatak na mirovinu ostvaren prema Zakonu o mirovinskom osiguranju dobivaju korisnici mirovina koji su ostvarili pravo na mirovinu nakon 1. siječnja 1999., prema Zakonu o mirovinskom osiguranju, određuje se zavisno od svote mirovine i godine ostvarivanja prava na mirovinu.

Osnovicu za određivanje dodatka čini mjesečna svota mirovine koja se usklađuje svake kalendarske godine, odnosno dva puta godišnje (počevši od 1. siječnja, odnosno od 1. srpnja) prema (svakoj) novoj aktualnoj vrijednosti mirovine.

U svotu mirovine određenu prema članku 79., stavku 1. Zakona o mirovinskom osiguranju uračunava se dodatak na mirovinu određen na način i pod uvjetima propisanim Zakonom o dodatku na mirovine ostvarene prema Zakonu o mirovinskom osiguranju (NN 79/07, 114/11). Prema članku 79. stavku 2. Zakona o mirovinskom osiguranju dodatak na mirovinu određen na način i pod uvjetima propisanim Zakonom o dodatku na mirovine ostvarene prema Zakonu

⁴ Zakon o mirovinskom osiguranju (NN 157/13, 151/14, 33/15 i 93/15), članak 85

⁵ <http://mirovinsko.hr/default.aspx?id=76> [pristupljeno 25.3.2016.]

o mirovinskom osiguranju uračunava se u svotu mirovine, odnosno dodatak je sastavni dio formule za izračun mirovine.

Pravo na dodatak imaju:

- a. korisnici mirovine kojima je mirovina priznata i određena prema ZOMO-u⁶ (članak 74. do 81. i 184. ZOMO)
- b. korisnici mirovine ostvarene primjenom međunarodnih sporazuma o socijalnom osiguranju kojima je mirovina iz hrvatskoga mirovinskog osiguranja priznata i određena isključivo prema ZOMO-u
- c. redoviti članovi HAZU koji su mirovinu ostvarili nakon 26. prosinca 2002. i kojima je mirovina priznata i određena prema ZOMO-u i ako iznosi manje od najviše mirovine.

Pravo na dodatak nemaju⁷:

- a. korisnici osnovne mirovine
- b. korisnici obiteljske mirovine, određene nakon 1. siječnja 1999. od mirovine ostvarene prema propisima o mirovinskom i invalidskom osiguranju koji su važili do 31. prosinca 1998.
- c. korisnici najviše mirovine
- d. korisnici najniže mirovine
- e. korisnici mirovina ostvarenih i/ili određenih na temelju posebnih propisa pod povoljnijim uvjetima od uvjeta određenih prema ZOMO-u.

4.2 Praktični primjer izračuna mirovine ostvarene na temelju posebnih propisa pod povoljnijim uvjetima na hipotetskom slučaju osiguranika I. i II. stupa obveznog mirovinskog osiguranja

U ovom poglavlju će se na praktičnom primjeru hipotetskog osiguranika I. i II. stupa obveznog mirovinskog osiguranja, uz uzimanje određenih pretpostavki, projicirati mirovinski prihodi koje bi osiguranik ostvarivao ukoliko bi zadržao status osiguranika II. stupa obveznog mirovinskog osiguranja, odnosno ukoliko bi odlučio ostati osiguranik samo u I. stupu mirovinskog osiguranja.

Osiguranik koji ostvaruje mirovinu po povoljnijim uvjetima prema Zakonu o pravima iz mirovinskog osiguranja djelatnih vojnih osoba, policijskih službenika i ovlaštenih službenih osoba na temelju rješenja nadležnog ministra, odnosno čelnika tijela sigurnosno-obavještajnog sustava o prestanku službe zbog potreba službe osiguranik može ostvariti pravo na starosnu mirovinu, bez obzira na godine života, kada navrši mirovinski staž od najmanje 30 godina, od toga najmanje 15 godina mirovinskog staža na dužnostima, odnosno na poslovima na kojima se staž osiguranja računa s povećanim trajanjem.

Hipotetski osiguranik I. i II. stupa mirovinskog osiguranja ima prijavljeno prebivalište u Splitu (prirez 10 %), mjesečnu bruto plaću u iznosu 7 500 kuna te prema zakonu ostvaruje pravo na mirovinu po povoljnijim uvjetima. Pravo na starosnu mirovinu ostvaruje navršavanjem 30 godina mirovinskog staža, odnosno 2030. godine (za potrebe izračuna uzeta je 2000. godina kao godina u kojoj se zaposlio i postao osiguranik obveznog mirovinskog osiguranja temeljenog na međugeneracijskoj solidarnosti). 1. 1. 2002. godine također postaje osiguranikom novouvedenog II. stupa mirovinskog osiguranja temeljenog na individualnoj kapitaliziranoj štednji.

Mirovina iz I. stupa koju će osiguranik ostvarivati po zakonu se sastoji iz dva dijela: za staž ostvaren do početka osiguranja u II. stupu (1. 1. 2002.) dio mirovine osiguranicima se određuje jednako kao i osiguranicima osiguranim samo u I. stupu. Za staž ostvaren nakon početka osiguranja u II. stupu određuje se po istoj formuli kao i osnovna mirovina, pri čemu

⁶ Zakon o mirovinskom osiguranju

⁷ Zakon o dodatku na mirovine ostvarene prema Zakonu o mirovinskom osiguranju (NN 79/07, 114/11), članak 3

se uz prije navedene varijable u izračunu uključuje i faktor osnovne mirovine⁸ koji iznosi 0,75.

Mirovina iz drugog stupa projicirana je temeljem mjesečnih uplata osiguranika, uzimajući u obzir i prosječni zadani prinos, počevši od 1. 1. 2002. do kraja 2029. godine, pri čemu se ta sredstva odlaskom u mirovinu osiguranika isplaćuju dinamikom koju on sam odredi.

U donjoj tablici 1 nalaze se projicirane vremenske serije godišnje bruto plaće osiguranika, prosječne godišnje bruto plaće svih zaposlenih u RH te temeljem njih izračunati vrijednosni i prosječni vrijednosni bodovi. Vrijednosti ostalih varijabli potrebnih za izračun mirovine sljedeći su:

- a. Mirovinski staž iznosi 30 godina
- b. Polazni faktor je 1
- c. Mirovinski faktor je 1
- d. Aktualna vrijednost mirovine (AVM) iz izračuna je zadnja određena na datum 1. srpnja 2015. i iznosi 61,10 kuna. Istu je vrlo teško vjerodostojno projicirati kroz nadolazeće godine uslijed složenosti njenog izračuna (veliki broj međuovisnih varijabli) i značajnog utjecaja politike (Vlade) prilikom njenog određivanja.

Tablica 1 Izračun vrijednosnih bodova i prosječnih vrijednosnih bodova

Godina	Bruto plaća	Prosjek bruto plaća u državi	Vrijednosni bodovi	Ulaganja u 2. mirovinski stup
2000	66471,2192	58428	1,137660355	
2001	67827,7747	60732	1,116837495	
2002	69212,015	64392	1,074854253	3460,60
2003	70624,5051	67476	1,046661111	3531,23
2004	72065,8216	71820	1,003422745	3603,29
2005	73536,5526	74976	0,980801225	3676,83
2006	75037,2986	79608	0,942584898	3751,86
2007	76568,672	84546	0,905645117	3828,43
2008	78131,298	90528	0,863062235	3906,56
2009	79725,8143	92532	0,861602627	3986,29
2010	81352,8717	92148	0,882850108	4067,64
2011	83013,1344	93552	0,887347512	4150,66
2012	84707,28	94500	0,896373333	4235,36
2013	86436	95268	0,90729311	4321,80
2014	88200	95436	0,924179555	4410,00
2015	90000	96000	0,9375	4500,00
2016	91800,00	99840,00	0,919471154	4725,00
2017	93636,00	103833,60	0,901789016	4961,25
2018	95508,72	107986,94	0,88444692	5209,31
2019	97418,89	112306,42	0,867438325	5469,78
2020	99367,27	116798,68	0,850756819	5743,27
2021	101354,62	121470,63	0,834396111	6030,43
2022	103381,71	126329,45	0,818350032	6331,95
2023	105449,34	131382,63	0,802612531	6648,55
2024	107558,33	136637,93	0,787177675	6980,98
2025	109709,50	142103,45	0,772039643	7330,03
2026	111903,69	147787,59	0,757192726	7696,53
2027	114141,76	153699,09	0,742631328	8081,35
2028	116424,60	159847,06	0,728349956	8485,42

⁸ Zakon o mirovinskom osiguranju (NN 157/13, 151/14, 33/15 i 93/15), članak 93

2029	118753,09	166240,94	0,714343226	8909,69
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Vremenski niz godišnjih bruto plaća osiguranika dobiven je određivanjem vrijednosti za 2015. godinu koja je uzeta kao referenta vrijednost pri čemu su protekle i nadolazeće godine iz vremenskog niza određene verižno umanjivanjem odnosno povećanjem za 2 posto. Na isti način dobiven je i vremenski niz prosjeka bruto plaća u državi pri čemu su vrijednosti 2000. – 2014. godine preuzete sa stranica HZMO-a, dok su vrijednosti 2016. – 2029. dobivene verižno povećanjem za 4 posto. Procijenjeni godišnji prinos na sredstva u drugom mirovinskom stupu iznosi 5 %. Prosječni vrijednosni bodovi iznose 0,891655705 (zbroy svih vrijednosnih bodova po godinama podijeljen s ukupnim brojem razdoblja za koji se računaju. Završno će se prikazati izračun mirovine iz I. stupa za staž ostvaren prije osnivanja II. stupa, odnosno za staž ostvaren nakon početka osiguranja u II. stupu, prema novom Zakonu o mirovinskom osiguranju od 1. 1. 2014.

Izračun se vrši korištenjem formule za osnovnu mirovinu, ali bez korištenja prava na dodatak na mirovinu od 27 posto na što imaginarni osiguranik po zakonu nema pravo.

$$M = \underbrace{PVB * MS * PF}_{OB} * MF * AVM \quad (1)$$

Uvrštavanjem vrijednosti u gornju formulu dobivamo iznos mirovine iz I. stupa za staž ostvaren prije osnivanja II. stupa u iznosu 1634,404907 kuna.

Za staž ostvaren nakon početka osiguranja u II. stupu, prema novom ZOMO-u od 1. 1. 2014., također se koristi gornja formula pri čemu se, uz navedene varijable, u nju još mora uključiti i faktor osnovne mirovine od 0,75. Uvrštavanjem vrijednosti u gornju formulu dobivamo iznos mirovine iz I. stupa za staž ostvaren nakon osnivanja II. stupa u iznosu 1225,80368 kuna.

Zbrajanjem ovih dvaju izračunatih iznosa dobivamo ukupni iznos od 2860,208587 kuna, što odgovara iznosu imovine iz I. stupa mirovinskog osiguranja. Ukoliko još njoj pridodamo i kapitalizirana sredstva na individualnim računima koja su mjesečno uplaćivana i ostvarivala prinos od 5 posto godišnje evidentno je da bi ukupni mirovinski prihodi bili veći ukoliko bi osiguranik ostao u II. stupu.

5. Zaključak

Ovim radom stavljen je naglasak na važnost financijskog opismenjavanja fizičkih osoba kao temeljne pretpostavke u upravljanju osobnim financijama. Imajući u vidu trenutni problem održivosti postojećeg mirovinskog sustava temeljenog na međugeneracijskoj solidarnosti i individualnoj kapitaliziranoj štednji, više no ikad javlja se potreba da pojedinci (osiguranici) samostalno počnu donositi financijske odluke temeljene na informiranosti i financijskim ciljevima koje žele ostvariti. Jedan takav primjer obrađuje i ovaj rad, pri čemu su analizirana dva slučaja; u jednom slučaju osiguranik odabire ostanak samo u prvom stupu mirovinskog osiguranja, dok u drugom slučaju osiguranik zadržava status u drugom mirovinskom stupu, preuzimajući time dijelom i odgovornost za vlastite buduće mirovinske prihode.

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Zakon o dodatku na mirovine ostvarene prema Zakonu o mirovinskom osiguranju (NN 19/07 i 114/11)

Zakon o mirovinskom osiguranju (NN 157/13, 151/14, 33/15 i 93/15)

Zakon o obveznim mirovinskim fondovima (NN 19/14, 93/15), preuzeto 18. veljače 2016. sa: www.zakon.hr/z/708/Zakon-o-obveznim-mirovinskim-fondovima

Zakon o pravima iz mirovinskog osiguranja djelatnih vojnih osoba, policijskih službenika i ovlaštenih službenih osoba (NN 128/99, 129/00 – Zakon o policiji 16/01, 22/02, 41/08, 97/12 i 118/12)

<http://mirovinsko.hr/default.aspx?id=76> [pristupljeno 25.3.2016.]

Pension concerns and financial literacy

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Abstract. Although the first pension reform in Croatia was introduced more than a decade ago, more precisely in 2002, even today the majority of payers of pension contributions do not know what they can expect in the future from their pension. Financial literacy of Croatian citizens, after the results of many investigations, is not at an acceptable level. There are a number of programs that attempt to correct the current situation, but it is a process that requires a lot of time. Meanwhile citizens take management decisions that will determine their financial future.

Regulation on Amendments to the Law on Mandatory Pension Funds (Official Gazette, 93/15) adopted, at the session of the Croatian Government on 26 August 2015, before active military personnel, police officers and authorized officials under 40 years old, placed choice. Within 15 days they had to make a decision about remaining in the second pillar or getting out of it. In this paper, in a practical way, a projection of future retirement income for both selections will be displayed.

Keywords: *pension funds, pensions, financial literacy*

Prednosti i nedostaci novog Zakona o računovodstvu s osvrtom na male kompanije

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Sažetak. Sve zemlje članice Europske unije imale su obvezu uključivanja Direktive 2013/34/EU u svoje postojeće računovodstvene sustave najkasnije do 20. srpnja 2015. Navedena obveza rezultirala je donošenjem novog Zakona o računovodstvu 3. srpnja 2015. (NN 78/15). Direktivom 2013/34/EU se nastoji uskladiti financijsko izvještavanje kompanija s novonastalim tržišnim uvjetima te osigurati transparentnost i usklađenost na cijelom području Europske unije. Direktiva 2013/34/EU prvenstveno je usmjerena na olakšanje poslovanja malim trgovačkim kompanijama kroz smanjenje administrativnog opterećenja. Polazeći od činjenice da upravo male trgovačke kompanije snose najveći teret trenutnih tržišnih uvjeta te da iste predstavljaju zamašnjak gospodarstva, ovim radom će se komparirati nastale promjene zakonodavnog računovodstvenog okvira vezane upravo uz male trgovačke kompanije. Stoga će se u okviru ovog rada ukazati na prednosti i nedostatke proizašle iz novog Zakona o računovodstvu koje se odnose na male trgovačke kompanije.

Ključne riječi: *Zakon o računovodstvu, male trgovačke kompanije, prednosti, nedostaci*

1. Uvod

Direktiva 2013/34/EC Europskog parlamenta i Vijeća donesena 26. lipnja 2013. o godišnjim financijskim izvještajima, konsolidiranim financijskim izvještajima i srodnim izvještajima za određena društva mijenja dosadašnju Direktivu 78/660/EC (tzv. Četvrta direktiva) i Direktivu 83/349/EEC (tzv. Sedma direktiva). Direktivu 2013/34/EC sve zemlje članice Europske Unije imale su obvezu uvrstiti u svoje računovodstvene sustave (Cirkveni Filipović, 2015). Navedenom direktivom projiciran je cijeli niz promjena kojima se ističe prvotna namjera iste, a to je olakšanje poslovanja malim kompanijama kroz smanjenje administrativnih opterećenja. Stoga će se ovim radom ukazati na nastale promjene u računovodstveno-zakonodavnom okviru kao i utjecaj tih promjena na male kompanije.

2. Zakon o računovodstvu

Direktiva 2013/34/EC propisuje cijeli niz promjena koje sve zemlje članice Europske unije moraju implementirati u svoje nacionalne računovodstvene sustave. Sukladno Direktivi

2013/34/EC donesen je novi Zakon o računovodstvu (NN 78/15) koji je stupio na snagu 1. siječnja 2016. Navedeni zakon je donesen s ciljem usklađenja i harmonizacije hrvatskog računovodstveno-zakonodavnog okvira sa zakonodavnim okvirom Europske unije propisanim Direktivom 2013/34/EC. Značajnije novine proizašle stupanjem na snagu novog zakona mogu se sistematizirati kroz sljedeće:

- kategorizacija poduzetnika
- licenciranje računovođa
- knjigovodstvene isprave
- jedinstveni kontni plan
- rokovi čuvanja računovodstveno financijske dokumentacije
- sastavljanje temeljnih financijskih izvještaja.

Novim zakonom se čl.5. propisuje nova kategorija poduzetnika, tj. mikro poduzetnici te se propisuju i nove vrijednosti za kategoriziranje poduzetnika. Navedeno se može prikazati sljedećom tablicom:

Tablica 1 Kategorizacija poduzetnika prema novom Zakonu o računovodstvu (Cirkveni Filipović, 2015)

Opis	MIKRO PODUZETNICI (ako ne prelaze dva od tri kriterija)	MALI PODUZETNICI (ako ne prelaze dva od tri kriterija)	SREDNJI PODUZETNICI (ako ne prelaze dva od tri kriterija)	VELIKI PODUZETNICI (ako prelaze dva od tri kriterija)
Ukupna aktiva	2.600.000,00 kn	30.000.000,00 kn	150.000.000,00 kn	150.000.000,00 kn
Prihod	5.200.000,00 kn	60.000.000,00 kn	300.000.000,00 kn	300.000.000,00 kn
Prosječan broj zaposlenih	10	50	250	250

Pored kategorizacije navedene tablicom velikim poduzetnicima se smatraju i banke, štedne banke, stambene štedionice, institucije za elektronički novac, društva za osiguranje, društva za reosiguranje, leasing-društva, društva za upravljanje UCITS fondovima, društva za upravljanje alternativnim investicijskim fondovima, UCITS fondovi - otvoreni investicijski fondovi s javnom ponudom, alternativni investicijski fondovi, mirovinska društva koja upravljaju obveznim mirovinskim fondovima, mirovinska društva koja upravljaju dobrovoljnim mirovinskim fondovima, dobrovoljni mirovinski fondovi, obvezni mirovinski fondovi te mirovinska osiguravajuća društva, društva za dokup mirovine, faktoring-društva, investicijska društva, burze, operatori multilateralne trgovinske platforme (MTP-a), središnja klirinška depozitarna društva, operatori središnjeg registra, operatori sustava poravnanja i/ili namire i operatori Fonda za zaštitu ulagatelja (Cirkveni Filipović, 2015).

Novim zakonom propisuje se licenciranje osoba koja obavljaju računovodstvenu djelatnost, odnosno čl.7. st.4. novog zakona propisuje da ukoliko poduzetnik povjeri obavljanje računovodstvenih poslova drugim pravnim ili fizičkim osobama iste moraju biti licencirane za obavljanje tih poslova. Ova odredba bi trebala stupiti na snagu 1. siječnja 2018.

Novim zakonom se čl.9. propisuje obvezna forma knjigovodstvene isprave, koja je promijenjena temeljem Uredbe o izmjeni i dopuni novog zakona (NN 134/15), odnosno uredbom je iz novog zakona isključena obveza potpisa knjigovodstvene isprave i obveza prikazivanja konta na kojem će knjigovodstvena isprava biti proknjižena. Sukladno navedenom knjigovodstvena isprava treba sadržavati:

1. naziv i broj knjigovodstvene isprave
2. opis sadržaja poslovnog događaja i identifikaciju sudionika poslovnog događaja koja sadržava njihov naziv ili ime i prezime te sjedište ili adresu
3. novčani iznos ili cijenu po mjernoj jedinici s obračunom ukupne svote
4. datum poslovnog događaja ako nije isti kao datum izdavanja
5. datum izdavanja knjigovodstvene isprave

Novim zakonom, čl.11., propisuje se obveza primjene jedinstvenog kontnog plana kojega će formirati Odbor za standarde financijskog izvještavanja. Navedena obveza je temeljem Uredbe o izmjenama i dopunama novog Zakona o računovodstvu prolongirana za 1. siječnja 2017., a Odbor za standarde financijskog izvještavanja je obavezan objaviti jedinstveni kontni plan do 30. lipnja 2016.

Novim zakonom se čl.10. i čl.14. propisuju rokovi čuvanja knjigovodstvenih isprava i poslovnih knjiga i to:

- isplatne liste, analitička evidencija o plaćama za koje se plaćaju obvezni doprinosi – trajno
- isprave na temelju kojih su podaci uneseni u dnevnik i glavnu knjigu – najmanje 11 godina
- isprave na temelju kojih su podaci uneseni u pomoćne knjige – najmanje 11 godina

Nadalje, novim zakonom, čl.14., propisuje se obvezno čuvanje dnevnika, glavne knjige i pomoćnih knjiga u trajanju od najmanje 11 godina te se iste trebaju zaključiti najkasnije 4 mjeseca nakon završetka poslovne godine. Također se novim zakonom dopušta da se knjigovodstvene isprave i poslovne knjige mogu čuvati i van granica Republike Hrvatske, ali unutar Europske unije.

Novi zakonom se čl.19. propisuje da mali i mikro poduzetnici imaju obvezu sastavljanja bilance, računa dobiti i gubitka te bilješki uz financijske izvještaje, dok su srednji poduzetnici pored navedenih izvještaja obvezni sastavljati izvještaj o novčanim tijekovima i izvještaj o promjenama kapitala, a veliki su poduzetnici pored navedenih obvezni sastavljati i izvještaj o ostalom sveobuhvatnom dobitku.

Pored nabrojanih novina proizašlih iz novog računovodstveno-zakonskog uređenja postoji još promijenjenih stavki koje nisu u direktnom odnosu s malim kompanijama stoga su i izostavljene iz obrade.

3. Promjene Zakona o računovodstvu s osvrtom na male kompanije

Fokus na male kompanije proizlazi iz njihove uloge u gospodarstvu Republike Hrvatske. Svoju ulogu male kompanije opravdavaju prije svega kroz brojnost koja se može prikazati sljedećom tablicom:

Tablica 2 Struktura kompanija s obzirom na veličinu u 2011., 2012. i 2013. godini (Alpeza & Singer, 2015)

	2011.		2012.		2013.	
	Broj kompanija	%	Broj kompanija	%	Broj kompanija	%
Male kompanije	89.539	98,2	95.597	98,3	99.537	98,3
Srednje kompanije	1.292	1,4	1.309	1,3	1.268	1,3
Velike kompanije	359	0,4	348	0,4	350	0,4
Ukupno	91.190	100	97.254	100	101.191	100

Temeljem navedene tablice može se uočiti brojčana nadmoć malih kompanija koja se kroz promatrane godine potvrđuje kroz udjele od čak 98,2 %, 98,3 % i 98,3 % u ukupnom broju kompanija, što opravdava fokus ovoga rada na upravo male kompanije. Gospodarska kriza te trenutna tržišna kretanja uvelike su otežali uvjete poslovanja koji se reflektiraju kroz nesolventnost, netransparentnost, stečaje i zatvaranje poslovnih subjekata. Stoga se nastoje pronaći načini kojim bi se omogućilo pojednostavljenje poslovanje svim tržišnim subjektima. Jedan od prijedloga je i Direktiva 2013/34/EC koja je prvenstveno orijentirana na smanjenje opterećenja malim kompanijama za koje se ističe da predstavljaju generatore gospodarskog oporavka i razvoja. Shodno navedenoj Direktivi donesen je Zakon o računovodstvu (NN 78/15, 2015) iz kojeg je proizašla Uredba o izmjenama i dopunama novog Zakona o računovodstvu (NN 134/15, 2015). U nastavku će se analizirati eventualni utjecaj prethodno navedenih novina novoga Zakona o računovodstvu.

Kao najznačajnija novina ističe se uvođenje nove kategorije poduzetnika, odnosno mali poduzetnici se dijele na dodatnu kategoriju mikro poduzetnika za koje bi se Zakonom trebao osigurati jednostavniji postupak financijskog izvještavanja. Međutim, novi Zakon ne samo da ne osigurava jednostavniji oblik financijskog izvještavanja već propisuje obvezu sastavljanja bilance, računa dobiti i gubitka i bilješki uz financijske izvještaje u punom opsegu što predstavlja dodatno opterećenje u odnosu na stari Zakon koji je propisivao skraćeni oblik navedenih izvještaja za male kompanije. Samim time može se zaključiti da podjela malih kompanija na mikro i male kompanije ne stvara nikakve prednosti, već dapače, uslijed obveze sastavljanja financijskih izvještaja u punom opsegu predstavlja dodatno opterećenje za iste.

Nadalje, s ciljem adekvatnijeg vrednovanja računovodstvene djelatnosti novim Zakonom se predviđa licenciranje računovodstvene profesije koje bi trebalo stupiti na snagu počevši od 1.siječnja 2018. Ujedno se očekuje poseban Zakon ili Pravilnik kojim bi se propisali uvjeti licenciranja. Licenciranje je predviđeno samo za osobe koje pružaju računovodstvene usluge, ali ne i za osobe koje obavljaju računovodstvene poslove kod svojih poslodavaca, tek ostaje za vidjeti hoće li se postići prava svrha uvođenja ove odredbe (Omašić, 2015). S obzirom da je prema informacijama Financijske agencije u Republici Hrvatskoj približno oko 7.000 zaposlenih u 2.752 računovodstveno knjigovodstvena servisa nužno je žurnije i detaljnije pristupiti navedenom, te uključiti što više stvarnih aktera računovodstveno knjigovodstvenih poslova u formiranje što kvalitetnijeg okvira licenciranja računovodstvene profesije. Shodno

prethodno navedenom ova mjera bi trebala doprinijeti poboljšanju statusa računovodstvene profesije, ali ostaje za vidjeti što i kako će biti.

Glede zakonske novine vezane uz obveznu formu knjigovodstvene isprave može se zaključiti da se ovime želi povećati transparentnost poslovanja te efikasnost internih kontrola poslovnih subjekata. Navedeno bi trebalo omogućiti poslovnim subjektima precizniji i sigurniji uvid u vlastito poslovanje temeljem kojega projiciraju vlastite snage i vlastite slabosti, čime bi se osiguralo donošenje kvalitetnijih poslovnih odluka. Upravo su male kompanije te koje ne mogu priuštiti luksuz pogrešne poslovne odluke, stoga ova novina predstavlja pozitivan pomak u odnosu na stari Zakon.

Zakonska novina uvođenja jedinstvenog kontnog plana s ciljem transparentnijih poslovnih knjiga naišla je na otpor među poslovnim subjektima, prije svega zbog kratkog roka i visokog troška implementiranja istoga. Polazište Direktive 2013/34/EC je smanjenje administrativnih opterećenja što je u suprotnosti s iznesenim. Ujedno dok većina članica Europske unije nije zakonski definirala kontni plan i dopušta slobodu u korištenju kontnog plana postavlja se pitanje svrsishodnosti istoga. Kao što je i ukazano uvođenje jedinstvenog kontnog plana vodi suprotno od smjernica Direktive 2013/34/EC te povećava opterećenja na sve kompanije, a poglavito na male kompanije.

Zakonske novine vezane uz produljenje rokova čuvanja računovodstveno financijske dokumentacije doprinijeli su usklađenju s Općim poreznim Zakonom. Ujedno se poslovne knjige trebaju zaključiti najkasnije 4 mjeseca po završetku poslovne godine što doprinosi usklađenju s rokom za javnu objavu, rokom za predaju financijskih izvještaja za statističke potrebe te rokom za prijavu poreza na dobit. Sve navedeno osigurava usklađenost poslovanja i lakše praćenje potrebitih aktivnosti vezanih uz pripremu konačnih rezultata poslovanja. Usklađenost poslovnih aktivnosti doprinosi lakšem poslovanju malim kompanijama čiji su predstavnici često nedovoljno informirani i upadaju u određene administrativne probleme uslijed neispunjavanja potrebitih obveza.

4. Zaključak

Polazeći od činjenice da se novim Zakonom o računovodstvu trebalo isključiti ono što je godinama predstavljalo problem u poslovanju kompanija te doprinijeti stabilizaciji poslovanja kroz smanjenje administrativnih opterećenja postavlja se pitanje "računovodstvena bit ili računovodstvena forma". Naime, čitajući novi Zakon o računovodstvu i komparirajući proizašle zakonske novine u odnosu na stari Zakon o računovodstvu ne može se zaključiti da je došlo do smanjenja administrativnog opterećenja za male kompanije te se postavlja pitanje čemu kategorizacija mikro poduzetnika kada snose iste računovodstvene obveze kao i male kompanije. Također, nekim zakonskim novinama, odnosno obvezom sastavljanja financijskih izvještaja u punom opsegu za male kompanije te uvođenjem jedinstvenog kontnog plana doprinijelo se povećanju administrativnog opterećenja na male kompanije. Stoga se može projicirati zaključak da su napravljene promjene više kozmetičke prirode nego li stručne.

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The advantages and disadvantages of the new accounting law with an emphasis on small companies

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Abstract. All the European Union member states were obliged to include Directive 2013/34/EC in their existing accounting systems by 20th July 2015. The obligation resulted in the adoption of a new accounting law on 3rd July 2015 (NN 78/15). Directive 2013/34/EC seeks to harmonize the financial reporting of companies with the new market conditions and to ensure transparency and compatibility in the whole European Union. Directive 2013/34/EC is primarily focused on simplifying the work of small trading companies via a decrease in administrative burdens. Starting from the fact that small trading companies bear the biggest burden of the current market conditions and that they represent the driving force of economy, this paper will compare the resulting changes of accounting law precisely with relation to small trading companies. Therefore, the paper will point to the advantages and disadvantages resulting from the new accounting law relating to small trading companies.

Key words: *accounting law, small trading companies, advantages, disadvantages*

Financiranje ESCO modelom – primjer tvrtke Galeb d.d.

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Sažetak. Energetska učinkovitost okosnica je jedinstvene energetske politike Europske unije i jedan je od pet glavnih ciljeva strategije Europa 2020 - smanjenje potrošnje energije za 20 % do 2020. godine. Povećanje energetske učinkovitosti djelotvoran je način postizanja ciljeva održivog razvoja budući da energetska učinkovitost izravno pridonosi smanjenju emisija štetnih plinova u okoliš, jačanju konkurentnosti industrije, otvaranju novih radnih mjesta i povećanju sigurnosti opskrbe energijom. U kontekstu Kohezijske politike EU-a, Republici Hrvatskoj dostupna su značajna sredstva financijske potpore za provedbu projekata energetske učinkovitosti iz EU fondova u različitim sektorima kroz programe za financiranje i sufinanciranje hrvatskog Fonda za zaštitu okoliša i energetske učinkovitost (FZOEU). Jasan i mjerljiv utjecaj smanjenja potrošnje energije na konkurentnost poslovanja, uz dodatnu mogućnost subvencije projekata energetske učinkovitosti iz javnih izvora, rezultirali su pojavom inovativnog modela financiranja projekata ove vrste na domaćem tržištu. ESCO (*Energy Service Company*) predstavlja generičko ime koncepta na tržištu usluga iz područja energetike. ESCO model obuhvaća razvoj, izvedbu i financiranje projekata energetske učinkovitosti s ciljem smanjenja troškova za energiju i održavanje ugradnjom energetski učinkovitije opreme i optimiziranjem energetskih sustava pri čemu se osigurava otplata investicije kroz ostvarene uštede u određenom razdoblju. U ovom radu prezentiran je projekt ulaganja u energetski učinkovitu rasvjetu i kompresorsko postrojenje u proizvodnom pogonu tekstilne tvrtke Galeb d.d. odnosno sveobuhvatne aktivnosti pripreme, prijave, ugovaranja, provedbe i izvještavanja na projektu koji je financiran ESCO modelom ugovaranja energetske usluge i subvencijom FZOEU-a kroz program potpora male vrijednosti (*de minimis* potpore) te su prezentirani međusobni odnosi svih uključenih strana u projektu.

Ključne riječi: *ESCO model, energetska usluga, subvencije ulaganjima u mjere energetske učinkovitosti.*

1. Uvod

U Republici Hrvatskoj Zakon o energetske učinkovitosti (NN 127/14) uređuje područje učinkovitog korištenja energije, donošenje planova na lokalnoj, područnoj (regionalnoj) i nacionalnoj razini za poboljšanje energetske učinkovitosti te njihovo provođenje, mjere energetske učinkovitosti, obveze energetske učinkovitosti, obveze regulatornog tijela za energetiku, operatora prijenosnog sustava, operatora distribucijskog sustava i operatora tržišta energije u svezi s prijenosom, odnosno transportom i distribucijom energije, obveze

distributera energije, opskrbljivača energije i/ili vode, a posebice djelatnost energetske usluge, utvrđivanje ušteda energije te prava potrošača u primjeni mjera energetske učinkovitosti.

Ovim se Zakonom u zakonodavstvo Republike Hrvatske prenosi Direktiva 2012/27/EU Europskog parlamenta i Vijeća od 25. listopada 2012. o energetske učinkovitosti kojom se dopunjuju direktive 2009/125/EZ i 2010/30/EU i ukidaju direktive 2004/8/EZ i 2006/32/EZ (SL L 315, 14. 11. 2012.). Na odnose koji nisu uređeni ovim Zakonom supsidijarno se primjenjuje niz propisa kojima se uređuje područje energetske učinkovitosti. Svrha je ovoga Zakona ostvarivanje ciljeva održivog energetskog razvoja, a u skladu sa zaključcima Direktive 2012/27 koji ističu izazove ovisnosti Unije o uvozu energije i oskudnim izvorima energije kao i potrebom za ograničavanjem klimatskih promjena i prevladavanjem gospodarske krize. Cilj povećanja energetske učinkovitosti potvrđen je kao jedan od krovnih ciljeva nove strategije Unije za radna mjesta, održiv i uključiv rast. Ostvarenje zajedničkog cilja povećanja energetske učinkovitosti za 20 % poželjno je ostvariti provođenjem različitih politika i mjera za povećanje energetske učinkovitosti te utvrđivanjem pojedinačnih nacionalnih ciljeva, sustava i programa koji obuhvaćaju cjelokupni energetski lanac.

Ulaganja u energetske učinkovitost s neupitnim potencijalom za uštedu električne energije te jasnim ciljem smanjenja krajnje potrošnje dodatna su prilika za rast i zapošljavanje u obrtnom i građevinskom sektoru, u proizvodnji i profesionalnim djelatnostima kao što su konzultantske usluge, arhitektura i inženjerstvo. Nadalje, poticanje ulaganja u energetske učinkovitost može riješiti pitanje troškovno učinkovitih velikih radova, a u pravilu duži period povrata investicije u obnovljive izvore energije svesti na prihvatljiv rok. Upravo je pitanje financiranja projekata energetske učinkovitosti dovelo do pojave novih modela financiranja poput ESCO koncepta, uz značajnu ulogu posredničkih tijela za korištenje i upravljanje strukturnim instrumentima EU, koja kroz programe i provedbu mjera energetske učinkovitosti pridonose rastu investicija u energetske učinkovitost u javnom i privatnom sektoru.

S ciljem smanjenja troška energije zamjenom energetski neučinkovite rasvjete i kompresorskog postrojenja, uz otplatu investicije iz ostvarenih ušteda u prihvatljivom roku, tvrtka Galeb d.d. u 2015. godini uspješno je realizirala projekt *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina* ugovaranjem energetske usluge s tvrtkom Veritas ESCO d.o.o., uz ugovaranje zajedničkog financiranja projekta energetske učinkovitosti davanjem sredstava subvencije od strane Fonda za zaštitu okoliša i energetske učinkovitost.

2. ESCO koncept

Novi koncept na tržištu usluga iz područja energetike nude tvrtke za pružanje energetskih usluga (engl. ESCO – *Energy service company*). ESCO modelom primjene mjera energetske učinkovitosti, privatna tvrtka provodi određeni projekt poboljšanja energetske učinkovitosti na imovini klijenta što obuhvaća razvoj, projektiranje, financiranje i izvedbu projekta na način da ESCO tvrtka ulaže vlastita financijska sredstva, znanje, tehnologiju i rad te upravlja rizicima u projektu energetske učinkovitosti, a projekt se financira isključivo iz ostvarenih ušteda za klijenta kroz određeni broj godina. Ostvarene uštede sadržane su u troškovima za energente i održavanje.

Područje poslovanja tvrtke za pružanje energetskih usluga podijeljeno je na javni i privatni sektor, a projekti poboljšanja energetske učinkovitosti obuhvaćaju zgradarstvo, toplinarstvo, industriju i javnu rasvjetu.

Djelatnost energetskih usluga u Republici Hrvatskoj regulira Zakon o učinkovitom korištenju energije u neposrednoj potrošnji (NN 152/08).

2.1 Ugovor o energetske učinku

Ugovor o smanjenju potrošnje energije temeljem poboljšanja performansi (engl. EPC - *Energy performance contracting*) oblik je „kreativnog financiranja“ kapitalnih poboljšanja i mehanizam poticanja investicijske klime gdje pružatelj energetske usluge, privatna ESCO tvrtka, investira u javnu ili privatnu imovinu drugih, a povrate investicije ostvaruje iz tijeka prihoda iz postignutih ušteda u višegodišnjem razdoblju.

Način ugovaranja energetske usluge reguliran je Uredbom o ugovaranju i provedbi energetske usluge u javnom sektoru (NN 11/15) te u skladu s postojećom zakonskom regulativom u Republici Hrvatskoj ovakvi ugovori spadaju u kategoriju Ugovora o energetskom učinku. Ovakav model financiranja u skladu je sa načelima javno-privatnog partnerstva te kao takav ne generira javni dug za naručitelja. U tom smislu, osim opskrbljivača energije i korisnika mjera energetske učinkovitosti, ovaj ugovorni sporazum uključuje i treću stranu koja osigurava kapital za te mjere i zaračunava korisniku naknadu koja odgovara dijelu energetskih ušteda koje su posljedica mjera za poboljšanje energetske učinkovitosti. U osnovi, ESCO tvrtka neće dobiti svoju uplatu ukoliko projekt ne donosi očekivanu uštedu.

Ugovorni pristup temeljen je na prijenosu tehnoloških, tehničkih i financijskih rizika s klijenta, naručitelja energetske usluge na ESCO tvrtku, pružatelja energetske usluge koja daje činidbena jamstva, a ugovorena naknada temeljena je na dokazanoj izvedbi, odnosno postignutom i verificiranom poboljšanju energetske učinkovitosti.

Održiva provedba ESCO modela zahtjeva multidisciplinarni pristup i stručnost svih uključenih u pripremu kvalitetnog Ugovora o energetskom učinku, odnosno realizaciju projekta energetske učinkovitosti provođenjem mjera energetske učinkovitosti.

2.2 Pružatelj energetske usluge Veritas ESCO d.o.o.

Veritas ESCOd.o.o. prva je privatna tvrtka u Republici Hrvatskoj iz područja modernizacije odnosno rekonstrukcije javne rasvjete. Tvrtka je osnovana 2013. g. prepoznavanjem tržišne niše u potrebi modernizacije preko 80 % javne rasvjete u Hrvatskoj. Osnivanju ove tvrtke koja posluje po ESCO modelu prethodilo je više od pet godina razvoja koncepta u tri paralelna smjera: pravnom, tehnološkom i ekonomskom.

Najzahtjevniji i najdugotrajniji posao bio je uspostava pravnog okvira za djelovanje utjecanjem na donošenje propisa iz područja energetske učinkovitosti i energetskih usluga prenošenjem i usklađivanjem EU direktiva u hrvatsko zakonodavstvo, a ovaj posao još uvijek traje. U stalno promjenjivom poslovnom okruženju koje zahtijeva kontinuirani proces učenja, Veritas ESCO razvija svoje kapacitete u suradnji sa znanosti pa zapošljava mlade visokoobrazovane inženjere, redom studente Fakulteta elektrotehnike, strojarstva i brodogradnje (FESB) Splitskog sveučilišta. Počevši s troje zaposlenih u 2013. g., tvrtka Veritas ESCO danas broji osamnaest zaposlenih, od čega dvanaest inženjera FESB-a.

Snažnim opredjeljenjem ulaganju u razvoj, tvrtka Veritas ESCO razvila je vlastitu LED uličnu svjetiljku pod nazivom Veritas ST-M, globalno konkurentan proizvod koji ima sve pripadajuće certifikate potrebne za plasman i korištenje ove svjetiljke na tržištu EU.

Kako ESCO model u pravilu ne pretpostavlja tvrtku proizvođača, specifičnost tvrtke Veritas ESCO jest upravo u činjenici što uličnu svjetiljku Veritas ST-M tvrtka proizvodi u vlastitom proizvodnom pogonu u Splitu. Brojne jedinice lokalne samouprave prepoznale su potencijal ESCO modela te stručnost i najmoderniju LED tehnologiju ugrađenu u ovaj proizvod pa je broj projekata rekonstrukcije javne rasvjete koje provodi Veritas ESCO u stalnom porastu.

2.3 Fond za zaštitu okoliša i energetska učinkovitost

Sustav upravljanja i kontrole operativnog programa Konkurentnost i kohezija 2014. – 2020. u Republici Hrvatskoj uspostavilo je strukturu na način da je glavno upravljačko tijelo Ministarstvo regionalnog razvoja i fondova Europske unije, a u kontekstu projekata

energetske učinkovitosti, posredničko tijelo razine 1 jest Ministarstvo zaštite okoliša i prirode, dok je posredničko tijelo razine 2 Fond za zaštitu okoliša i energetske učinkovitost (FZOEU). Djelatnost FZOEU-a, između ostalog, obuhvaća poslove vezane za financiranje pripreme, provedbe i razvoja programa i projekata u području energetske učinkovitosti (Zakon o Fondu za zaštitu okoliša i energetske učinkovitost NN 107/03).

Projekt *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina* odgovor je na Javni natječaj za sufinanciranje projekata energetske učinkovitosti u industriji Fonda za zaštitu okoliša i energetske učinkovitost, otvorenog u listopadu 2014. g. (NN 122/14) u skladu s *Programom rada Fonda*, a temeljem *Trećeg nacionalnog akcijskog plana energetske učinkovitosti RH-a za razdoblje od 2014. do 2016.*

U skladu s uvjetima Javnog natječaja i preporukama FZOEU za izradu ponude te specifičnostima financiranja modelom energetske usluge, u nastavku opisan je postupak prijave projekta na Javni natječaj za sufinanciranje projekata energetske učinkovitosti u industriji kao i sama provedba projekta.

3. Projekt energetske učinkovitosti “Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d. Omiš”

Projekt ugradnje energetski učinkovite LED rasvjete i kompresorskog postrojenja u tvrtki Galeb d.d. provodio se u razdoblju nešto duljem od godinu dana, od studenoga 2014. godine do prosinca 2015. godine, a sastojao se od pripremnih radnji, izrade projektne dokumentacije, ugovaranja financijskog modela sve do ugradnje energetski učinkovite opreme.

3.1 Korisnik Galeb d.d.

Galeb dalmatinska trikotaža d.d. osnovana je 1951. g., sa sjedištem u Omišu. Osnovna djelatnost tvrtke Galeb d.d. je proizvodnja donjeg rublja i odjeće, a kompletan proizvodni proces od pređe do gotovog proizvoda odvija se unutar vlastitog proizvodnog pogona kroz sljedeće tehnološke faze: pletenje, dorada pletiva (bojenje, bijeljenje, pranje, sušenje), krojenje, šivanje, pregled i pakiranje. Tvrtka ima oko 400 zaposlenih od čega je više od pola zaposleno u proizvodnji.

Tvrtka je u sustave upravljanja implementirala međunarodne norme: ISO 9001 za upravljanje kvalitetom, ISO 14001 za upravljanje zaštitom okoliša, OHSAS 18001 za upravljanje sigurnošću i ISO 50001 za upravljanje energijom. U politici upravljanja, s naglaskom na zahtjeve uspostavljene norme ISO 50001, tvrtka Galeb d.d. u svojim aktivnostima i procesima analizira sve aspekte okoliša, sigurnosti i potrošnje energije te ocjenjuje i mjeri njihov utjecaj i značaj na organizaciju. U provedbi procesa rada i kompletnog poslovanja tvrtke opredjeljuje se za ispunjavanje zahtjeva i trajno poboljšanje sustava kvalitete, okoliša i sigurnosti te sustava energije i performansi energije. Također, poduzima adekvatne preventivne radnje u svrhu sprječavanja nesukladnog rada, pojave onečišćenja okoliša, nesigurnog rada i neadekvatnog odnosa prema energiji.

3.2 Analiza stanja i kontekst

Tvrtka Galeb d.d. smještena je u Omišu na dvije lokacije, a pogon proizvodnje pletiva na lokaciji Priko Lisičina mjesto je provedbe projekta energetske učinkovitosti. U skladu s uvjetima Javnog natječaja za sufinanciranje projekata energetske učinkovitosti u industriji od strane Fonda za zaštitu okoliša i energetske učinkovitost (FZOEU) Galeb d.d. poduzeo je sve potrebne predradnje kako bi prijavio projekt za sufinanciranje. Uz mogućnost visokog udjela sufinanciranja FZOEU-a upravo zbog činjenice da se proizvodni pogon Priko Lisičina nalazi u zaštićenom području prirode odnosno značajnom krajobrazu kanjona rijeke Cetine (Zakon o

zaštiti prirode NN 80/13), Galeb d.d koristi i dodatnu mogućnost da ovu investiciju realizira putem financijskog modela energetske usluge.

U studenom 2014. godine započinje suradnja s tvrtkom Veritas ESCO d.o.o. iz Splita čiji tim iskusnih stručnjaka savjetuje i planira daljnje korake koji će uslijediti kroz provedbu. Galeb d.d. voditeljem projekta imenuje inženjera Marka Juričića, stručnog suradnika za energetiku i automatiku.

Zbog specifičnosti izvora financiranja, u slučaju modela energetske usluge, a prije dostave ponude Fondu za zaštitu okoliša i energetske učinkovitost, potrebno je izvršiti određene predradnje, odnosno pripremiti potrebnu dokumentaciju snimanjem postojećeg stanja.

3.3 Studija izvodljivosti

Studija izvodljivosti prvi je dokument koji treba dokazati opravdanost i nužnost provedbe namjeravanog zahvata rekonstrukcije i zamjene energetske neučinkovite rasvjete i kompresora u proizvodnom pogonu i preduvjet je za potpis Ugovora o energetskom učinku između naručitelja energetske usluge, tvrtke Galeb d.d. i pružatelja energetske usluge, tvrtke Veritas ESCO d.o.o.

U studenom 2014. g. Galeb d.d. i Veritas ESCO d.o.o. pristupaju izradi Studije izvodljivosti projekta *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d. Omiš*. Studija izvodljivosti daje opis postojećeg stanja s tehničkim podacima kao i opis planiranog tehničkog rješenja te izračun ušteda u odnosu na postojeće stanje. Provedena Studija nedvojbeno ukazuje na nužnost i opravdanost planiranog zahvata. Postojeće stanje unutrašnje i vanjske rasvjete kao i kompresorskog postrojenja iskazano u bilancama referentnog stanja i to angažirane snage u kW, potrošnje električne energije u kW/god, referentnu emisiju tCO₂ /god i referentni trošak za električnu energiju u kn/god, sumarno je prikazano u tablici 1.

Tabela 1 Sumarna bilanca Referentnog stanja proizvodnog pogona pletionice

SUMARNO REFERENTNO STANJE	
SNAGA:	111, 58 (kW)
POTROŠNJA:	431.665,50 (kWh/god)
EMISIJA CO ₂ :	162,31 (tCO ₂ /god)
TROŠAK:	323.749,13 (kn/god)

Izvor: Studija izvodljivosti projekta energetske učinkovitosti *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d. Omiš* (prilagodio autor).

U tabeli 2 prikazana je sumarna bilanca novoprojektiranog/novoinstaliranog stanja pogona nakon rekonstrukcije.

Tabela 2 Sumarna bilanca novoprojektiranog stanja proizvodnog pogona pletionice

SUMARNO NOVOPROJEKTIRANO STANJE	
SNAGA:	61,70 (kW)
POTROŠNJA:	182.040,64 (kWh/god)
EMISIJA CO ₂ :	68,45 (tCO ₂ /god)
TROŠAK:	136.530,48 (kn/god)

Izvor: Studija izvodljivosti projekta energetske učinkovitosti *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d. Omiš* (prilagodio autor).

Ukupni troškovi planiranog zahvata rekonstrukcije opreme koji uključuje ugradnju 1500 komada novih LED cijevi u proizvodni pogon, 30 komada novih LED svjetiljki za vanjsku

rasvjetu te jedan novi visokoučinkoviti vijčani kompresor, uz troškove demontaže, zbrinjavanja i montaže iznose 911.730,00 kn bez PDV-a.

Prema ukupnom trošku planiranog zahvata i bilanci novoprojektiranog stanja jasno su vidljivi indikatori kvalitete ulaganja i to smanjenje emisije 93,86 tCO₂/god u odnosu na referentno stanje te specifični trošak od 9.713,83 kn/tCO₂ god za postizanje tog smanjenja što je prikazano u tablici 3.

Tabela 3 Indikatori kvalitete ulaganja

INDIKATORI KVALITETE ULAGANJA
Godišnje smanjenje emisije CO ₂ prema referentnom stanju:
162, 31 (tCO ₂ /god) referentno - 68,45 (tCO ₂ /god) novo = 93,86 (tCO₂/god)
Indikator kvalitete ulaganja za novoprojektiranu tehnologiju:
911.730,00 (kn) / 93,86 (tCO ₂ /god) = 9.713,83 (kn/tCO₂ god)

Izvor: Studija izvodljivosti projekta energetske učinkovitosti *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d. Omiš* (prilagodio autor).

U tabeli 4 prikazani su indikatori energetske učinkovitosti u odnosu na referentno stanje i to uštede električne energije od 249.624,86 kWh/god, godišnje postotno smanjenje potrošnje električne energije od 57,83 % i godišnji novčani iznos uštede električne energije od 187.218,65 kn.

Tabela 4 Indikatori energetske učinkovitosti

INDIKATORI ENERGETSKE UČINKOVITOSTI
Godišnja ušteda električne energije novoprojektiranog stanja u odnosu na Referentno stanje:
431.665,50 (kWh/god) referentno - 182.040,64 (kWh/god) novo = 249.624,86 (kWh/god)
Energetska učinkovitost (smanjenje godišnje potrošnje) u odnosu na Referentno stanje:
249.624,86 (kWh/god) / 431.665,50 (kWh/god) = 57,83 (%)
Novčani iznos godišnje uštede električne energije u odnosu na Referentno stanje:
323.749,13 (kn/god) referentno - 136.530,48 (kn/god) novo = 187.218,65 (kn/god)

Izvor: Studija izvodljivosti projekta energetske učinkovitosti *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d. Omiš* (prilagodio autor).

3.4 Ponuda za sufinanciranje projekata energetske učinkovitosti u industriji

Nakon provedene Studije izvodljivosti koja je potvrdila nužnost i opravdanost ulaganja, u prosincu 2014. g. potpisan je Ugovor o energetsom učinku između naručitelja energetske usluge (NEU), tvrtke Galeb d.d. i pružatelja energetske usluge (PEU), tvrtke Veritas ESCO d.o.o., Ugovorom se pružatelj energetske usluge obvezao provesti mjere energetske učinkovitosti te se obvezao postići Ugovorom zajamčene uštede provedbom mjera. PEU u cijelosti snosi financijski, tehnički, komercijalni i gospodarski rizik provedbe ovog Ugovora. NEU se Ugovorom obvezao podnijeti svoju ponudu na Javni natječaj FZOEU-a te se obvezao

plaćati PEU mjesečnu cijenu/naknadu za izvršenu energetska uslugu nakon provedbe mjera u trajanju od tri godine. Cijena ugovorene energetske usluge (Cn) jednaka je troškovima planiranog zahvata na što se obračunava PDV što čini ukupnu cijenu usluge (Cuk). Financiranje predmeta Ugovora definirano je na način da FZOEU sufinancira 80 % iznosa Cn prema odgovarajućem ugovoru o zajedničkom financiranju s NEU-om, NEU iz ostvarenih ušteda financira 20 % iznosa Cn te financira ukupan iznos PDV-a. PEU se obvezao izraditi glavni projekt o vlastitom trošku, a NEU imenovati nadzornog inženjera sukladno Zakonu o građenju (NN 153/13). Projekt *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina* je pravovremeno prijavljen upućivanjem Ponude za sufinanciranje projekata energetske učinkovitosti u industriji Fondu za zaštitu okoliša i energetska učinkovitost.

U skladu s uvjetima Javnog natječaja za sufinanciranje projekata energetske učinkovitosti u industriji, prijavitelj je dužan dostaviti Ponudu za sufinanciranje koja sadrži propisanu natječajnu dokumentaciju. U tablici 5 naveden je sadržaj predmetne ponude projekta energetske učinkovitosti.

Tabela 5 Natječajna dokumentacija (sadržaj ponude)

SADRŽAJ PONUDE
1. Prijavni obrazac FZOEU
2. Opis projekta s ciljevima projekta
3. Indikatori projekta prema Ugovoru o energetska učinku
4. Terminski plan provedbe i financijskog tijeka
5. Izjava o zatvaranju financijske konstrukcije – energetska usluga
6. Studija izvodljivosti
7. Projektni zadatak
8. Troškovnik opreme i radova
9. Ugovor o energetska učinku
10. Indikatori kvalitete ulaganja i energetske učinkovitosti
11. Ugovoreni terminski plan
12. Potvrda porezne uprave o podmirenju obveza javnih davanja
13. Zemljišno-knjižni izvadak
14. BONPLUS obrazac
15. SOL 2 obrasci
16. Izjava o korištenim potporama male vrijednosti
17. Izjava o korištenim potporama male vrijednosti povezanih društava
18. Izjava poduzetnika da nije u teškoćama
19. Izvadak iz sudskog registra
20. Izvadak iz katastra
21. Preslika katastra s GEO portala
22. CD s Prijavnim obrascem i Troškovnikom

Izvor: Ponuda projekta energetske učinkovitosti *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina* tvrtke *Galeb d.d. Omiš* (prilagodio autor).

U Prijavnom obrascu za projekte energetske učinkovitosti u industriji FZOEU, uz sve podatke o ciljevima, mjerama, utjecaju mjera i očekivanim uštedama, iskazana je vrijednost ukupne investicije i iznos tražene subvencije Fonda kako je prikazano u tabeli 6.

Tabela 6 Odjeljak Očekivana sredstva fonda Prijavnog obrasca

OČEKIVANA SREDSTVA FONDA	
Status ponuditelja (t.III Natječaja):	Zaštićeni dijelovi prirode
Vrijednost ukupne investicije:	1.139.622,50 kn (s PDV-om)
Vrijednost opravdanih troškova (sukladno t. IV Natječaja):	911.730,00 kn (bez PDV-a)
Učešće Fonda u opravdanim troškovima (t.III Natječaja):	80,00%
Iznos tražene subvencije Fonda:	729.384,00 kn (bez PDV-a)

Izvor: Prijavni obrazac za projekte energetske učinkovitosti u industriji Fonda za zaštitu okoliša i energetske učinkovitosti projekta energetske učinkovitosti *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d. Omiš* (prilagodio autor).

3.5 Odluka o odabiru korisnika i dodjeli sredstava Fonda

Po podnošenju Ponude potrebno je čekati odluku Fonda koja će biti donesena nakon obrade svih prijava podnesenih na natječaj, a u roku od 60 dana od dana isteka roka za dostavu ponuda. Za projekte za koje iznos sufinanciranja ne prelazi 2.000.000,00 kn, odluku o odabiru korisnika i dodjeli sredstava Fonda za zaštitu okoliša i energetske učinkovitost donosi direktor Fonda, a za one koje prelaze ovaj iznos odluku donosi Upravni odbor Fonda.

U ožujku 2015. g. korisnik Galeb d.d. primio je pisanu obavijest o prihvaćanju ponude za projekt *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d. Omiš* Odlukom o odabiru korisnika i dodjeli sredstava Fonda za zaštitu okoliša i energetske učinkovitost i za koju se odobrava subvencija u visini od 80 % opravdanih troškova, a najviše u iznosu do 641.640,00 kuna. Prije sklapanja Ugovora s Fondom, a najkasnije u roku od tri mjeseca od dana zaprimanja ove obavijesti, korisnik Galeb d.d. dužan je Fondu dostaviti odgovarajuću dopunu dokumentacije potrebnu za sklapanje ugovora.

3.6 Dopuna dokumentacije

Odlukom o odabiru korisnika Galeb d.d. i dodjeli sredstava Fonda, a u skladu s Ugovorom o energetske učinkovitosti, pružatelj energetske usluge Veritas ESCO d.o.o. u suradnji s ovlaštenim inženjerima trećih tvrtki kreće s izradom glavnog projekta koji se sastoji od dvije cjeline, elektrotehničkog i strojarskog projekta. Imajući u vidu točku IV. Odluke i točku IX. Natječaja, ugovoren je ponuditelj opreme, specifikacija opreme s pripadajućim troškovnikom i rekapitulacijom troškovnika te je izmijenjen terminski plan provedbe projekta.

Nadalje, ocjenom podnesene Prijave za sufinanciranje Fond je utvrdio da dio troškova nije opravdan jer se ne odnosi direktno na industrijski pogon, a to je dio rasvjete u proizvodnom pogonu koji se nalazi u uredskim prostorima, isto tako i kompletna vanjska rasvjeta u vanjskom krugu industrijskog pogona. Odlukom Fonda svakako je prihvaćeno subvencioniranje 80 % opravdanih troškova, međutim za ostvarenje ciljeva projekta potrebno je provesti čitav zahvat rekonstrukcije odnosno dio koji se odnosi na neopravdane troškove također realizirati u skladu s provedbenim planom. U skladu s navedenim, dodatkom Ugovoru o energetske učinkovitosti mijenja se dio o financiranju kako je prikazano u tablici 7.

Tabela 7 Vrijednost opravdanih troškova i iznos najvišeg iznosa subvencije

ODLUKOM ODOBRENA SREDSTVA FONDA	
Vrijednost ukupne investicije:	1.139.622,50 kn (s PDV-om)
Vrijednost opravdanih troškova (sukladno t. IV Natječaja):	802.050,00 kn (bez PDV-a)
Učešće Fonda u opravdanim troškovima (t.III Natječaja):	80,00%
Iznos odobrene subvencije Fonda najviše do:	641.640,00 kn (bez PDV-a)

Izvor: Odluka o odabiru korisnika i dodjeli sredstava Fonda za zaštitu okoliša i energetske učinkovitost radi sufinanciranja projekata energetske učinkovitosti u industriji KLASA 310-34/14-03/123 (prilagodio autor).

Prihvatanjem Odluke mijenja se, odnosno povećava učešće naručitelja energetske usluge pa sada naručitelj Galeb d.d. iz ostvarenih ušteda financira 29,6 % iznosa cijene energetske usluge (Cn) Ugovora o energetskom učinku za razliku od ranije „idealnih“ 20 %. Proporcionalno je tako ugovoren i povećani iznos mjesečne cijene/naknade za izvršenu energetske uslugu.

3.7 Potpis Ugovora o sufinanciranju i provedba projekta rekonstrukcije

U lipnju 2015. g. Fondu je pravovremeno predana sva odgovarajuća dopuna dokumentacije potrebna za sklapanje Ugovora, a u rujnu 2015. g. Galeb d.d. je s Fondom sklopio Ugovor o zajedničkom financiranju projekta energetske učinkovitosti *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d.* davanjem sredstva subvencije Fonda. Ugovorena su sredstva upravo u visini odobrene subvencije iz Odluke o odabiru korisnika, a rok za realizaciju Projekta i dostavu Završnog izvješća o realizaciji jest najkasnije do kraja 2015. godine.

Pružatelj energetske usluge, Veritas ESCO d.o.o. nabavio je svu potrebnu opremu, imenovani nadzorni inženjer provjerio je sukladnost opreme s Glavnim projektom, a do prosinca 2015. g. pod stručnim nadzorom su provedeni svi radovi primjene mjera energetske učinkovitosti.

3.8 Dostava Završnog izvješća o realizaciji projekta

Nakon provedenih svih mjera ugradnje, nadzora, ispitivanja i mjerenja učinkovitosti ugrađene opreme odnosno privremene situacije izvršenja energetske usluge, pristupilo se izradi Završnog izvješća.

Završno izvješće o realizaciji projekta energetske učinkovitosti *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d.* dostavljeno je Fondu za zaštitu okoliša i energetske učinkovitost 17. 12. 2015. g., a sukladno odredbama Ugovora o zajedničkom financiranju projekta energetske učinkovitosti. U tabeli 8 naveden je sadržaj Završnog izvješća predmetnog Projekta.

Tabela 8 Sadržaj Završnog izvješća

SADRŽAJ ZAVRŠNOG IZVJEŠĆA
1. Obrazac Završnog izvješća o ostvarenim učincima projekta FZOEU
2. Račun Privremene situacije za pružanje energetske usluge, a za dio provođenja mjera energetske učinkovitosti (oprema i radovi)
3. Završno izvješće nadzornog inženjera o obavljenom stručnom nadzoru nad izvođenjem elektrotehničkih instalacija
4. Završno izvješće nadzornog inženjera o obavljenom stručnom nadzoru nad izvođenjem strojarских instalacija

5. Zapisnik o puštanju u rad
6. Zapisnik o primopredaji građevine
7. Prateći list za otpad kao dokaz o propisnom zbrinjavanju demontiranih izvora svjetlosti na bazi žive
8. Specifikacija ugrađene opreme i izvedenih radova i pripadajućim količinama
9. Izjava poduzetnika da nije u teškoćama
10. Izjava o korištenim potporama male vrijednosti
11. Izjava o korištenim potporama male vrijednosti povezanih društava
12. Jedna bjanko zadužnica na iznos od 1.000.000,00 kuna, ovjerena i potvrđena kod javnog bilježnika

Izvor: Završno izvješće projekta energetske učinkovitosti *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d. Omiš* (prilagodio autor).

3.9 Uplata subvencije Fonda

Dostavljeno Završno izvješće Projekta prihvaćeno je od strane Fonda jer je u potpunosti sukladno Pravilniku o načinu praćenja namjenskog korištenja sredstava Fonda za zaštitu okoliša i energetske učinkovitost i ugovoreni prava i obveza (NN 183/04 i 29/14) i općim aktima Fonda. Uplata sredstava subvencije FZOEU-a korisniku Galeb d.d. realizirana je u siječnju 2016. g. te je Galeb d.d., u svojstvu naručitelja energetske usluge (NEU) doznačena sredstva subvencije uplatio na račun pružatelja energetske usluge (PEU), Veritas ESCO d.o.o., u roku od osam dana, sukladno Ugovoru o energetske učinku.

Specifičnost Ugovora o energetske učinku jest privremena situacija okončanja provedenih mjera energetske učinkovitosti odnosno izvršenja radova i ugradnje opreme čime je ispunjen dio ugovornih obveza. Nakon toga teče ugovoreni otplatni rok za pružanje energetske usluge gdje NEU plaća ugovorenu mjesečnu naknadu u jednakim iznosima kroz ugovoreno vremensko razdoblje za pruženu energetske uslugu na temelju privremenih situacija za izvršenu uslugu i radove PEU-a. Nakon isteka Ugovora, ovlašteni predstavnici NEU-a i PEU-a će sastaviti i potpisati okončani obračun i utvrditi stvarne moguće obveze i nepodmirena plaćanja. Obračun okončane situacije sastavit će se i potpisati najkasnije u roku od dvadeset dana nakon završetka Ugovora o energetske učinku.

4. Zaključak

Energetska učinkovitost skup je isplaniranih i provedenih mjera čiji je cilj korištenje najmanje moguće količine energije na način da razina udobnosti i stopa proizvodnje ostanu sačuvane ili pojednostavljeno, energetska učinkovitost znači uporabu manje količine energije za obavljanje istog posla. Za razliku od štednje energije koja uvijek podrazumijeva odricanja određene razine koristi, energetska učinkovitost podrazumijeva zadržavanje jednake razine tih koristi, ali uz manju potrošnju energije.

Za pokretanje aktivnosti energetske učinkovitosti nužno je prije svega podizanje svijesti i volje poduzetnika i njihovih zaposlenika za promjenom ustaljenih navika prema energetske učinkovitim rješenjima, a za provedbu projekata energetske učinkovitosti ključna je financijska podrška.

Potencijal za smanjenje potrošnje energije odnosno postizanje energetske ušteda u gospodarskom sektoru jasno je vidljiv iz provedenog projekta energetske učinkovitosti *Rekonstrukcija vanjske i unutrašnje rasvjete te kompresorskog postrojenja u pogonu Priko Lisičina tvrtke Galeb d.d.* gdje je provedbom mjera energetske učinkovitosti postignuto godišnje smanjenje potrošnje električne energije od gotovo 60 % i godišnji novčani iznos uštede električne energije od gotovo 200.000,00 kn, uz napomenu da je Natječajem za

sufinanciranje uvjetovano ostvarivanje ušteda od 20 %. Neupitna isplativost i opravdanost Projekta jasno je vidljiva iz visokih vrijednosti indikatora energetske učinkovitosti i indikatora kvalitete ulaganja.

Izdašnom subvencijom Fonda za zaštitu okoliša i energetske učinkovitost, uz ESCO model ugovaranja energetske usluge, projekt rekonstrukcije realiziran je bez inicijalnog vlastitog ulaganja i troška, ESCO tvrtka preuzela je u potpunosti financijski, tehnološki i komercijalni rizik, a naplaćuje se isključivo iz ostvarenih ušteda.

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Financing with ESCO model- example of company Galeb

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Abstract. Energy efficiency is the backbone of the unique energy policy of the European Union and is one of the five major objectives of the Europe 2020 strategy - reducing energy consumption by 20% by 2020. Increasing energy efficiency is an effective way of achieving the goals of sustainable development, since energy efficiency directly contributes to the reduction of emissions into the environment, thus strengthening the competitiveness of the industry, creating new jobs and increasing the security of energy supply. In the context of the

EU Cohesion Policy, the Republic of Croatia has significant funds of financial support at its disposal, intended for the implementation of energy efficiency projects from EU funds in various sectors through programs for financing and co-financing Croatian Environmental Protection and Energy Efficiency Fund (FZOEU). A clear and measurable impact the attempts to reduce energy consumption have on the competitiveness of business, in addition to the possibility of subsidies of energy efficiency projects from public sources, has resulted in the emergence of innovative models of financing projects of this kind in the domestic market. ESCO (Energy Service Company) is the generic name of the concept of market services in the energy sector. ESCO model includes development, implementation and financing of energy efficiency to reduce energy costs and maintenance by installing energy-efficient equipment and optimizing energy systems while ensuring the repayment of the investment through savings achieved in a given period. This paper presents a case study on the project investment in energy-efficient lighting and compressor plant in the production plant textile company Galeb. Also, preparatory activities, applications, contracting, implementation and reporting on the project, which is financed by ESCO contract model energy services with subsidy of FZOEU through the de minimis aid and relations between all parties involved in the project, are presented.

Keywords: *ESCO model, energy services, subsidies, investments in energy measures*

Novine u financijskom poslovanju i računovodstvu neprofitnih organizacija

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Sažetak. Razlozi donošenja novih zakona i pravilnika po pitanju neprofitnih organizacija su nedovoljno razrađeni uvjeti dodjele financijskih podrški udrugama, ali i povratna informacija o sredstvima danim na raspolaganje u sklopu različitih projekata. Kako bi se spriječila mogućnost zloupotreba u korištenju sredstava namijenjenih udrugama za provođenje programa i projekata te u konačnici mogla prezentirati transparentnost rada udruga ovakav pravilnik bio je jedina opcija. Neprofitne organizacije, tj. udruge koje vode dvojno knjigovodstvo, dočekale su još jednu izmjenu Pravilnika propisanog Zakonom o financijskom poslovanju i računovodstvu neprofitnih organizacija. Udruge, koje su se po tko zna koji put našle u nedoumici što i kako dalje, moraju ovim Pravilnikom utvrditi način provođenja samoprocjene funkcioniranja sustava financijskog upravljanja i kontrole neprofitne organizacije te primijeniti metodologiju izrade financijskog plana, kao i uvjete i način izvršavanja financijskog plana. Novi Pravilnik sastoji se od nekoliko cjelina koje ćemo prezentirati u nastavku. Zakon je u tom pogledu predvidio i popunjavanje upitnika s ciljem potvrde da se sredstva udruge koriste zakonito, namjenski i svrhovito, ali i da se dobije povratna informacija o uložnim sredstvima po raznim projektima. Prvi financijski plan koji neprofitna organizacija mora temeljiti na odredbama ovog Pravilnika izrađuje se tek u 2016. godini za 2017. godinu pa bismo ovo kašnjenje donošenja Pravilnika mogli nazvati srećom u nesreći jer nam pruža duži period prilagodbe nametnutim uvjetima planiranja, kao i još jednu godinu u kojoj nećemo saznati da li su sredstva pametno uložena.

Ključne riječi: neprofitna organizacija, pravilnik, upitnik, sredstva

1. Uvod

Financijsko poslovanje udruga propisano je s nekoliko zakona i pravilnika. Jedan od njih je Zakon o financijskom poslovanju i računovodstvu neprofitnih organizacija te su sve neprofitne organizacije (udruge) dužne sukladno Zakonu voditi uredno financijsko poslovanje.

U svojoj primjeni oslanja se na tri pravilnika:

1. Pravilnik o sustavu financijskog upravljanja i kontrola, izradi i izvršavanju financijskih planova neprofitnih organizacija.

2. Pravilnik o izvještavanju u neprofitnom računovodstvu i Registru neprofitnih organizacija.

3. Pravilnik o neprofitnom računovodstvu i računskom planu neprofitnih organizacija.

Obveznici su domaće i strane udruge te njihovi savezi, zaklade, fundacije, ustanove, umjetničke organizacije, komore, sindikati, udruge poslodavaca i sve druge pravne osobe kojima temeljni cilj osnivanja i djelovanja nije stjecanje dobiti te za koje, iz posebnih propisa, proizlazi da su neprofitnog karaktera. Sustav financijskog poslovanja obuhvaća načela sustava financijskog poslovanja, izradu i izvršavanje financijskih planova i izvještaj o potrošnji proračunskih sredstava.

Financijsko poslovanje udruga temelji se na dva osnovna načela: načelu javnosti i transparentnosti te načelu dobrog financijskog upravljanja i kontrole. Načelo javnosti i transparentnosti podrazumijeva javnu objavu financijskih izvještaja i to putem Registra neprofitnih organizacija i Registra udruga. Za udruge s ukupnim prihodom iznad 3 milijuna kuna ono, također, podrazumijeva uvid u financijske izvještaje protekle godine putem ovlaštenog revizora, a za udruge s prihodom iznad 10 milijuna kuna i javnu objavu revizorskog izvještaja o obavljenoj reviziji.

Načelo dobrog financijskog upravljanja i kontrole podrazumijeva odgovornost tijela uprave glede planiranja, izrade i realizacije financijskog plana, zatim odgovornost po pitanju računovodstva i izrade izvještaja, a sve to sa svrhom postizanja postavljenih ciljeva i zaštite resursa udruge od gubitaka bilo neadekvatnim korištenjem i/ili prijevarama.

2. Financiranje udruga i drugih neprofitnih organizacija iz javnih sredstava

Sve neprofitne organizacije moraju se prilagoditi novom sustavu financiranja iz javnih sredstava. S obzirom na brojnost kriterija, mjerila, normiranost postupaka financiranja i ugovaranja programa i projekata od interesa za opće dobro, očekuje se primjereni angažman kako bi svi proveli novodoneseni propis koji zahtijeva stroga pravila ponašanja.

Financiranje projekata i programa od interesa za opće dobro koje provode udruge jedan je od najčešćih oblika suradnje državnih tijela i udruga te ostalih organizacija civilnog društva u provedbi javnih politika, odnosno rješavanju prioriternih društvenih problema.

Prema podacima za 2014. godinu, iz Državnog proračuna se za financiranje programa i projekata udruga godišnje izdvaja više od 600 milijuna kuna, a iz proračuna jedinica lokalne i područne (regionalne) samouprave više od 1,044 milijarde kuna.

Osim toga, zadnji prikupljeni podatci o donacijama i sponzorstvima trgovačkih društava u vlasništvu Republike Hrvatske upućuju na skoro 145 milijuna kuna rashoda po osnovi donacija i sponzorstva. Unatoč tako visokim izdvajanjima, dosad još uvijek nisu bili dovoljno precizno razrađeni kriteriji i mjerila dodjele financijskih potpora udrugama iz javnih izvora, a postojali su i različiti standardi u postupanju kako na državnoj tako i na lokalnoj razini, a s time i mogućnosti različitih zlouporaba u korištenju sredstava iz javnih izvora namijenjenih za provedbu programa i projekata od interesa za opće dobro.

Udruge koje pokazuju interes za korištenje sredstava iz javnih izvora moraju biti spremne na ispunjavanje dodatnih zahtjeva koje ova Uredba postavlja sa svrhom osiguranja što kvalitetnijeg nadzora nad trošenjem sredstava poreznih obveznika. Temeljna mjerila koja moraju ispunjavati udruge vezana su, s jedne strane uz obveze koje udruga ima prema državi, a s druge strane, uz unutarnji ustroj i organizacijske kapacitete same udruge. Ponajprije, udruge se mogu koristiti financijskim odnosno nefinancijskim potporama iz javnih izvora jedino ako su upisane u Registar udruga, odnosno u Registar neprofitnih organizacija te ako su se svojim statutom opredijelile za obavljanje djelatnosti i aktivnosti koje su predmet financiranja i kojima promiče uvjerenja i ciljeve koji nisu u suprotnosti s Ustavom i zakonom.

Nadalje, udruge moraju uredno ispunjavati obveze iz svih prethodno sklopljenih ugovora o financiranju iz javnih izvora, a u suprotnom će im svaka prijava novog programa ili projekta na javni natječaj bilo kojeg davatelja financijskih sredstava biti odbijena. Konačno, udruge moraju uredno ispunjavati obveze plaćanja doprinosa za mirovinsko i zdravstveno osiguranje i plaćanja poreza te drugih davanja prema državnom proračunu i proračunima jedinica lokalne uprave i samouprave.

Sukladno članku 14. stavku 1. Pravilnika o izvještavanju u neprofitnom računovodstvu i Registru neprofitnih organizacija („Narodne novine“, broj 31/15) neprofitne organizacije koje ostvaruju sredstva iz javnih izvora, uključujući sredstva iz proračuna jedinice lokalne samouprave obvezno sastavljaju izvještaj o potrošnji proračunskih sredstava za poslovnu godinu i dostavljaju ga davatelju sredstava u roku od 60 dana od isteka poslovne godine.

Ovim se omogućuje odgovornije i racionalnije financiranje programa i projekata udruga iz javnih izvora jer se očekuje da će veća transparentnost i otvorenost postupaka dodjele financijskih sredstava za projekte i programe udruga i ostalih organizacija civilnog društva iz javnih izvora pridonijeti osnaživanju povjerenja građana u rad tijela javne vlasti, kao i u rad udruga te ostalih organizacija civilnog društva. Primjenom se očekuje postupna transformacija pristupa financiranju programa i projekata udruga kao instrumentu provedbe javnih politika, odnosno jednom od načina rješavanja društvenih problema, a ne instrumentu za pridobivanje potpore pojedinih interesnih skupina.

Izvještaj o potrošnji proračunskih sredstava sastavlja se na obrascu PROR-POT. Obrazac je dan u prilogu Pravilnika. Međutim, ako je drugim propisima ili aktima utvrđen detaljniji sadržaj i izgled obrasca izvještaja o potrošnji proračunskih sredstava, nije obvezno korištenje obrasca PROR-POT. Izvještaj se obvezno sastavlja za poslovnu godinu, ali se može sastavljati i za razdoblja tijekom poslovne godine, ali ako to zatraži davatelj sredstava.

Međutim, Pravilnikom je dopušteno da se Izvještaj može dostaviti davatelju sredstava i u roku različitom od propisanog ako je rok utvrđen u drugim propisima ili aktima.

Obrazac PROR-POT, koji se nalazi u prilogu Pravilnika, sadržava najmanje sljedeće podatke:

1. primatelj sredstava
2. davatelj sredstava
3. naziv projekta / programa / ostalo
4. razdoblje izvještavanja

Obrazac PROR-POT uzima u obzir i činjenicu da pojedini davatelji sredstava, posebice za doznake neprofitnim organizacijama u zadnjem tromjesečju poslovne godine, omogućavaju prijenos nepotrošenih sredstava i potrošnju istih u sljedećoj poslovnoj godini.

U ovom dijelu obrasca PROR-POT navode se isključivo oni javni davatelji sredstava koji financiraju isti projekt, program ili slično te davatelj kojemu se podnosi Izvještaj o potrošnji proračunskih sredstava na ovom obrascu. Dakle, ako se Izvještaj podnosi jedinici lokalne i područne (regionalne) samouprave za primljenu donaciju vezanu za nabavu nogometnih dresova, a druga jedinica lokalne i područne (regionalne) samouprave je, primjerice, istoj neprofitnoj organizaciji donirala sredstva za organizaciju nekog susreta, u III. dijelu obrasca PROR-POT nije potrebno navoditi ovu drugu jedinicu i njezinu donaciju. Ali, ako je jedinica lokalne i područne (regionalne) samouprave doznala sredstva neprofitnoj organizaciji za redovito poslovanje, kao primjerice i neka druga jedinica, onda je to potrebno navesti u obrascima koji se dostavljaju objema jedinicama. U prethodnim su dijelovima obrasca PROR-POT neprofitne organizacije navodile na koje su troškove odnosno rashode alocirale novac doznačen iz javnih izvora. U IV. dijelu obrasca navode se aktivnosti koje su provedene te se opisuju postignuti rezultati. Prethodno je opisan sadržaj obrasca PROR-POT.

Međutim, s obzirom na „šarolikost“ neprofitnog sustava kada je riječ o djelatnosti, ustrojstveni oblik i izvore financiranja, Pravilnikom je dana mogućnost davateljima sredstava

dopune obrasca izvještaja o potrošnji proračunskih sredstava i drugim podacima prilikom donošenja odluke ili drugog akta o odobrenju sredstava neprofitnoj organizaciji. Neprofitna organizacija koja je primatelj javnih sredstava obvezna je, na zahtjev davatelja sredstava, dostaviti i kopiju vjerodostojne dokumentacije na temelju koje je rashod / izdatak, iskazan u obrascu PROR-POT.

3. Novi pravilnik o sustavu financijskog upravljanja i kontrola, izradi i izvršavanju financijskih planova neprofitne organizacije

Neprofitne organizacije, osim dosadašnjih izmjena zakona o poslovanju, uvođenjem obrasca PROR-POT kako bismo saznali o potrošnji javnih sredstava, dočekale su još jednu izmjenu Pravilnika propisanog Zakonom o financijskom poslovanju i računovodstvu neprofitnih organizacija.

U Narodnim novinama broj 119/15 Ministarstvo financija objavilo je Pravilnik o sustavu financijskog poslovanja i kontrola te izradu i izvršavanje financijskih planova neprofitnih organizacija koji je stupio na snagu 09. studenog 2015. godine

Udruge, koje su se po tko zna koji put našle u nedoumici što i kako dalje, moraju ovim pravilnikom utvrditi način provođenja samoprocjene funkcioniranja sustava financijskog upravljanja i kontrole neprofitne organizacije, te primijeniti metodologiju izrade financijskog plana, kao i uvjete i način izvršavanja financijskog plana.

Novi Pravilnik sastoji se od nekoliko cjelina koje ćemo prezentirati u nastavku..

3.1 Financijsko upravljanje i kontrola

Ova cjelina odnosi se na upravljačku odgovornost u upravljanju poslovanjem udruge vezano za planiranje poslovnih aktivnosti udruge, kao i izradu financijskih planova te njihovu realizaciju. Odnosi se na ispravno vođenje računovodstva te računovodstveno izvješćivanje (npr. ovlaštena osoba mora kontrolirati sve vrste knjigovodstvenih dokumenata koje u udugu ulaze ili iz nje izlaze kao što su ispravni ulazni računi i izlazni računi, zakonski propisan način priznavanja i knjiženja prihoda i rashoda, obračuna amortizacije i sl.).

Ovaj dio, također, podrazumijeva i osobni i profesionalni integritet zakonskih zastupnika i zaposlenika, rukovođenje i stil upravljanja kao i definiranje vizije i ciljeva neprofitne organizacije.

Na žalost, vrlo je nejasno kako će se porezni nadzor postaviti vezano za kontrolu navedene odredbe budući da ni zakonski predstavnik ni zaposlenici često nisu u mogućnosti uvjetovati da određeni knjigovodstveni dokumenti koji ulaze u udugu, od kojih su najbitniji ulazni računi, budu kreirani na način da zadovolje prethodno navedene stavke. Što zapravo znači da vam na računu za vođenje knjigovodstvenih usluga više nije dovoljno da piše knjigovodstvene usluge za listopad 2015. godine temeljem ugovora br. 10., nego moraju biti specificirane sve usluge izvršene za taj mjesec, a svi znamo da je vrlo teško, a u većini slučajeva i nemoguće dobavljaču uvjetovati stavke na računu koji vam ispostavlja.

3.2 Praćenje sustava financijskog upravljanja i kontrola

Ovaj dio predstavlja temelj za ispunjavanje Upitnika o funkcioniranju sustava financijskog upravljanja i kontrola budući da je zakonski zastupnik neprofitne organizacije obavezan za svaku poslovnu godinu provesti samoprocjenu učinkovitosti i djelotvornosti funkcioniranja navedenog sustava. Samoprocjena provodi se popunjavanjem propisanog upitnika s ciljem potvrde da se sredstva udruge koriste zakonito, namjenski i svrhovito te da je sustav financijskog upravljanja udruge djelotvoran i učinkovit.

To znači da je ovaj upitnik vlastita kontrola, pri čemu odgovaranjem na pitanja koja se tiču pojedine udruge, tj. koja su primjenjiva na poslovanje pojedine udruge izvrše neku vrstu

kontrole poslovanja udruge te imaju mogućnost regulacije i poboljšanja poslovanja ako utvrde da je to potrebno. Naravno da mnoga od ovih pitanja na većinu malih i srednjih udruga nisu primjenjiva te smatramo da se njima nije potrebno opterećivati i razmišljati da moraju imati odgovore na sva pitanja i zato je jedna od danih opcija odgovora N/P (nije primjenjivo).

Ako udruga nema potrebu za skladištem, jer se bavi isključivo uslužnom djelatnošću, na dio upitnika koji se tiče opreme i dokumentacije, vezano za opremu, odgovorit će N/P.

Kao i uvijek, prvo što smo se zapitali nakon objave ovog upitnika bilo je da što bi se dogodilo ako na neko od ovih pitanja odgovore da se ne primjenjuje ili odgovore pogrešno. Nažalost, ne bi se dogodilo ništa jer Pravilnikom nisu propisane kaznene odredbe za neispravno ispunjavanje ili ako zbog nesigurnosti na određena sporna pitanja odgovore da nisu primjenjiva na određenu organizaciju.

Međutim, i ovdje treba biti na oprezu jer su kaznene odredbe sadržane u drugim zakonskim i podzakonskim aktima. Tako, na primjer, na pitanje „Na zaprimljenim računima navedeni su svi elementi računa u skladu sa zakonskim i podzakonskim aktima“ ni u kojem slučaju ne može se odgovoriti ne ili nije primjenjivo jer su stavke na ulaznim računima propisane nizom drugih zakona temeljem kojih su propisane i kazne koje ćete platiti ako vam je račun neispravan.

Tako država nastoji pomoći udrugama da prepoznaju probleme u financijskom i pravnom funkcioniranju te ih na vrijeme isprave i izbjegnu nepotrebno plaćanje kazni. Samoprocjena, odnosno popunjavanje upitnika provodi se najkasnije u roku od 30 dana od roka predviđenog za predaju financijskih izvještaja za prethodnu poslovnu godinu, što znači da za 2015. upitnik morate popuniti najkasnije do 30. ožujka 2016. godine. Rok čuvanja, tj. arhiviranja ispunjenih upitnika je sedam godina od završetka godine na koju se upitnik odnosi.

3.3 Izrada financijskog plana

Neprofitna organizacija koja je obveznik primjene ovog Pravilnika obvezna je izrađivati financijski plan za provedbu godišnjeg programa rada. Prijedlog financijskog plana neprofitne organizacije za sljedeću godinu priprema zakonski zastupnik i dostavlja ga najvišem tijelu neprofitne organizacije, odnosno tijelu koje je temeljem statuta neprofitne organizacije ovlašteno za njegovo donošenje.

Financijski plan za sljedeću godinu donosi najviše tijelo neprofitne organizacije, odnosno tijelo koje je temeljem statuta neprofitne organizacije za to ovlašteno, najkasnije do 31. prosinca tekuće godine.

Financijski plan neprofitne organizacije sastoji se od:

1. plana prihoda i rashoda
2. plana zaduživanja i otplata
3. obrazloženja financijskog plana (tzv. bilješke uz financijski plan).

Uz sastavne dijelove financijskog plana, financijski plan može sadržavati i plan novčanih tokova.

Budući da u dijelu pravilnika nije precizno definirana metodologija, naišli smo na preporuke da se prihodi i rashodi planiraju na minimalno drugoj razini računa računskog plana. To znači, kao prvo i osnovno da, htjeli ili ne, potrebno je na izradi financijskog plana surađivati s računovođom jer gotovo sve ove podatke moguće je dobiti od računovodstva, tj. računovođa mora objasniti kako ove podatke iščitava iz prethodnih financijskih izvještaja temeljem kojih će se raditi procjena prihoda i rashoda za određenu godinu. Smatramo da je nepotrebno i naivno da se u ovu avanturu upuštaju sami predsjednici udruga jer zasigurno neće dobro završiti.

Što se tiče plana zaduživanja i otplata neophodno je donijeti odluke (nije potrebno mijenjati statut) kojima će se definirati najviši iznos do kojeg se neprofitna organizacija može jednokratno kratkoročno zadužiti (odnosi se na kredite na rok otplate do godine dana), kao i najviši iznos do kojeg neprofitna organizacija može jednokratno dati kratkoročne zajmove.

Čak, i ako se za planiranu godinu ne planira zadužiti, bitno je da odlukama definira limite jer se tako, ako zaista dođe do potrebe za zaduživanjem, organizacija ipak može zadužiti bez obzira što to nije definirano financijskim planom.

Uz navedene odluke plan zaduživanja i otplata sadrži visinu planiranih primitaka od dugoročnog zaduživanja temeljem primljenih kredita i zajmova, primitaka od prodaje vrijednosnih papira, dionica i udjela u glavnici, primitaka od povrata glavnice danih zajmova te izdataka od danih dugoročnih zajmova, ulaganja u vrijednosne papire, dionice i udjele u glavnici te otplata glavnice primljenih dugoročnih kredita i zajmova.

Bitno je napomenuti da u financijskom planu neprofitne organizacije mora biti vidljiv planirani rezultat poslovanja za koji se očekuje da će ga neprofitna organizacija ostvariti na dan 31. prosinca godine koja prethodi godini za koju se donosi financijski plan.

Rezultat poslovanja sastoji se od prenesenog manjka odnosno viška iz prethodnih godina i očekivanog manjka odnosno viška za godinu koja prethodi godini za koju se donosi financijski plan. Preneseni manjkovi, odnosno viškovi iz prethodnih godina ne moraju biti nužno pokriveni, odnosno iskorišteni (utrošeni) u godini za koju se sastavlja financijski plan.

3.4 Izmjene i dopune financijskog plana (rebalans)

Pravilnikom je propisano da se izmjene i dopune financijskog plana provode tijekom godine po postupku za donošenje financijskog plana te je preporučljivo rebalans raditi najmanje jednom godišnje ili u slučaju značajnih odstupanja nastalih prihoda i rashoda u odnosu na planirane, kao i u slučaju nastanka novih obveza za čije podmirenje sredstva nisu osigurana te u slučaju smanjenja prihoda uz čije je ostvarenje vezano podmirenje već nastalih obveza.

Bitno je da se prilikom izrade plana donese odluka temeljem koje se određuje postotak odstupanja stvarno nastalih prihoda i rashoda od planiranih. U trenutku kada odstupanja premaše definirani postotak neophodno je raditi rebalans financijskog plana.

4. Zaključak

Zašto je pitanje udruga važno državi, ali i javnosti, govori podatak da je proračunom svake godine predviđeno oko 600 milijuna kuna za financiranje nevladinih udruga. Tome treba pridodati i nemale iznose koji se za rad udruga izdvajaju iz lokalnih proračuna pa interes javnosti, na što se troši i kako se raspodjeljuje taj silni novac, nije za čuditi. Sve ove izmjene zakona (uvođenje Izvještaja o potrošnji proračunskih sredstava, financijski plan, upitnik itd.) donesene su kako bismo rasvijetlili na što se troše milijuni kuna iz javnog proračuna, unijeli transparentnost i na koncu riješili pitanje brojke od oko 50 000 udruga u Hrvatskoj.

Već smo počeli s prvim korakom ove godine te je predan Izvještaj o potrošnji proračunskih sredstava. Obrazac PROR-POT jedan je od sistema kontrole uloženih sredstava te njegovom primjenom dobit ćemo novu i bolju sliku o potrošnji sredstava iz javnih izvora. Sada javnost očekuje prve povratne informacije.

I za kraj da razjasnimo rokove donošenja financijskog plana. Financijski plan za 2016. godinu ne sastavlja se temeljem ovog Pravilnika već je zbog njegova kasnog donošenja dana mogućnost obveznicima da navedeni plan izrađuju temeljem Zakona o financijskom poslovanju i računovodstvu neprofitnih organizacija koji propisuje da financijski plan neprofitne organizacije mora sadržavati plan prihoda i rashoda, plan zaduživanja i otplata te obrazloženje financijskog plana i usvaja se do 31. prosinca 2015.

Prvi financijski plan koji neprofitna organizacija mora temeljiti na odredbama ovog Pravilnika izrađuje se tek u 2016. godini za 2017. godinu pa bismo ovo kašnjenje donošenja Pravilnika mogli nazvati srećom u nesreći jer nam pruža duži period prilagodbe nametnutim uvjetima planiranja, koje je kod mnogih neprofitnih organizacija gotovo nemoguća misija.

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Changes in financial operations and accounting of non-profit organizations

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Abstract: The reasons for the adoption of new laws and regulations with regard to non-profit organizations are under-developed conditions of providing financial support to associations, but also the feedback of the funds given to the disposal within different projects. This Ordinance was the only option for associations in order to prevent the possibility of abuse in the use of funds for implementing programs and projects, and ultimately presenting the transparency of an association. Non-profit organizations, i.e. associations of double-entry bookkeeping, once again met with the modification of the Ordinance prescribed by the law of financial operations and accounting of non-profit organizations. Associations, finding themselves in a dilemma as to what their next step should be, have to determine a way of conducting the self-assessment function of financial management and control of non – profit organizations. They also have to apply methodology for making the way and terms for the execution of their financial plan. New Ordinance consists of several sections which we will present in continuation. This law predicted the need of filling in the questionnaires in order to verify that the Associations use their funds legally, in a dedicated and purposeful manner, but also to get feedback on the funds invested in various projects. The first financial plan that non-profit organizations have to base on the provisions of this Ordinance shall be drawn up in 2016 for 2017, and we could call this delay a blessing in disguise because it gives us longer period of adjustment to imposed conditions of planning, as well as another year in which we will not find out whether the funds are invested wisely.

Keywords: *Non-profit organization, Ordinance, questionnaire, resources*

Financial ratios of commercial banks in the Republic of Croatia

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Abstract. Banks are an important part of the financial system and they have an important role in contributing to the economic development of the country. They play a vital role in the distribution of a country's economic resources. Banks are intermediaries between savings and investors. If banks have poor indicators, it can have repercussions for the country's economy which leads to the conclusion that a safe and profitable banking system is of utmost importance to a country. The financial crisis has also affected the business operations of banks in Croatia. This paper examines the performance of commercial banks in the Republic of Croatia in the period from 2009. to 2014. Profitability, liquidity, capitalization and credit quality are shown through financial ratios analysis. The database used for the analysis was created from the annual reports of banks, the newsletters published periodically by the Croatian National Bank, and other publicly available information.

Key words: banks, financial ratios, financial crisis, Republic of Croatia

1. Profitability Ratios

In the banking literature two measures are used to assess the profitability of a certain bank. First one is Return on Assets (ROA) and the second one is Return of Equity (ROE). ROA is a measure of bank's profitability which shows the quality of bank's assets management. It also measures the managerial efficiency (Hasan and Bashir, 2003). ROA is calculated as a ratio between profit after taxation and average total assets and it shows how much money bank earned on each monetary unit of assets. Desirable ROA value depends on the intensity of company's assets. Success of a bank is perceived if ROA is higher than 1 percent. ROE is calculated as a ratio between profit after taxation and average or total equity. Value of ROE required for successful business activities of a bank amounts 8 – 10 percent.

Table 1. Average bank profitability in Republic of Croatia measured by average return on bank's assets and capital

Year	ROAA	ROAE
2014	0,50%	2,80%
2013	0,20%	0,80%
2012	0,80%	4,80%
2011	1,20%	6,90%
2010	1,10%	6,50%
2009	1,10%	6,40%
2008	1,60%	9,90%
2007	1,60%	10,90%

Source: HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

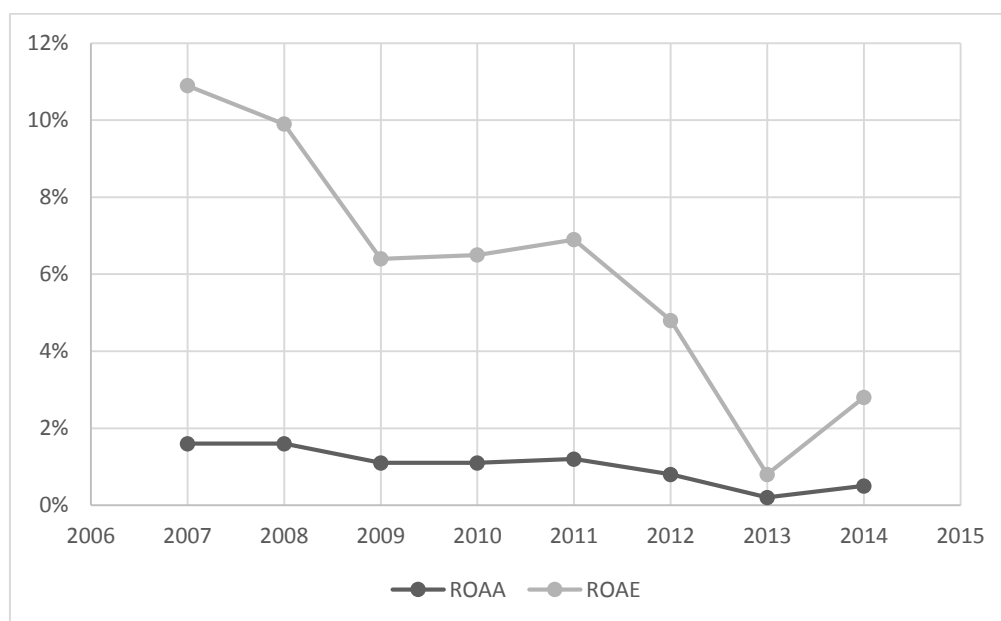


Figure 1. Average bank profitability in Republic of Croatia measured by average return on bank's assets and capital

Source: Author's creation according to HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

2. Management Efficiency Ratios

Management efficiency is reflected in operating costs management. Operating costs consist of employee costs, material costs and amortization. They are the result of the successful bank management. Salaries and bonuses can represent a significant percentage in the structure of bank costs. Similarly, large banks have high values of capital, especially IT equipment that are amortized relatively quickly and must be frequently replaced. The profit of a bank is directly related to the cost. Operating costs are measured by CIR (Cost to Income Ratio), which is calculated as ratio between operating costs and total revenue. This ratio reflects the bank's ability to cover operating costs. High CIR value in financial institutions is equivalent to low productivity in the real sector. CIR shows how many monetary units are needed in certain period of time to generate one monetary unit of revenue. If the ratio increases, it means that costs are growing at a higher rate than revenue. Control of noninterest costs is the most important in the process of reducing CIR, since the costs of interest are, however, mainly influenced by exogenous (market) factors (Trip, 1998). High CIR directly reflects on quality and price of loans. CIR is generally regarded as a benchmark in comparison among banks (Cochea, 2000, Asher, 1994). Little (2008) identifies five key performance indicators of European banks: culture of cost rationing, high degree of automation and investment in IT equipment, clear decision – making hierarchy, high degree of decentralization and focus on costs that are directly related to generating income. Higher ratio implies less efficient management (Kosmidou, 2008). Operating costs have a negative effect on the bank profitability (Abreu and Mendes, 2001, Sufian, 2011). It is expected that banks with high costs charge higher margins to cover their costs (Maudos and de Guevara, 2004). Also, greater operational efficiency enables banks to lower interest margins through lower loan rates or higher deposit rates (Claeys and Vander Venne, 2008).

Table 2.: Operating costs management ratio

Year	Cost to income ratio (CIR)
2014	51%
2013	52%
2012	52%
2011	48%
2010	48%
2009	50%
2008	52%
2007	52%

Source: HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

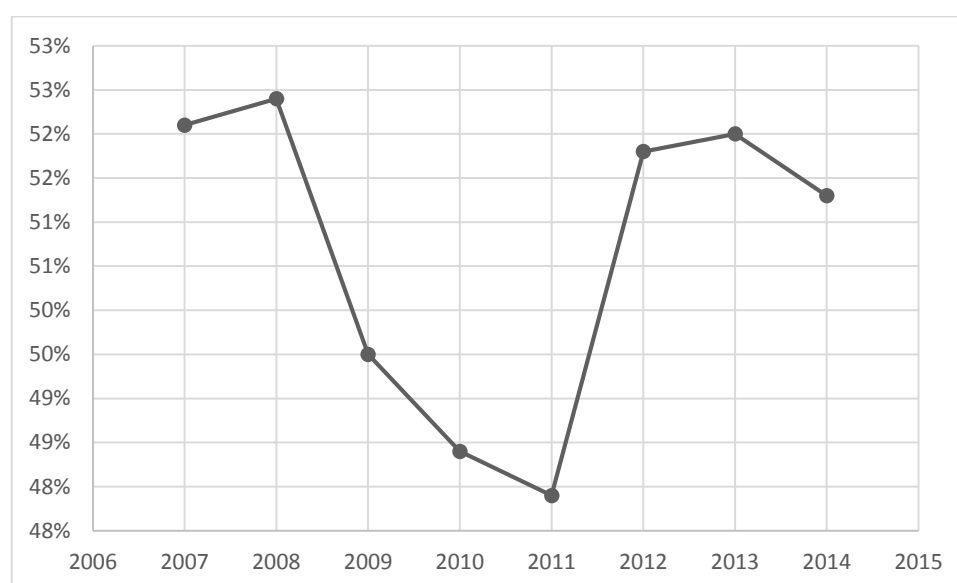


Figure 2. Operating costs management ratio

Source: Author's creation according to HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

3. Capitalization Ratios

In general, the banks are expected to absorb losses generated by particular bad loans from their operating income. But, the problems emerge with unexpected, extraordinary losses that cannot be absorbed from regular income. Bank's capital is the "first line of defense" against these unexpected shocks. The capital adequacy ratio, as a measure of a bank's capitalization is calculated as the ratio between capital and risk-weighted assets. In order to ensure that banks can absorb a reasonable level of losses before they become insolvent, a minimal capital adequacy ratio is defined by international standards. Minimal capital adequacy ratio is intended for protection of depositors and promoting the stability and efficiency of the banking system. Regulators demand that banks maintain capital adequacy ratio above the required minimum level as a corrective for excessively risky loans and investments. In the analysis of bank profitability, unavoidable variable is the capital adequacy ratio. Better capitalized banks should achieve higher profitability. That is confirmed by Berger (1995), Abreu and Mendes (2001), Staikouras and Wood (2003), Athanasoglu, Brissimis and Delis (2005), Kosmidou (2008), Gul, Irshad and Zaman (2011) and Olalekan and Adeyinka (2013). Some studies have shown that banks which have high capital adequacy ratio operate cautiously and ignore potentially profitable investments (Goddard, Molyneux and Wilson, 2004). At the same time,

better capitalized banks typically have less need for external financing, what results in greater profitability (Pasiouras and Kosmidou, 2007).

Table 3. Capital Adequacy Ratio

Year	Capital Adequacy Ratio (CAR)
2014	22%
2013	21%
2012	21%
2011	20%
2010	19%
2009	16%
2008	15%
2007	16%

Source: HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

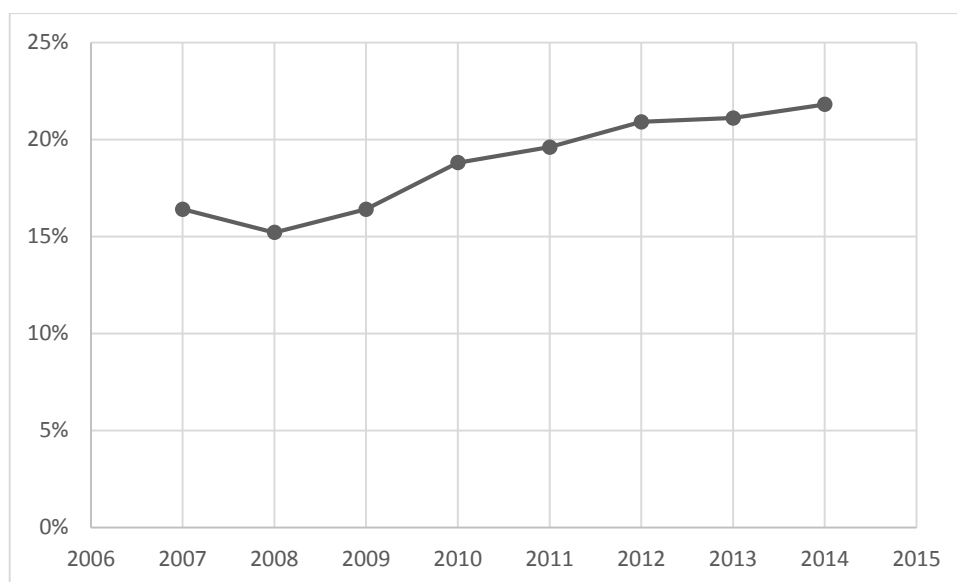


Figure 3. Capital Adequacy Ratio

Source: Author's creation according to HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

4. Liquidity Ratios

Liquidity is defined as the ability of a bank to settle their obligations within maturity. It is determined by comparing maturity of the loans on the asset side of balance sheet and asset funding sources on the liability side of balance sheet. Although the liquidity is crucial for bank's operations, high liquidity reduces income and negatively influences returns (Atahnasoglou, Delis, Staikouras, 2006). High liquidity can also result in lower interest rates which usually lead to increased demand for loans. In this way, high liquidity in banks stimulates economic growth. The liquidity of banks can be measured using three indicators:

1. liquid assets to total assets ratio,
2. liquid assets to total deposits ratio, and
3. total loans and total assets ratio.

In this research, third indicator will be presented. Loans are less liquid than other components of a bank's assets. The higher value of this ratio indicates lower liquidity of the bank.

Table 4.Total Loans to Total Assets Ratio

Year	Total Loans to Total Assets Ratio
2014	64%
2013	66%
2012	67%
2011	68%
2010	68%
2009	67%
2008	67%
2007	63%

Source: HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

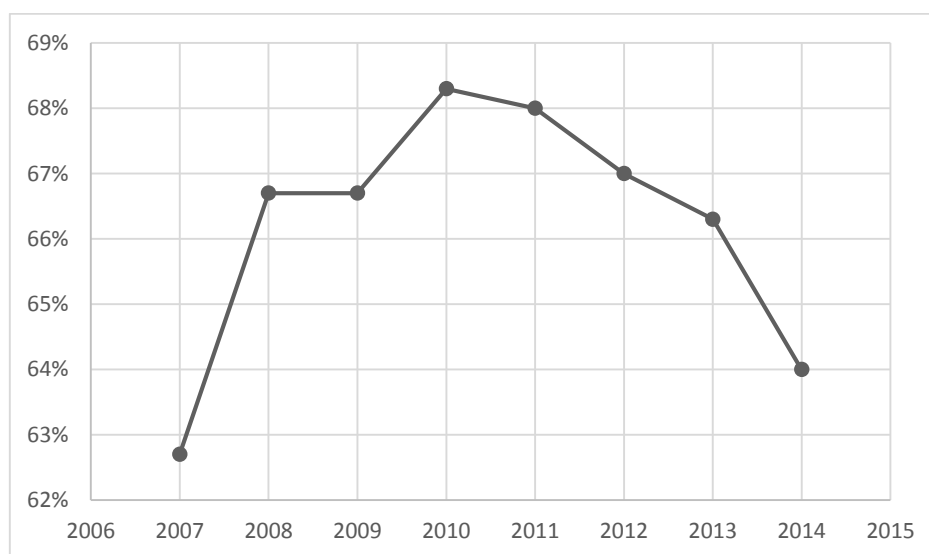


Figure 4.Total Loans to Total Assets Ratio

Source: Author's creation according to HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

5. Funding Sources Ratios

Deposit ratio is the ratio between deposits held by banks and total assets and it shows attracted deposits contribute to the financing of bank's assets. Deposits are the main source of bank's assets and represent a cheap financing source for the bank (Roman, Tomuleasa, 2013). Financing costs are calculated as the ratio between costs of deposit interests and total deposits.

Table 5. Share of Deposits in Total Assets

Year	Share of Deposits in Total Assets
2014	72%
2013	71%
2012	69%
2011	69%
2010	69%
2009	68%
2008	67%
2007	68%

Source: HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

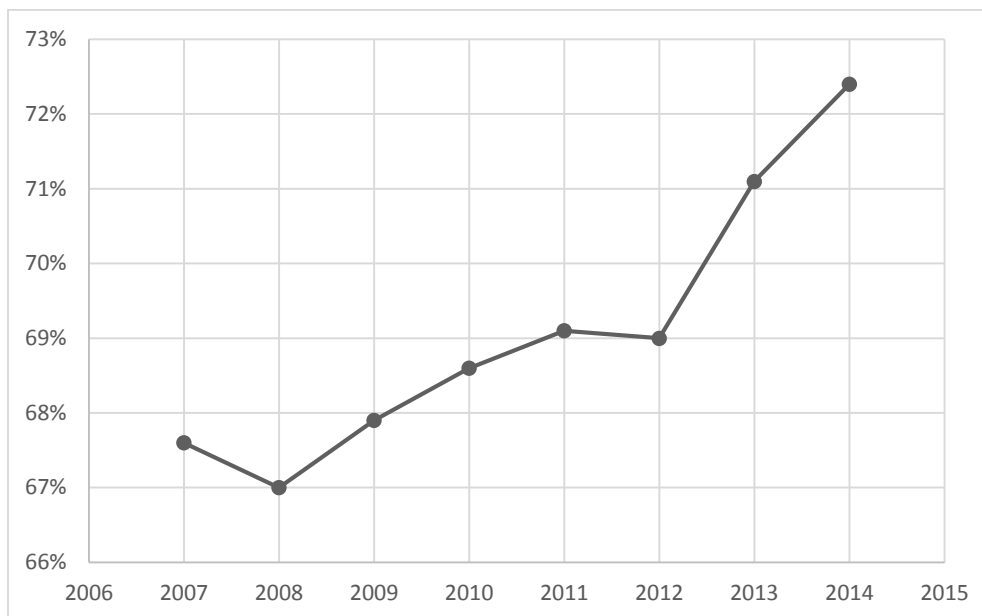


Figure 5. Share of Deposits in Total Assets

Source: Author's creation according to HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

6. Income Diversification Indicators

Deregulation and increased competition forced banks to expand their activities and to develop new lines of business alongside their traditional activities. Banks diversify their income by engaging in new activities such as the issuing and trading securities, investment banking brokerage and other activities that generate noninterest income. Cross – country bank analysis in eleven developing countries (Sanya and Wolfe, 2011) has showed that diversified income positively affects profitability and reduces insolvency of banks. NIIR variable is equal to the proportion of noninterest income in total income where noninterest income comprises different types of charges. Gross values of charges are usually used, since it is difficult to determine the cost of certain charge because it is often independent of noninterest income. High noninterest costs carry certain risks. Namely, there is a possibility of losing clients if charges are constantly increasing. Also, the growth of noninterest income may be related to a stronger credit activity, which increases the volatility risk of income. Noninterest income can be divided into those generated by traditional banking activities and those generated by untraditional banking activities (such as investments in financial innovations, derivatives etc.).

Table 6. Share of Noninterest Income in Total Income

Year	Share of Noninterest Income in Total Income
2014	29,0%
2013	29,4%
2012	30,9%
2011	27,7%
2010	29,9%
2009	37,5%
2008	30,1%
2007	32,5%

Source: HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

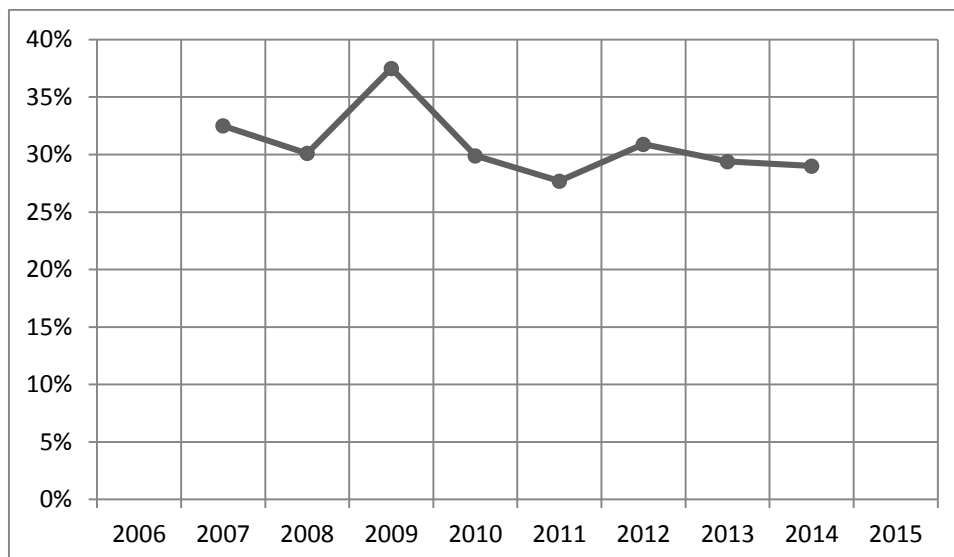


Figure 6. Share of Noninterest Income in Total Income

Source: HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

7. Market Concentration Measures

Concentration is a measure of market power. Market power can be defined as the ability of companies to increase the price above their marginal costs without reducing their total sales. A higher level of concentration implies a market in which larger banks that can effectively benefit from economies of scale are present. On the banking market with a higher concentration, customers have less choice and market power of some banks is higher. Under this approach, a higher concentration will be positively correlated with the profitability of banks. Concentration Ratio and Herfindahl – Hirschman Index are most frequently used as a measure of concentration. In this study, the concentration index CR5 which measures asset proportion of five largest banks in banking sector will be used as a measure of market structure.

Table 7. Total Assets Share of Five Largest Croatian Banks in Total Assets of Croatian Banking System

Year	CR5
2014	72%
2013	73%
2012	74%
2011	76%
2010	75%
2009	75%
2008	72%
2007	72%

Source: HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

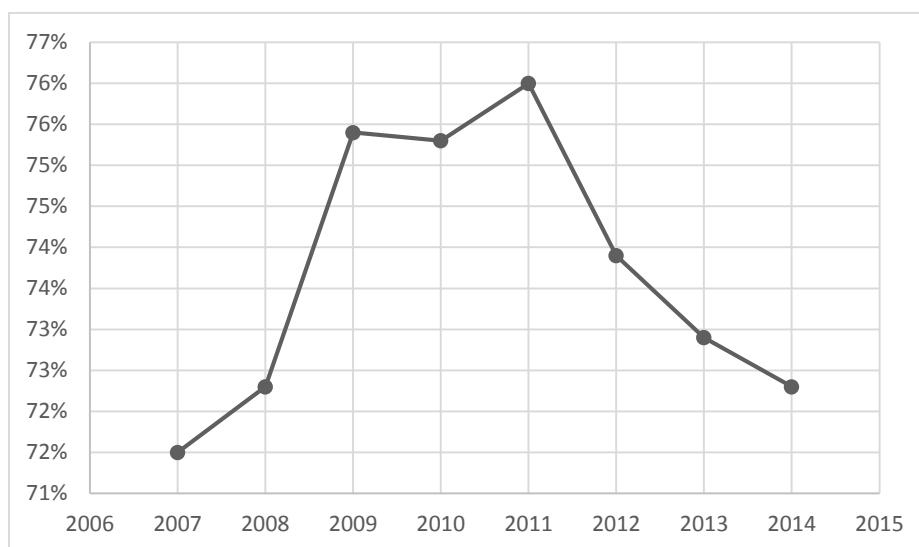


Figure 7.Total Assets Share of Five Largest Croatian Banks in Total Assets of Croatian Banking System

Source: Author's creation according to HNB (2007. – 2014.), Bilten o bankama, available at website: http://www.hnb.hr/publikac/bilten-o-bankama/hbilten_o_bankama.htm

8. Conclusion

This paper presents business performance of banks in the Republic of Croatia through series of indicators. Profitability indicators (ROAA and ROAE), despite the good operational costs management, have a downward trend. It is the consequence of financial crisis, particularly because of the decreasing economic activity in some sectors (such as construction) and reduced demand for house and car loans, traditionally the most abundant income of banks. Capitalization of the Croatian banking system is very good, capital adequacy ratios are well above the legal minimum, indicating the safety of the Croatian banking system. It is also supported by liquidity, sources of financing and revenue structure. In the traditional banking system, such as Croatian, loans constitute the most significant component of bank's assets, deposits are the most important source of financing, while interest income is most significant part of income structure. Croatian banks have avoided the challenge of greater presence in the financial markets, the so-called casino banking, which has (bearing in mind the financial crisis) positively affected the stability of the Croatian banking system. As far as the market concentration measures are concerned, Croatian banking system is highly concentrated, significantly higher than the banking systems of Germany and Italy, but on the other side significantly less than the banking systems of Estonia, Lithuania, Finland and Netherlands.

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Prijevare u financijskim izvještajima – odgovornosti za sprječavanje i otkrivanje

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Sažetak. Pogrešno prikazivanje, odnosno nepravilnosti u financijskim izvještajima mogu biti uzrokovane prijevarama i pogreškama. Za razliku od pogreške, koja predstavlja nenamjeran propust, najčešće računovodstvenog osoblja klijenta, prijevara predstavlja namjernu radnju koja je najčešće motivirana stjecanjem nepripadne materijalne koristi i oblikovanjem zavaravajućih financijskih izvještaja. U okviru ovog članka naglasak je na prijevarnom prikazivanju u financijskim izvještajima jer se prijevare događaju u svim segmentima gospodarstva. Naime, svako društvo je izloženo riziku prijevarnog prikazivanja u financijskim izvještajima neovisno o obliku, vlasništvu, veličini i ostalim značajkama poslovanja. Pogrešno, odnosno prijevarno prikazivanje u financijskim izvještajima može biti uzrokovano prijevornim financijskim izvještavanjem ili protupravnim prisvajanjem imovine. Kako bi se minimalizirao rizik prijevara u financijskim izvještajima potrebno je aktivno sudjelovanje svih sudionika lanca financijskog izvještavanja: od uprave koja je odgovorna za sastavljanje i prezentiranje financijskih izvještaja do eksternih revizora koji utvrđuju vjerodostojnost tih izvještaja. U okviru ovog rada autori obrađuju čimbenike rizika prijevare, tj. faktore koji uvjetuju prijevare, kao i odgovornosti za njihovo sprječavanje i otkrivanje. U kontekstu odgovornosti za sprječavanje i otkrivanje prijevara u financijskim izvještajima razmatraju se uloge pojedinih sudionika u lancu financijskog izvještavanja s naglaskom na razgraničenje odgovornosti uprave, interne i eksterne revizije.

Ključne riječi: *prijevare, trokut prijevare, eksterna revizija, interna revizija*

1. Uvod

Veliki korporativni skandali koji su se dogodili u posljednjih 20-ak godina bili su uzrokovani prijevarama i doveli su do gubitka radnih mjesta, propadanja korporacija, propadanja mirovinskih fondova te narušavanja povjerenja u procese financijskog izvještavanja i revizije. Prijevare se mogu klasificirati na nekoliko vrsta. Tako primjerice, sukladno Međunarodnom revizijskom standardu 240 „Revizorove odgovornosti u vezi s prijevarama u reviziji financijskih izvještaja“ (dalje MRevS 240) razlikuju se dvije vrste prijevarnog prikazivanja: pogrešno prikazivanje nastalo zbog prijevarnog financijskog izvještavanja i pogrešno prikazivanje nastalo zbog protupravnog prisvajanja imovine (MRevS 240, 2010.). Prema Udruženju ovlaštenih istražitelja prijevare (eng. *Association of Certified Fraud Examiners – ACFE*) prijevare se klasificiraju u tri kategorije (ACFE, 2014.): zloupotreba imovine, korupcija i prijevare u financijskim izvještajima. Zloupotreba imovine najčešći je oblik prijevara i događa se u čak 85 % slučajeva, međutim, ovaj oblik prijevara uzrokuje najniže gubitke. Tako primjerice, prema rezultatima istraživanja za 2014. godinu zloupotreba imovine uzrokovala je prosječan gubitak od 130.000 \$. S druge pak strane, prijevare u financijskim izvještajima događaju se u tek 9 % slučajeva, međutim, uzrokuju najveće gubitke, a prosječan

gubitak od ovih prijevarena iznosi milijun dolara (ACFE, 2014.). Prijevarno financijsko izvještavanje dovelo je do nekih od najvećih korporativnih skandala kao što su Enron, WorldCom, Parmalat itd. Korupcija kao oblik prijevarnog ponašanja javlja se u 37 % slučajeva i uzrokuje prosječan gubitak od 200.000 \$. Procjenjuje se da prosječna korporacija godišnje gubi oko 5 % prihoda zbog prijevara, međutim, bitno je naglasiti da se štete od prijevara i zloupotreba ne mogu točno utvrditi jer mnoge nisu otkrivene te se može govoriti samo o procijenjenim gubicima. Iz prethodno navedenog može se uočiti kako su svi poslovni subjekti u većoj ili manjoj mjeri izloženi riziku prijevara te bi poduzeća, neovisno o svojoj veličini, strukturi vlasništva ili vrsti djelatnosti trebala identificirati i procijeniti rizike nastanka prijevara te u svoje poslovanje implementirati mjere za sprječavanje prijevara.

2. Prijevare u financijskim izvještajima

2.1. Pojam prijevara

Pogrešno prikazivanje, odnosno nepravilnosti u financijskim izvještajima mogu biti uzrokovane prijevarama i pogreškama. Za razliku od pogreške, koja predstavlja nenamjerno propust, najčešće računovodstvenog osoblja klijenta, prijevara predstavlja namjernu radnju u kojoj mogu sudjelovati svi zaposleni kod klijenta, uključujući i one koji su zaduženi za upravljanje, koja je najčešće motivirana stjecanjem nepripadne materijalne koristi i oblikovanjem zavaravajućih financijskih izvještaja. Prema MRevS-u 240 prijevara se definira kao namjerna radnja jedne ili više osoba unutar menadžmenta, onih koji su zaduženi za upravljanje, zaposlenika ili trećih stranaka, koja uključuje varanje kako bi se stekla nepravdna ili nezakonita prednost. Udruženje ovlaštenih istražitelja prijevara definira prijevaru kao namjerno čin ili propust kreiran s ciljem obmane koji rezultira gubicima žrtve i/ili postizanjem cilja izvršitelja. Ovisno o akterima koji su uključeni u prijevaru razlikuju se prijevara od strane menadžmenta i prijevara od strane zaposlenika.

Sukladno MRevS-u 240 dvije su vrste namjernog pogrešnog (prijevarnog) prikazivanja (MRevS 240, 2010.):

- ✓ pogrešno prikazivanje nastalo zbog prijevarnog financijskog izvještavanja (i)
- ✓ pogrešno prikazivanje nastalo zbog protupravnog prisvajanja imovine.

Dok prijevarno financijsko izvještavanje uključuje namjerni pogrešni prikaz te izostavljanje iznosa ili neobjavljivanje podataka s ciljem zavaravanja korisnika financijskih izvještaja, dotle protupravno prisvajanje imovine uključuje krađu imovine poslovnog subjekta. Prema odredbama MRevS-a 240 prijevarno financijsko izvještavanje može uključivati (MRevS 240, 2010.):

- ✓ manipulaciju, falsificiranje (uključujući krivotvorenje) ili izmjenu računovodstvenih evidencija ili potkrjepljujuće dokumentacije iz koje su financijski izvještaji pripremljeni
- ✓ pogrešno prikazivanje ili namjerne propuste u financijskim izvještajima o događajima, transakcijama ili ostalim značajnim informacijama (te)
- ✓ namjernu krivu primjenu računovodstvenih principa vezanih uz iznose, klasifikaciju, način prezentiranja ili objave.

Protupravno prisvajanje imovine odnosno zlouporaba imovine uključuje krađu imovine poduzeća i može biti provedeno na razne načine (uključujući preusmjeravanje priljeva, krađu materijalne i nematerijalne imovine, navođenje poslovnog subjekta na plaćanje robe i usluga koje nisu primljene te korištenje imovine subjekta za osobne potrebe). Zlouporaba imovine je često popraćena krivotvorenim ili neprimjerenim spisima i evidencijama kako bi se prikrio nedostatak imovine.

Prijevare u financijskim izvještajima mogu biti provedene na različite načine, a u tablici 1 navedeni su najčešći oblici internih i eksternih prijevare

Tablica 1: Najčešći oblici internih i eksternih prijevare

INTERNE PRIJEVARE		EKSTERNE PRIJEVARE
ZAPOSLENICI	MENADŽERI	
Krađa zaliha	Pogrešno prikazivanje rezultata poslovanja	Krivotvoreni računi primljeni od vanjskih stranki
Zloupotreba gotovine	Lažni računi za prihode i troškove	Prezentiranje lažnih informacija
Krađa novca primljenog od kupaca	Isisavanje novca pomoću prijateljskih tvrtki	Krađa intelektualnog vlasništva
Krivotvorenje financijskih isprava	Krivotvorenje isprava	Lažni računi od dobavljača
Lažni računi za troškove	Primanje i davanje mita	Obmana kupaca i investitora
Novac za plaćanje na crno	Novac za plaćanje na crno	Podmićivanje/tajne provizije
Mito	Nepoštene kupoprodaje na štetu tvrtke	Nepoštene ponude cijena
Posudbe koje se ne vraćaju	Insajderska trgovina	Prijevarni ugovori
Lažno prikazivanje radnih sati i učinaka	Neplaćanje računa	Neplaćanje računa od strane kupaca
Korištenje službenih automobila u privatne svrhe	Neisporuka naplaćene robe	Neisporučivanje naplaćene robe od strane dobavljača
Korištenje usluga poduzeća u privatne svrhe	Obmana kupaca	Obmana dobavljača
Rad za vlastite potrebe u toku radnog vremena	Varanje na kvaliteti i količini isporučene robe	Varanje na kvaliteti i količini isporučene robe

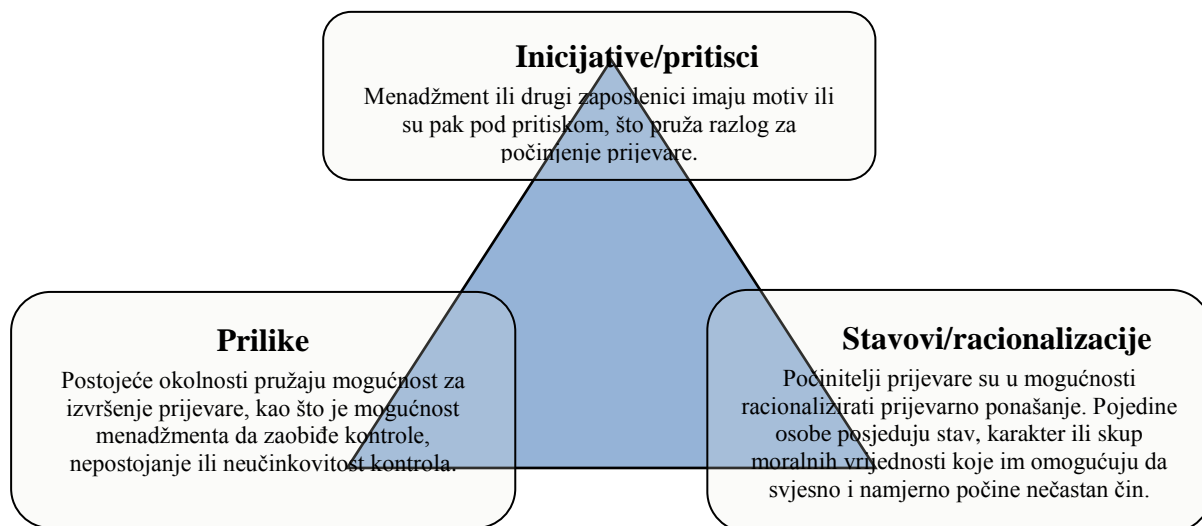
Izvor: KPMG, Fraud Awareness Survey, Citirano prema: Belak, V., Poslovna forenzika i forenzično računovodstvo, Borba protiv prijevare, Belak Excellens d.o.o., Zagreb, 2011., str. 120.

Kao motivi za prijevarno financijsko izvještavanje u Republici Hrvatskoj se obično javljaju tri osnovna motiva za prijevaru (Bešvir, 2007.):

- ◊ podcjenjivanje rezultata financijske godine u računu dobiti i gubitka, precjenjivanje obveza u pasivi bilance te podcjenjivanje stanja aktive u bilanci (npr. zbog smanjenja osnovice poreza na dobit, zadržavanja isplata dividendi i sl.)
- ◊ precjenjivanje rezultata financijske godine u računu dobiti i gubitka podcjenjivanjem obveza u pasivi bilance te precjenjivanjem stanja aktive bilance (primjerice zbog stvaranja slike uspješnosti, kredibiliteta, isplata dividendi i sl.) (te)
- ◊ pronevjera – protupravno prisvajanje imovine.

2.2. Faktori koji uzrokuju prijevaru

Čimbenici rizika prijevare mogu se definirati kao događaji ili uvjeti koji indiciraju da se prijevara dogodila, odnosno kao faktori koji su obično prisutni kada se prijevara dogodi. Bitno je napomenuti da čimbenici rizika prijevare ne upućuju nužno na postojanje prijevare u određenom poslovnom subjektu, međutim, oni su uglavnom prisutni pri počinjenju prijevare. U cilju procjene rizika prijevare, čimbenici rizika prijevare klasificiraju se na temelju tri uvjeta koji se pojavljuju kod prijevare. Ta se tri uvjeta nazivaju „trokut prijevare“, a sastoje se od inicijativa, tj. pritisaka, prilika te stavova i racionalizacija. „Trokut prijevare“ prikazuje slika 1 (Ramos, 2016.).



Slika 1: Trokut prijevare

Bitno je naglasiti da su ova tri uvjeta u međusobnoj interakciji. Tako pojedinci, koji su inače poštteni, mogu počiniti prijevaru i namjerno pogrešno iskazati financijske informacije ako djeluju u okruženju koje im nameće određene pritiske. Posljednjih godina uz „trokut prijevare“ razmatra se i tzv. „dijamant prijevare“ koji uz inicijativu, prilike i racionalizaciju uključuje i sposobnost počinitelja prijevare. Naime, brojni su korporativni skandali pokazali da neće doći do prijevare ako nije prisutna i četvrta komponenta, odnosno ako počinitelj nema sposobnost da osmisli, provede i u konačnici prikrije prijevaru.

U „Dodatku 1“ MRevS-a 240 navedeni su primjeri čimbenika rizika prijevare s kojima se revizori mogu susresti u različitim situacijama, a klasificirani su na čimbenike rizika povezane s prijevarnim financijskim izvještavanjem te čimbenike rizika povezane s protupravnim prisvajanjem imovine. Za svaku od navedene dvije vrste prijevara čimbenici rizika su razvrstani na osnovi tri uvjeta koji su obično prisutni kada se prijevara dogodi: poticaji/pritisci, prilike te stavovi/opravljanja.

Kao primjeri čimbenika rizika prijevare povezani s pogrešnim prikazivanjem nastalim prijevarnim financijskim izvještavanjem uobičajeno se navode (MRevS 240, 2010.):

Poticaji/pritisci

- ◇ financijsku stabilnost ili profitabilnost ugrožavaju ekonomski uvjeti, industrijski ili poslovni uvjeti subjekta
- ◇ postoji pretjerani pritisak na menadžment da ispuni zahtjeve ili očekivanja trećih stranaka
- ◇ dostupne informacije koje ukazuju da je osobna financijska situacija menadžmenta ili onih koji su zaduženi za upravljanje ugrožena financijskim poslovanjem subjekta
- ◇ postoji pretjerani pritisak na menadžment ili operativne djelatnike da ispune financijske ciljeve određenih od strane onih koji su zaduženi za upravljanje, uključujući poticajne ciljeve prodaje ili profitabilnosti.

Prilike

- ◇ priroda industrije ili poslovanja subjekta pruža prilike za prijevarno izvještavanje
- ◇ nadgledanje menadžmenta nije efikasno
- ◇ postoje kompleksne ili nestabilne organizacijske strukture
- ◇ komponente sustava internih kontrola su nedostatne.

Stavovi/opravljanja

- ◇ menadžment neučinkovito priopćava, uvodi, podržava ili nameće vrijednosti ili etičke standarde subjekta ili priopćava neprimjerene vrijednosti ili etičke standarde,

- ◇ nefinancijski menadžment pretjerano sudjeluje u odabiru računovodstvenih načela i provedbi značajnih procjena
- ◇ praksa kršenja zakona o vrijednosnim papirima ili drugih zakona i regulative ili sudski sporovi protiv subjekta, njegovog višeg menadžmenta ili onih koji su zaduženi za upravljanje zbog prijevара ili prekršaja zakona i regulative
- ◇ pretjeran interes menadžmenta za zadržavanje ili povećavanje vrijednosti subjektivih cijena dionica ili trenda zarada
- ◇ praksa menadžmentovog obvezivanja analitičarima, kreditorima i ostalim trećim strankama na ostvarivanje agresivnih ili nerealističnih prognoza
- ◇ menadžment propušta pravodobno ispraviti značajne nedostatke u internim kontrolama
- ◇ interes menadžmenta za poduzimanje neprimjerenih načina minimaliziranja zarada zbog oporezivanja
- ◇ slab moral među višim menadžmentom
- ◇ vlasnici-menadžeri ne prave razliku između osobnih i poslovnih transakcija
- ◇ neslaganje između dioničara u subjektima pod snažnom kontrolom
- ◇ ponavljajući pokušaji menadžmenta da opravda marginalno ili neprimjereno računovodstvo temeljem značajnosti
- ◇ zategnuti odnosi između menadžmenta i postojećeg ili prethodnog revizora.

I u slučaju zloupotrebe imovine čimbenici rizika su podijeljeni na osnovi tri uvjeta koji su obično prisutni kada nastane pogrešno prikazivanje zbog prijevара. Kao primjeri čimbenika rizika povezani s pogrešnim prikazivanjima nastalim zbog zloupotrebe imovine navode se (MRevS 240, 2010.):

Poticaji/pritisци

- ◇ osobne financijske obveze mogu stvoriti pritisak na menadžment ili djelatnike s pristupom novcu ili drugoj imovini podložnoj krađi ili zloupotrebi
- ◇ negativan odnos između subjekta i djelatnika s pristupom gotovini ili drugoj imovini podložnoj krađi može motivirati te djelatnike na zloupotrebu imovine.

Prilike

- ◇ određene karakteristike ili okolnosti mogu povećati podložnost imovine zloupotrebi (i)
- ◇ neprimjerene interne kontrole nad imovinom mogu povećati podložnost te imovine zloupotrebi.

Stavovi/oprаvdanja

- ✓ zanemarivanje potrebe nadgledanja ili smanjivanja rizika povezanog sa zloupotrebom imovine
- ✓ zanemarivanje internih kontrola nad zloupotrebom imovine zaobilaznjem postojećih kontrola ili propuštanjem ispravljanja poznatih nedostataka u internim kontrolama
- ✓ ponašanje kojim se pokazuje nezadovoljstvo subjektom ili njegovim tretmanom djelatnika
- ✓ promjene u ponašanju ili stilu života koje mogu ukazivati da je došlo do protupravnog prisvajanja imovine (te)
- ✓ toleriranje sitnih krađa.

U „Dodatku 1“ MRevS-a 240 navedeni su primjeri čimbenika rizika prijevара relevantni za revizorovo razmatranje, međutim revizori ili druge osobe koje istražuju mogućnost nastanka prijevара u poduzeću mogu definirati dodatne čimbenike rizika specifične za određeno poduzeće (ovisno o veličini subjekta, vlasničkoj strukturi, uvjetima djelatnosti, ...).

3. Odgovornosti za sprječavanje i otkrivanje prijevара u financijskim izvještajima

Sprječavanje i otkrivanje prijevара u financijskim izvještajima zadatak je svih sudionika korporativnog upravljanja. Naime, iako je menadžment primarno odgovoran za sastavljanje i prezentiranje financijskih izvještaja te za oblikovanje efikasnog sustava internih kontrola ne mogu se zaobići ni uloge ostalih sudionika u lancu korporativnog izvještavanja u sprječavanju i otkrivanju prijevара. U tom smislu, u okviru ovog poglavlja se definiraju uloge i odgovornosti menadžmenta te internih i eksternih revizora u sprječavanju i otkrivanju prijevара.

3.1. Odgovornost menadžmenta

Menadžment je primarno odgovoran za sastavljanje i prezentiranje financijskih izvještaja te za oblikovanje sustava internih kontrola. Odgovornost menadžmenta i onih koji su zaduženi za upravljanje je uspostaviti efikasan sustav internih kontrola te održavati politike i postupke koji će osigurati da financijski izvještaji budu pripremljeni, u svim značajnim odrednicama, u skladu s primjenjivim okvirom financijskog izvještavanja. Sukladno t. 13. MRevS-a 240 osnovna odgovornost za sprječavanje i otkrivanje prijevара je na onima koji su zaduženi za upravljanje i menadžmentu subjekta.

Kako bi učinkovito izvršavao svoje dužnosti financijskog izvještavanja, menadžment bi trebao provoditi sljedeće aktivnosti (Rezaee, Riley, 2010.):

- identificirati i ocijeniti okolnosti, uvjete i čimbenike koji mogu voditi prijevarama u financijskim izvještajima
- ocijeniti i upravljati rizikom prijevarama u financijskim izvještajima koji je povezan s identificiranim okolnostima, uvjetima i čimbenicima te
- oblikovati i uvesti odgovarajući i učinkovit proces internih kontrola za sprječavanje i otkrivanje prijevarama u financijskim izvještajima.

Menadžment je, uz nadzor onih koji su zaduženi za upravljanje, osim uspostavljanja odgovarajućeg sustava internih kontrola, zadužen za stvaranje klime čestitosti i etičnog ponašanja te za stvaranje pozitivnog radnog okruženja u kojem će djelovati odgovorni i savjesni zaposlenici koji će poduzeti odgovarajuće aktivnosti kao reakciju na prijevarama koje su se dogodile ili postoji izvjesna sumnja da će se dogoditi. Menadžment je, dakle, odgovoran za postavljanje odgovarajućeg „tona s vrha“ i organizacijske kulture u kojoj će biti jasno definirano da se ne tolerira prijevorno ponašanje.

3.2. Odgovornost interne revizije

Interna revizija se može promatrati kao prva linija obrane protiv prijevarama zbog statusa i uloge interne revizije u sustavu korporativnog upravljanja. Interni revizori trebaju imati proaktivnu ulogu u prevenciji i otkrivanju prijevarama u financijskim izvještajima jer za razliku od eksternih revizora njihova uloga nije ograničena ni vremenskim ni prostornim resursima. S obzirom na svoj organizacijski status interni revizori su u najboljem položaju da kontinuirano nadziru sustav internih kontrola, procjenjuju rizike prijevarama, identificiraju moguće crvene zastavice odnosno znakove upozorenja te sprječavaju i otkrivaju prijevarama u organizaciji.

Funkcija interne revizije treba najprije provjeravati (Tušek, Žager, 2008.):

- Odnos prema riziku na najvišoj organizacijskoj razini – npr. jesu li članovi uprave skloni rizičnom ponašanju, boje li se rizika ili su između tih dviju krajnosti te kako se njihov stav odražava na organizaciju u cjelini.
- Strategije upravljanja rizicima – tretiraju li se ključni rizici u različitim područjima organizacije na odgovarajući način, odnosno je li se ignoriraju, prihvaćaju, minimiziraju, eliminiraju i tome slično.

- Opći sustav upravljanja rizicima – jesu li ugrađeni unutar organizacije, odražavaju li i predstavljaju strategiju spram specifičnih rizika na određenom području organizacije.

Sukladno standardima interne revizije, interni revizori trebaju imati odgovarajuća znanja potrebna za identifikaciju crvenih zastavica i pokazatelja koji ukazuju na moguću prijevare. Također, interni revizori moraju djelovati s dužnom pažnjom i odgovarajućom razinom profesionalnog skepticizma kako bi uočili nepravilnosti koje mogu ukazivati na moguće prijevorno ponašanje. Interna revizija je nadzorna funkcija i savjetodavna aktivnost menadžmenta te se interni revizori trebaju uključiti u borbu protiv prijevare na svim razinama. Oni mogu značajno doprinijeti sprječavanju pogrešaka i prijevare ako ispunjavaju svoju glavnu zadaću, a to je da opskrbljuju menadžment mišljenjem o efikasnosti interne kontrole, daju prijedloge za poboljšanje interne kontrole te informiraju o najnovijim tehnikama i metodologijama za otkrivanje prijevare (Tušek, Žager, 2008.).

U procesu istraživanja prijevare interni revizori trebaju procijeniti jesu li primjerene i učinkovite interne kontrole na mjestu za otkrivanje prijevare, oblikovati odgovarajuće procedure za otkrivanje prijevare, identificirati simptome i znakove upozorenja te obavijestiti primjerene razine menadžmenta o mogućim prijevarama. Interni revizori su u mogućnosti da otkriju i spriječe sve vrste prijevare u organizaciji – od prijevare zaposlenika do prijevare menadžmenta – međutim njihova učinkovitost u otkrivanju prijevare ovisi i o njihovoj poziciji u hijerarhijskoj strukturi poduzeća. Naime, na učinkovitost internih revizora u otkrivanju prijevare značajno utječe njihova neovisnost te potencijalni sukob interesa kojem mogu biti izloženi. Funkcija interne revizije može zaštititi poduzeće od prijevare u financijskim izvještajima ako su interni revizori učinkoviti u tri područja (Rezaee, Riley, 2010.):

- sprječavanju prijevare u financijskim izvještajima kroz adekvatne i učinkovite sustave internih kontrola
- otkrivanju prijevare u financijskim izvještajima provođenjem funkcije interne revizije te
- izvještavanjem otkrivene prijevare u financijskim izvještajima timu vrhovnog menadžmenta i revizorskom odboru.

3.3. Odgovornost eksterne revizije

MRevS 240 „Revizorove odgovornosti u vezi s prijevarama u reviziji financijskih izvještaja“ definira odgovornosti i ulogu eksternih revizora u otkrivanju prijevare i pogrešaka u financijskim izvještajima. Iako korisnici financijskih izvještaja očekuju da će revizori provodeći reviziju financijskih izvještaja otkriti prijevare i pogreške ako one postoje u financijskim izvještajima, bitno je naglasiti da, zbog karakteristika revizije i ograničenja u njenom provođenju, postoji rizik neotkrivanja značajnih pogrešnih prikazivanja u financijskim izvještajima nastalih zbog prijevare i pogrešaka, odnosno revizori ne moraju otkriti prijevare i pogreške u financijskim izvještajima unatoč provođenju revizije u skladu s MRevS-ima. U prilog tome idu i rezultati istraživanja koje je 2014. godine provelo Udruženje ovlaštenih istražitelja prijevare. Prema tom istraživanju eksterni revizori su tek na sedmom mjestu u otkrivanju prijevare, a otkrili su prijevare u samo 3 % promatranih slučajeva (ACFE, 2014.). Nešto učinkovitiji u otkrivanju prijevare su interni revizori koji su otkrili oko 14 % prijevare, a najveći broj prijevare otkriven je putem anonimne dojave (oko 42 % slučajeva) – bilo od strane zaposlenika, kupaca ili dobavljača ili pak slučajno (7 % slučajeva).

Revizija financijskih izvještaja rezultira razumnim uvjerenjem da financijski izvještaji kao cjelina ne sadrže značajna pogrešna prikazivanja nastala uslijed prijevare ili pogrešaka. Revizorova je odgovornost primjereno isplanirati i provesti reviziju u skladu s Međunarodnim revizijskim standardima kako bi mogao izraziti mišljenje o realnosti i objektivnosti financijskih izvještaja. Pri tome treba imati u vidu činjenicu da, bez obzira što je revizija

obavljena sukladno MRevS-ima, revizor ne može steći bezrezervno, odnosno apsolutno uvjerenje da će svojim postupcima otkriti značajna pogrešna prikazivanja u financijskim izvještajima zbog, prije svega, ograničenja u obavljanju revizije. Naime, zbog čimbenika kao što su korištenje prosudbi, primjena testiranja, postojanje inherentnih ograničenja internih kontrola i činjenice da su revizijski dokazi više indikativni nego što pružaju zaključke, postoji neizbježan rizik da će neka značajna pogrešna prikazivanja u financijskim izvještajima ostati neotkrivena, iako je revizija ispravno planirana i provedena u skladu s MRevS-ima.

U postupku revizije financijskih izvještaja revizoru je teže otkriti prijevare nego pogrešku, budući da je prijevare namjerna radnja smišljena i počinjena s ciljem prijevare i zavaravanja ne samo revizora, nego i ostalih korisnika financijskih izvještaja. Rizik neotkrivanja značajnih pogrešnih prikaza nastalih zbog prijevare veći je od rizika neotkrivanja značajnih pogrešnih prikaza zbog pogrešaka jer prijevare obično obuhvaća radnje kojima se ona pokušava prikriti, kao što je krivotvorenje, namjerno ispuštanje knjiženja transakcije ili namjerni pogrešni prikazi dostavljeni revizoru. Navedene pokušaje prikrivanja prijevare revizor će još teže otkriti ako su prisutni i zlonamjerni sporazumi kojima je cilj navesti revizora da povjeruje u vjerodostojnost nekih dokaza, premda su oni zapravo lažni. Također, rizik neotkrivanja značajnih pogrešnih prikazivanja veći je kod prijevare od strane menadžmenta, nego kod prijevare od strane zaposlenika budući da menadžment, s obzirom na svoju upravljačku poziciju, može zaobići kontrolne postupke i narediti podređenima pogrešno evidentiranje određenih poslovnih događaja (MRevS 240, 2010.).

Ako se nakon obavljene revizije financijskih izvještaja utvrdi pogrešno prikazivanje financijskih izvještaja nastalo uslijed prijevare to ne mora nužno značiti da je došlo do propusta u primjeni MRevS-a pri provođenju revizije jer revizijski postupci mogu biti nedjelotvorni za utvrđivanje namjernih pogrešaka, tj. prijevare zbog postojanja prikrivenih zlonamjernih sporazuma između menadžmenta, onih koji su zaduženi za upravljanje, zaposlenika ili trećih osoba.

4. Zaključak

U okviru ovog rada autori su obradili pojam prijevare, čimbenike rizika prijevare te odgovornosti pojedinih sudionika u lancu financijskog izvještavanja u sprječavanju i otkrivanju prijevare. U cilju sprječavanja i otkrivanja prijevare iznimno su bitni različiti oblici nadzora, kako internog tako i eksternog. U ovom radu naglasak je na razgraničavanju uloge menadžmenta, internih i eksternih revizora u kontekstu sprječavanja i otkrivanja prijevare u financijskim izvještajima.

Menadžment i oni koji su zaduženi za upravljanje imaju primarnu odgovornost za sprječavanje i otkrivanje prijevare u poduzeću. Naime, menadžment je odgovoran za procjenu rizika te oblikovanje odgovarajućeg sustava internih kontrola koji će minimizirati prijevare ponašanje. Menadžeri su ti koji šalju „signal s vrha“ i definiraju cjelokupno kontrolno okruženje u poduzeću te i u tom smislu najviše mogu doprinijeti sprječavanju i otkrivanju prijevare. Interni revizori, u okviru internog nadzora poduzeća, imaju sve aktivniju ulogu u sprječavanju prijevare i preventivnom djelovanju. Naime, s obzirom na svoj položaj i prisutnost u poduzeću, oni su u boljem položaju za otkrivanje prijevare od eksternih revizora. Interni revizori su zaduženi za procjenu rizika te ocjenu sustava internih kontrola te u tom smislu trebaju imati i proaktivnu ulogu u sprječavanju i otkrivanju prijevare u poduzeću. Iako otkrivanje prijevare nije primarna dužnost internih revizora, oni ipak trebaju imati odgovarajuća znanja o vrstama prijevare, načinima njihova sprječavanja i otkrivanja. Također, interni revizori moraju djelovati s dužnom pažnjom i odgovarajućom razinom profesionalnog

skepticizma kako bi uočili nepravilnosti koje mogu ukazivati na moguće prijevorno ponašanje. Interna revizija je nadzorna funkcija i savjetodavna aktivnost menadžmenta te se interni revizori trebaju uključiti u borbu protiv prijevare na svim razinama.

Eksterna revizija predstavlja naknadno pregledavanje i utvrđivanje realnosti i objektivnosti financijskih izvještaja te „mjeru vjerodostojnosti financijskih izvještaja“. Svrha je eksterne revizije povećati vjerodostojnost financijskih izvještaja. Međutim, eksterni revizori nisu, niti mogu biti odgovorni za sprječavanje i otkrivanje prijevare u financijskim izvještajima. Odgovornost eksternih revizora provesti je reviziju sukladno revizijskim standardima te utvrditi jesu li financijski izvještaji pripremljeni u skladu s primjenjivim okvirom financijskog izvještavanja. Iako revizija doprinosi, već samom činjenicom što predstavlja dodatni i naknadni stupanj nadzora, sprječavanju i otkrivanju prijevare u financijskim izvještajima bitno je naglasiti da, zbog karakteristika revizije i ograničenja u njenom provođenju, postoji rizik neotkrivanja značajnih pogrešnih prikazivanja u financijskim izvještajima nastalih zbog prijevare i pogrešaka, odnosno revizori ne moraju otkriti prijevare i pogreške u financijskim izvještajima unatoč provođenju revizije u skladu s MRevS-ima. Neovisno o jasno definiranim odgovornostima eksternih revizora potrebno je spomenuti i nerealna očekivanja korisnika financijskih izvještaja koji očekuju da će revizori provodeći reviziju financijskih izvještaja otkriti prijevare i pogreške ako one postoje u financijskim izvještajima. Dakle, u praksi postoje prevelika očekivanja korisnika financijskih izvještaja, odnosno tzv. jaz u očekivanjima (eng. *expectation gap*) i nepotpuno razumijevanje uloge i odgovornosti revizora u sprječavanju i otkrivanju prijevare iako je ta problematika jasno definirana kroz MRevS 240.

Temeljem svega prethodno navedenog razvidno je kako različiti sudionici sustava korporativnog izvještavanja imaju različite uloge i odgovornosti u kontekstu sprječavanja i otkrivanja prijevare, međutim, potrebna je suradnja i odgovarajuće djelovanje svih kako bi se minimalizirao rizik prijevornog prikazivanja u financijskim izvještajima.

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Frauds in financial statements - prevention and detection responsibilities

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Abstract. Misstatements or irregularities in financial statements may be caused by frauds and errors. Unlike an error, which represents unintentional failure, usually made by the client's accounting staff, fraud represents an intentional act that is usually motivated by acquiring unjust material benefits and creating deceptive financial statements. In this article, the emphasis is on fraudulent presentations in financial statements (since frauds occur in all segments of the economy). Namely, every company is exposed to risk of fraudulent presentations in financial statements, regardless of the form, ownership, size, and other features of a business. Misstatements, or fraudulent presentations in financial statements, may be caused by fraudulent financial reporting and misappropriation of assets. In order to minimize the risk of frauds in financial statements, active participation of all participants in the financial reporting chain is required: from the management - who are responsible for the preparation and presentation of financial statements - to external auditors, who determine the credibility of such reports. In the context of this paper, authors deal with fraud risk factors or factors that indicate a fraud as well as responsibilities for their prevention and detection. In the context of the responsibility for preventing and detecting frauds in financial statements, roles of different participants in the chain of financial reporting are considered, with a focus on distinguishing responsibilities of management, internal, and external audit.

Key words: *frauds, fraud triangle, external audit, internal audit*

Komunalna naknada i komunalni doprinos

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Sažetak. Komunalna naknada i komunalni doprinos su jedni od najvećih prihoda proračuna jedinica lokalne samouprave u Republici Hrvatskoj. Komunalna naknada prihod je proračuna lokalne jedinice namijenjen za financiranje komunalnih djelatnosti: odvodnje atmosferskih voda, održavanja čistoće u dijelu koji se odnosi na čišćenje javnih površina, održavanja javnih površina, održavanja nerazvrstanih cesta, održavanja groblja i krematorija, javne rasvjete. Komunalni doprinos prihod je proračuna lokalne jedinice koji se koristi za financiranje gradnje i korištenja objekata i uređaja komunalne infrastrukture: javnih površina, nerazvrstanih cesta, groblja i krematorija te javne rasvjete. U ovom radu prikazano je na temelju zadataka kako se obračunava komunalna naknada, a kako komunalni doprinos. Komunalna naknada plaća se po koeficijentima, s tim da se pomnoži s kvadratnim metrom prostora. Detaljnije informacije nalaze se u Odluci o komunalnoj naknadi jedinice lokalne samouprave. Komunalni doprinos plaća se kod gradnje množenjem koeficijenta namjene i kubnog metra korisne površine objekta koji se gradi. Informacije o iznosima, zavisno od zone i namjene objekta, treba potražiti u Odluci o komunalnom doprinosu jedinice lokalne samouprave (grad, općina) u kojoj će se graditi. U ovom radu prikazat ćemo primjer obračuna komunalnih obveza i njihovog udjela u ukupnom prihodu na primjeru grada Šibenika.

Ključne riječi: *komunalna naknada, komunalni doprinos, lokalni prihodi*

1. Uvod

Navedena tema izabrana je iz razloga jer komunalna naknada i komunalni doprinos predstavljaju bitan instrument prikupljanja javnih prihoda općina i gradova kao jedinica lokalne samouprave u Republici Hrvatskoj te se prihodi od komunalne naknade i komunalnog doprinosa ubrajaju u fiskalno najizdašnije prihode općina i gradova.

Lokalnim i regionalnim jedinicama vlasti potrebni su prihodi kako bi podmirile zakonima definirane javne potrebe, uspješno obavile samoupravne funkcije te pružile lokalnom stanovništvu u skladu s njihovim sklonostima potrebnu razinu javnih dobara i usluga.

Vlastiti i vanjski izvori prihoda su osnovni izvori financiranja lokalnih jedinica vlasti. Vlastiti izvori prihoda su lokalni porezi i korisničke naknade, a vanjski izvori prihoda su izvori pomoći iz državnog ili županijskog proračuna, udjeli u zajedničkim poreznim i neporeznim prihodima te primicima od zaduživanja. Lokalne jedinice vlasti ostvaruju porezne prihode iz dva osnovna izvora: županijskih, općinskih i gradskih poreza s jedne strane te zajedničkih poreza s druge strane. Neporezni prihodi (tzv. prihodi po posebnim propisima) i kapitalni prihodi su prihodi koje lokalne jedinice samostalno utvrđuju i naplaćuju.

2. Komunalni doprinos

Nakon poreznih prihoda, drugi najznačajniji izvori prihoda lokalnih jedinica su neporezni prihodi. Neporezni prihodi su u skladu s načelom porezne korisnosti, a to znači da korisnici za pružene javne usluge plaćaju naknade. Neporezni prihodi su poželjan izvor financiranja lokalnih jedinica vlasti jer povećavaju autonomiju lokalnih jedinica vlasti i promoviraju njihovu vlastitu odgovornost u pružanju javnih usluga i dobara. U Hrvatskoj se neporezni prihodi uglavnom temelje na komunalnim naknadama i doprinosima koje naplaćuju lokalne jedinice i komunalna poduzeća. Visinu stope neporeznih prihoda utvrđuju samostalno lokalne jedinice te samostalno obavljaju njihovu naplatu.

Komunalni doprinos novčano je javno davanje koje se plaća za građenje i korištenje objekata komunalne infrastrukture. Prihod je jedinice lokalne samouprave, a plaća ga vlasnik građevne čestice na kojoj se gradi građevina, odnosno investitor.¹ Sredstva koja se prikupe od komunalnog doprinosa služe za građenje objekata i uređaja komunalne infrastrukture za:

- javne površine
- nerazvrstane ceste
- groblja i krematorija
- javnu rasvjetu.

Osim iz sredstava komunalnog doprinosa navedeni objekti financiraju se i iz proračuna lokalne samouprave, naknade za koncesiju i drugih izvora utvrđenih posebnim zakonom. Sredstvima komunalnog doprinosa financira se i pribavljanje zemljišta na kojem se grade objekti i uređaji komunalne infrastrukture (javne površine, nerazvrstane ceste, groblja i krematoriji, javna rasvjeta), rušenje postojećih objekata i uređaja, premještanje postojećih nadzemnih i podzemnih instalacija te radovi na sanaciji toga zemljišta.²

2.1 Obveznik plaćanja komunalnog doprinosa

Komunalni doprinos plaća vlasnik građevne čestice na kojoj se gradi građevina, odnosno investitor. Vlasnik građevne čestice, odnosno investitor plaćanjem komunalnog doprinosa sudjeluje u podmirenju troškova izgradnje objekata i uređaja komunalne infrastrukture utvrđenih Programom. Investitor je pravna ili fizička osoba na čije se ime gradi građevina.³ Obveznik plaćanja komunalnog doprinosa, tj. investitor dužan je uplatiti komunalni doprinos prije početka građenja, ali ostaje mogućnost da mu jedinica lokalne uprave i samouprave ostavi mogućnost obročnog plaćanja komunalnog doprinosa.

2.2 Način obračuna komunalnog doprinosa

Komunalni doprinos obračunava se u skladu s obujmom, odnosno po metru kubnom građevine koja se gradi na građevnoj čestici, a kod građevine koja se uklanja zbog građenja nove građevine ili kada se postojeća građevina dograđuje ili nadograđuje, komunalni se doprinos obračunava na razliku u obujmu u odnosu na prijašnju građevinu.⁴

Ono što u obračunu komunalnog doprinosa pojedinim investitorima predstavlja potencijalni problem je nepoznavanje načina obračuna, tj. da se komunalni doprinos obračunava po kubnom metru za razliku od komunalne naknade koja se obračunava po kvadratnom metru i to se vezuje uz trošak gradnje u tom razdoblju. Isto tako, ostavljena je mogućnost lokalnim

¹ <http://www.mgipu.hr/default.aspx?id=27827>

² Zakon o komunalnom gospodarstvu, članak 31. stavka 5; dostupno na : <http://www.zakon.hr/z/319/Zakon-o-komunalnom-gospodarstvu>

³ Zakon o gradnji, članka 49. stavka 1; dostupno na: <http://www.zakon.hr/z/690/Zakon-o-gradnji>

⁴ Zakon o komunalnom gospodarstvu, članak 31. stavka 8; dostupno na : <http://www.zakon.hr/z/319/Zakon-o-komunalnom-gospodarstvu>

jedinicama da sami utvrđuju raspored zona na svom području i koeficijente obračuna u tim zonama.

Jedinična vrijednost komunalnog doprinosa za obračun po metru kubnom građevine koja se gradi određuje se za pojedinu zonu u gradu, odnosno općini. Ta je vrijednost najviša za prvu zonu i ne može biti viša od 10 % prosječnih troškova gradnje prema kubnom metru etalonske građevine u Republici Hrvatskoj. Prosječni troškovi gradnje m^3 etalonske građevine u Republici Hrvatskoj iznose 1.382,86 kuna po kubnom metru, objavljuje se u Narodnim novinama.

2.3 Primjer obračuna komunalnog doprinosa po zonama u gradu Šibeniku

Primjer obračuna na poslovno-stambenoj zgradi u gradu Šibeniku od 114 stanova, 27 poslovnih prostora, 5 etaža garaže:

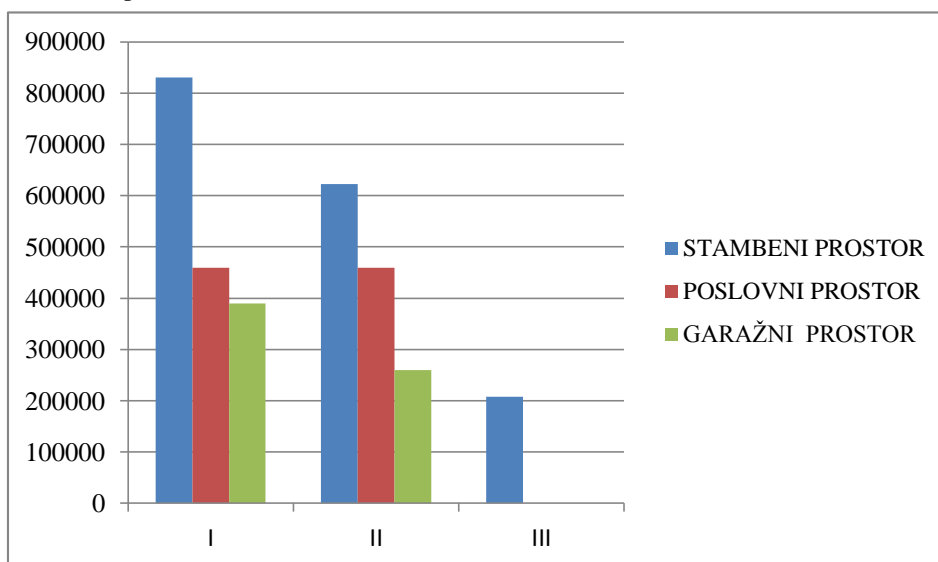
- 27 poslovnih prostora prosječne veličine 45 m^2 (visina poslovnog prostora 2,8 m),
- prosječni troškovi gradnje m^3 etalonske građevine u Republici Hrvatskoj iznose 1.382,86 kn po metru kubičnom
- 27 poslovnih objekata
- 114 stanova prosječne veličine 65 m^2 (visina stambenog prostora 2,8 m)
- 5000 m^2 garažnog prostora (visina garažnog prostora 2,6 m).

U tablici i pripadajućem grafu prikazan je iznos komunalnog doprinosa koji bi trebalo platiti za pripadajući stambeni, poslovni i garažni prostor iz gore navedenog primjera po zonama koje vrijede na području grada Šibenika.

Tablica 1: Prikaz komunalnog doprinosa po namjeni prostora za grad Šibenik

ZONE	STAMBENI PROSTOR	POSLOVNI PROSTOR	GARAŽNI PROSTOR
I	829.920	459.270	390.000
II	622.440	459.270	260.000
III	207.480		

Izvor: Izrada autora prema navedenom zadatku



Grafikon 1: Prikaz komunalnog doprinosa po namjeni prostora u gradu Šibeniku

3. Komunalna naknada

Komunalna naknada je prihod proračuna jedinice lokalne samouprave, a sredstva komunalne naknade namijenjena su financiranju obavljanja sljedećih djelatnosti:⁵

- odvodnja atmosferskih voda
- održavanje čistoće u dijelu koji se odnosi na čišćenje javnih površina
- održavanje javnih površina
- održavanje nerazvrstanih cesta
- održavanje groblja i krematorija
- javna rasvjeta.

Kao što je iz gore navedenih zakonskih akata vezanih za komunalnu naknadu vidljivo da se sredstvima komunalne naknade mora financirati održavanje raznih područja infrastrukture što iziskuje razna sredstva za lokalne jedinice, koja se ne mogu uvijek namaknuti komunalnom naknadom.

Predstavničko tijelo jedinice lokalne samouprave donosi odluku o komunalnoj naknadi kojom se obavezno utvrđuju:⁶

- naselja u kojima se naplaćuje komunalna naknada
- područja zona u gradu, odnosno općini
- koeficijent zona
- koeficijent namjene za poslovni prostor i za građevno zemljište koje služi u svrhu obavljanja poslovne djelatnosti
- rok plaćanja komunalne naknade
- nekretnine važne za jedinicu lokalne samouprave koje se u potpunosti ili djelomično oslobađaju od plaćanja komunalne naknade
- opći uvjeti i razlozi zbog kojih se u pojedinim slučajevima može odobriti potpuno ili djelomično oslobađanje od plaćanja komunalne naknade i izvore sredstava iz kojih će se namiriti iznos za slučaj potpunog ili djelomičnog oslobađanja od plaćanja komunalne naknade.

Predstavničko tijelo jedinice lokalne samouprave donosi i odluku o vrijednosti obračunske jedinice – boda.

Jedinica lokalne jedinice, tj. njeno predstavničko tijelo ima razne mogućnosti kroz gore navedene faktore omogućiti vlasnicima građevinskih objekata različite mogućnosti otplate komunalne naknade kroz različite socijalne kriterije ili omogućavanje razvoja pojedinih dijelova lokalne jedinice.

Komunalnu naknadu moguće je obuhvatiti jednako i zakonskim pojmom „poreza“, kao i pojmom „drugog javnog davanja“ jer komunalna naknada odgovara svim obilježjima koji su u skladu s potrebama da bi se određeni instrument smatrao porezom.⁷ Komunalna naknada ipak predstavlja javno davanje jer, za razliku od poreza, ipak ima određenu direktnu protučinidbu. Iz perspektive obveznika komunalne naknade, komunalna naknada je davanje u novcu koje su oni temeljem zakona obvezni platiti jedinicama javne vlasti, a iz perspektive lokalne jedinice ona predstavlja njihov proračunski prihod koji se koristi za podmirivanje proračunom utvrđenih javnih izdataka.

⁵ Zakon o komunalnom gospodarstvu, članak 22., dostupno na: <http://www.zakon.hr/z/319/Zakon-o-komunalnom-gospodarstvu>

⁶ <http://www.mgipu.hr/default.aspx?id=14118>

⁷ N. Žunić Kovačević, S. GADŽO, Komunalna naknada u RH i njezino pozicioniranje...Zb. Prav. fak. Sveuč. Rij. (1991) v. 35, br. 1, 245-270 (2014)

3.1 Obveznik plaćanja komunalne naknade

Komunalnu naknadu plaćaju vlasnici odnosno korisnici:⁸

- stambenog prostora
- poslovnog prostora
- garažnog prostora
- građevinskog zemljišta koje služi za obavljanje poslovne djelatnosti
- neizgrađenog građevinskog zemljišta.

Za nekretnine (stambeni prostor, poslovni prostor, garažni prostor, građevinsko zemljište koje služi za obavljanje poslovne djelatnosti i neizgrađeno građevinsko zemljište) koje se nalaze unutar građevinskog područja naselja plaća se komunalna naknada te za stambeni i poslovni prostor izvan građevinskog područja naselja u kojem se obavljaju komunalne djelatnosti (održavanje javnih površina, održavanje nerazvrstanih cesta i javna rasvjeta) i nekretnine koje su opremljene pristupnom cestom, objektima za opskrbu električnom energijom i vodom prema mjesnim prilikama te su sastavni dio infrastrukture lokalne samouprave.

Ono što predstavlja problem kod naplate komunalne naknade je problem utvrđivanja vlasništva nad pojedinim građevinskim objektima. Nesređene zemljišne knjige su velika prepreka u boljoj naplati komunalne naknade i potencijalnim ovrhama kod naplate komunalne naknade. Isto tako, ono što je prednost ovog načina obračuna je mogućnost koju lokalna jedinica ima da odredi iznose za različite vrste građevinskog prostora i na taj način potiče izgradnju građevina za određenu namjenu.

3.2 Način obračuna komunalne naknade

Visina komunalne naknade određuje se ovisno o:⁹

- lokaciji nekretnine, odnosno zoni u kojoj se nalazi nekretnina
- vrsti nekretnine.

Komunalnu naknadu obračunavamo po metru kvadratnom površine za stambeni, poslovni i garažni prostor po jedinici korisne površine koja se utvrđuje na način propisan Uredbom o uvjetima i mjerilima za utvrđivanje zaštićene najamnine, a za građevinsko zemljište po jedinici stvarne površine.

Za razliku od komunalnog doprinosa kod obračuna komunalne naknade kao obračunska jedinica koristi se kvadratni metar što sa gledišta vlasnika građevinskog objekta je puno transparentnije i jednostavnije za obračun.

3.3 Primjer obračuna komunalne naknade po zonama u gradu Šibeniku

Grad Šibenik podijeljen je na pet zona, a koeficijenti obračuna po zonama prikazani su u tablici 2:

Tablica 2: Iznosi komunalne naknade po u gradu Šibeniku

GRAD ŠIBENIK ZONE	STAMBENI kn/m ²	POSLOVNI kn/m ²
I	0,24	1,58
II	0,23	1,50
III	0,14	0,95
IV	0,10	0,63
V	0,05	0,32

Izvor: www.sibenik.hr

⁸ Zakon o komunalnom gospodarstvu, članak 22. stavka 3; dostupno na : <http://www.zakon.hr/z/319/Zakon-o-komunalnom-gospodarstvu>

⁹ Zakon o komunalnom gospodarstvu, članak 24. stavka 1, dostupno na: <http://www.zakon.hr/z/319/Zakon-o-komunalnom-gospodarstvu>

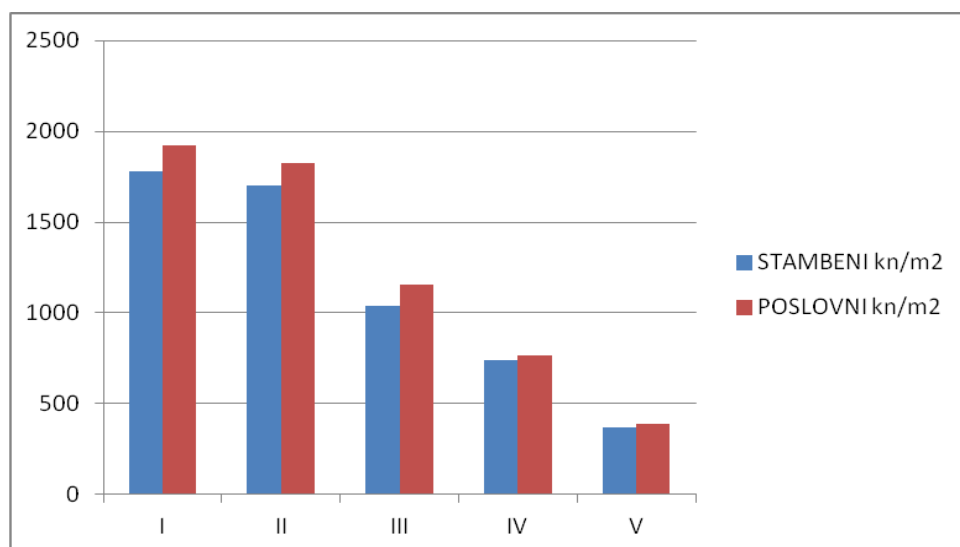
U tablici i pripadajućem grafu prikazan je iznos komunalne naknade koju bi trebalo platiti za pripadajući stambeni, poslovni i garažni prostor iz gore navedenog primjera po zonama koje vrijede na području grada Šibenika.

Obračun komunalne naknade za poslovni i stambeni prostor izrađen je na istom primjeru koji je naveden kod komunalnog doprinosa:

Tablica 3: Prikaz komunalne naknade grada Šibenika po namjeni prostora za sve zone

GRAD ŠIBENIK ZONE	STAMBENI kn/m ²	POSLOVNI kn/m ²
I	1778,40	1919,70
II	1704,30	1822,50
III	1037,40	1154,25
IV	741,00	765,45
V	370,50	388,80

Izvor: izrada autora prema zadatku navedenom kod komunalnog doprinosa



Grafikon 2: Prikaz komunalne naknade grada Šibenika po namjeni prostora za sve zone

4. Prihodi od komunalnog doprinosa i naknade

Prihodi od komunalnih doprinosa i naknada Grada Šibenika u 2014. godini iznosili su 33.008.042,00 kuna što je porast od 56,7 posto u odnosu na prethodnu godinu. Rast prihoda od komunalnih doprinosa oštro je varirao u razdoblju od 2011. do 2014. godine, dok su prihodi od komunalne naknade konstantno rasli.

Tablica 4: Prikaz koliko je potrebno metara kvadratnih da bi se ostvarili ukupni prihodi poslovanja Grada Šibenika

GRAD ŠIBENIK ZONE	STAMBENI kn/m ²	Izračun metara kvadratnih potrebnih da se ostvare ukupni prihodi proračuna Grada Šibenika				
		2010.	2011.	2012.	2013.	2014.
I	0,24	743.609.963	620.458.146	773.113.821	681.058.267	756.114.179
II	0,23	775.940.830	647.434.587	806.727.465	710.669.496	788.988.709
III	0,14	1.274.759.936	1.063.642.536	1.325.337.979	1.167.528.457	1.296.195.736
IV	0,1	1.784.663.910	1.489.099.550	1.855.473.170	1.634.539.840	1.814.674.030
V	0,05	3.569.327.820	2.978.199.100	3.710.946.340	3.269.079.680	3.629.348.060

GRAD ŠIBENIK ZONE	POSLOVNI kn/m ²	Izračun metara kvadratnih potrebnih da se ostvare ukupni prihodi proračuna Grada Šibenika				
		2010.	2011.	2012.	2013.	2014.
I	1,58	112.953.412	94.246.807	117.435.011	103.451.889	114.852.787
II	1,5	118.977.594	99.273.303	123.698.211	108.969.323	120.978.269
III	0,95	187.859.359	156.747.321	195.312.965	172.056.825	191.018.319
IV	0,63	283.279.986	236.365.008	294.519.551	259.450.768	288.043.497
V	0,32	557.707.472	465.343.609	579.835.366	510.793.700	567.085.634

Izvor: izrada autora prema podacima Ministarstva financija, *Proračun Grada Šibenika*, dostupno na: <http://www.mfin.hr/hr/ostvarenje-proracuna-jlprs-za-period-2010-2014>

U tablici 4 napravljen je izračun koliko je potrebno metara kvadratnih stambenog ili poslovnog prostora da bi se ostvarili ukupni prihodi poslovanja. Razvidno je da je komunalna naknada za poslovne prostore veća pa je stoga potrebno mnogo manje metara kvadratnih nego za stambene prostore.

5. Zaključak

Zbog svega navedenog, uzimajući u obzir komunalnu naknadu i komunalni doprinos, može se zaključiti da se komunalna naknada i komunalni doprinos ubrajaju među najizdašnije prihode jedinica lokalne samouprave, odnosno jedne od najvažnijih instrumenata financiranja jedinica lokalne samouprave u Republici Hrvatskoj.

Zajednička karakteristika komunalne naknade i komunalnog doprinosa je ta da se radi o javnim davanjima koja plaćaju fizičke i pravne osobe i od druge strane očekuju se određene protučinidbe. To nas dovodi do pitanja je li ispravnije komunalnu naknadu i komunalni doprinos definirati kao porez ili korisničku naknadu, pri tome se misli na postupak utvrđivanja obveze plaćanja komunalne naknade i komunalnog doprinosa te uvjete i postupak djelomičnog ili potpunog oslobođanja od obveze plaćanja komunalne naknade ili komunalnog doprinosa. Isto tako, često se za komunalnu naknadu veže i pojam drugog javnog davanja koji su građani temeljem zakona obvezni platiti jedinicama javne vlasti.

Komunalni doprinos je parafiskalni namet koji se plaća u trenutku dobivanja lokacijske dozvole. Za razliku od njega, komunalna naknada je parafiskalni namet koji se plaća višekratno bilo mjesečno ili tromjesečno ovisno o tome kako je definirano u pojedinom gradu ili općini. Iz toga i proizlazi temeljna razlika jer se komunalna naknada plaća na izgrađene građevine dok se komunalni doprinos plaća za građevine koje će se tek sagrađiti. Sukladno tome, novčana sredstva koja grad prikupi od komunalne naknade namijenjena su održavanju komunalne infrastrukture, a novčana sredstva koja grad prikupi od komunalnog doprinosa za izgradnju nove komunalne infrastrukture.

Komunalni doprinos i komunalna naknada mehanizam su u rukama jedinice lokalne samouprave kroz koji može omogućiti razvoj socijalne politike same lokalne jedinice, ali i ono što je još važnije, omogućiti razvitak same lokalne jedinice ili barem nekog dijela iste.

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Revenues from utility fees and utility contributions

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Abstract. Utility fees and utility contributions are one of the biggest budget revenues of local government units in Croatia. Communal fee income in the budget of the local unit is intended for financing the utilities: storm water drainage, cleanliness maintenance in the part relating to the cleaning of public areas, the maintenance of public areas, the maintenance of unclassified roads, and the maintenance of cemeteries, crematoria, and public lighting. The municipal contribution to the revenue of the local unit budget is used to finance the construction and use of facilities and equipment of communal infrastructure: public areas, unclassified roads, cemeteries and crematoria, and public lighting. In this paper, the emphasis is on the tasks concerning the calculation of utility compensations as a municipal contribution. The communal fee is paid by the coefficients provided, multiplied by m^2 - space. Municipal contributions are paid in the construction purposes and multiplying the quotient m^3 - the usable area of the building being built. Information about the amounts depending on the zone and the use of the building should refer to the decision concerning utility contributions of the local government (city, municipality) where the building is to be built. In this paper, we show an example of calculating utility charges and contributions and their share in total revenues, using the town of Šibenik as the example.

Key words: *Utility fee, utility contributions, local revenues*

Smanjenje vrijednosti dugotrajne materijalne imovine

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Sažetak. U ovom članku prikazat će se računovodstveni i porezni postupci i knjiženja vezana uz smanjenje vrijednosti dugotrajne materijalne imovine i revalorizaciju. Revalorizacija dugotrajne materijalne imovine predstavlja svođenje knjigovodstvene vrijednosti imovine na tržišnu vrijednost, koja može biti veća ili manja. Međutim, u praksi se pojam revalorizacije najčešće koristi u slučaju povećanja vrijednosti imovine, dok se za revalorizaciju na nižu vrijednost koriste pojmovi „smanjenje vrijednosti“ i „vrijednosno usklađenje“. U današnje vrijeme kada se još osjete posljedice ekonomske krize, često dolazi do smanjenja tržišne vrijednosti imovine, odnosno dolazi do pada njihovih fer vrijednosti. U 2014. godini u Republici Hrvatskoj donesene su izmjene i dopune Zakona o porezu na dobit koje imaju za posljedicu promjene u poreznom priznavanju rashoda od smanjenja vrijednosti imovine. S obzirom na navedene izmjene, u članku će se prikazati obračun poreza na dobitak i modeli knjiženja vezani uz porezno nepriznate rashode od usklađenja vrijednosti dugotrajne materijalne imovine koji dovode do privremenih razlika i odgođene porezne imovine. Nadalje, prikazat će se postupci i knjiženja vezana uz smanjenje vrijednosti revalorizirane dugotrajne materijalne imovine.

Ključne riječi: *smanjenje vrijednosti, metoda troška, revalorizacija, odgođena porezna imovina, odgođene porezne obveze*

1. Uvod

Dugotrajna materijalna imovina je oblik imovine bez kojeg najčešće nije moguće obavljati neku djelatnost. Trošak nabave nekog predmeta dugotrajne materijalne imovine treba priznati kao imovinu ako je vjerojatno da će buduće ekonomske koristi povezane s imovinom pritijecati poduzetniku i ako se trošak imovine može pouzdano izmjeriti. Prema Hrvatskom standardu financijskog izvještavanja (dalje: HSFI) 6 - *Dugotrajna materijalna imovina* i Međunarodnom računovodstvenom standardu (dalje: MRS) 16 – *Nekretnine, postrojenja i oprema*, dugotrajna materijalna imovina je ona imovina koja je namijenjena za korištenje u proizvodnji proizvoda ili isporuci roba ili usluga, za iznajmljivanje drugima ili u administrativne svrhe, koja se očekuje koristiti duže od jednog razdoblja i ona imovina koja je namijenjena za korištenje na neprekidnoj osnovi u svrhu aktivnosti poduzetnika.

Nakon početnog priznanja dugotrajne materijalne imovine klasificirane prema zahtjevima MRS-a 16, odnosno HSFI-a 6 po trošku nabave, poslovni subjekt ima mogućnost odabira računovodstvene politike za naknadno vrednovanje dugotrajne materijalne imovine. Sukladno MRS-u 16 i HSFI-u 6 za naknadno vrednovanje dugotrajne materijalne imovine koristi se ili metoda troška ili metoda revalorizacije. Odabrana računovodstvena politika za naknadno vrednovanje dugotrajne materijalne imovine ima direktan utjecaj na pozicije financijskih izvještaja, odnosno na računovodstvene informacije sadržane u financijskim izvještajima. U vremenu prije ekonomske krize na tržištima je vladala optimistička atmosfera, odnosno dolazilo je do povećanja tržišnih vrijednosti dugotrajne materijalne imovine. Stoga su poduzetnici u velikoj mjeri koristili metodu revalorizacije kao računovodstvenu politiku za naknadno vrednovanje dugotrajne materijalne imovine kako bi u financijskim izvještajima

poboljšali imovinski i financijski položaj poduzeća uslijed povećanja ukupne imovine i ukupnog kapitala.

U današnje vrijeme kada se još osjete posljedice ekonomske krize, često dolazi do smanjenja tržišne vrijednosti imovine, odnosno dolazi do pada njihovih fer vrijednosti. Umanjenje vrijednosti imovine regulirano je i MRS-om 36 – *Umanjenje imovine* koji propisuje obvezu provjere s ciljem utvrđivanja postoji li dokaz da vrijednost neke imovine može biti smanjena na datum bilance. MRS-u 36 raste važnost od početka ekonomske krize. Revalorizacija dugotrajne materijalne imovine predstavlja svođenje knjigovodstvene vrijednosti imovine na tržišnu vrijednost, koja može biti veća ili manja. Međutim, u praksi se pojam revalorizacije najčešće koristi u slučaju povećanja vrijednosti imovine, dok se za revalorizaciju na nižu vrijednost koriste pojmovi „smanjenje vrijednosti“ i „vrijednosno usklađenje“. Navedeni pojmovi koristit će se i u nastavku prilikom provođenja knjiženja i objašnjenja računovodstvenih postupaka vezanih uz smanjenje vrijednosti nerevalorizirane i revalorizirane dugotrajne materijalne imovine. Vrijednosno usklađenje dugotrajne materijalne imovine podrazumijeva usklađenje njezine vrijednosti na realnu (fer) vrijednost, što ima za posljedicu nastanak troškova s osnove vrijednosnog usklađenja. S obzirom na izmjene Zakona o porezu na dobit prikazat će se obračun poreza na dobit i modeli knjiženja vezani uz porezno nepriznate rashode od usklađenja vrijednosti dugotrajne materijalne imovine.

Za potrebe računovodstvenog evidentiranja smanjenja vrijednosti dugotrajne materijalne imovine potrebno je prvo utvrditi koju računovodstvenu politiku poduzetnik koristi za naknadno vrednovanje te imovine, odnosno je li koristi metodu troška ili pak metodu revalorizacije. Poduzetnik treba odabrati ili metodu troška ili metodu revalorizacije kao računovodstvenu politiku i primijeniti tu politiku na cjelokupnu skupinu dugotrajne materijalne imovine. Obveznici primjene HSFI-a pridržavat će se odredbi HSFI-a 6 prilikom računovodstvenog evidentiranja smanjenja vrijednosti dugotrajne materijalne imovine, dok je za obveznike primjene MSFI-a mjerodavan MRS 36. Bitno je naglasiti da u ovom slučaju nema razlika između odredbi MRS-a 36 i HSFI-a 6 koje uređuju smanjenje vrijednosti imovine. U nastavku će se posebno prikazati računovodstveni postupci smanjenja vrijednosti dugotrajne materijalne imovine koja se naknadno vrednuje po metodi troška, odnosno po metodi revalorizacije.

2. Smanjenje vrijednosti dugotrajne materijalne imovine koja se naknadno vrednuje po metodi troška

Prema metodi troška, nakon početnog priznanja dugotrajnu materijalnu imovinu treba iskazati prema njezinom trošku nabave umanjenom za akumuliranu amortizaciju i gubitke od umanjenja vrijednosti (Belak, 2009.). Prema ovoj metodi, dugotrajna materijalna imovina evidentira se prema nabavnim vrijednostima na jednom računu, a na odgovarajućem korektivnom računu ispravak vrijednosti koji se obračunava amortizacijom. Zemljište se iskazuje prema nabavnoj vrijednosti umanjenoj za moguće gubitke od smanjenja, s obzirom na to da zemljište ne podliježe obračunu amortizacije. Ako se vrijednost dugotrajne materijalne imovine iskazuje po metodi troška, tada se gubitak koji je proizašao iz smanjenja vrijednosti evidentira kao rashod razdoblja.

HSFI 6 u t. 51. navodi: „Na svaki datum izvještavanja poduzetnik treba ocijeniti postoji li pokazatelj da neka dugotrajna materijalna imovina može biti umanjena. Ako takav pokazatelj postoji, poduzetnik treba procijeniti nadoknadivi iznos imovine“. Sukladno t. 52. HSFI-a 6 nadoknadivi iznos je viši iznos pri usporedbi fer neto prodajne vrijednosti jedinice koja stvara novac i vrijednosti u upotrebi. Ako bilo koji od ovih iznosa premašuje knjigovodstvenu vrijednost imovine, imovina se ne umanjuje i nije nužno procijeniti drugi iznos. Po metodi troška vrijednost imovine neće se ni povećati neovisno o tome što jedan od ovih iznosa (fer

neto prodajna vrijednost ili vrijednost u upotrebi) premašuje knjigovodstvenu vrijednost. Ako je nadoknativa vrijednost imovine manja od njezine knjigovodstvene vrijednosti, knjigovodstvena vrijednost imovine se smanjuje na njezinu nadoknadivu vrijednost (MRS 36, t. 59.). To je smanjenje gubitka od umanjenja vrijednosti.

U 2014. godini u Republici Hrvatskoj donesene su izmjene i dopune Zakona o porezu na dobit koje imaju za posljedicu promjene u poreznom priznavanju rashoda od smanjenja vrijednosti imovine. Zakon o porezu na dobit u čl. 12. st. 22. navodi: „Ako porezni obveznik u poslovnim knjigama iskazuje vrijednosno usklađenje dugotrajne imovine navedene u ovom članku, u porezno priznate rashode poreznog razdoblja može se uključiti samo iznos koji bi bio utvrđen primjenom godišnjih amortizacijskih stopa iz stavka 5. ovoga članka“. U stavku 5. članka 12. Zakona o porezu na dobit propisane su godišnje amortizacijske stope (bez povećanja) za pojedine grupe dugotrajne imovine, što prikazuje i tablica 1.

Tablica 1 Godišnje amortizacijske stope prema članku 12. st. 5. Zakona o porezu na dobit

Red. br.	Naziv imovine	Vijek trajanja u godinama	Godišnja (redovna) stopa amortizacije
1.	Građevinski objekti i brodovi veći od 1000 BRT	20	5%
2.	Osnovno stado, osobni automobili	5	20%
3.	Nematerijalna imovina, oprema (strojevi, postrojenja i dr.), vozila (teretna) i mehanizacija	4	25%
4.	Računala, računalna oprema i programi, mobilni telefoni i oprema za računalne mreže	2	50%
5.	Ostala (nespomenuta) imovina	10	10%

Izvor: Zakon o porez na dobit, dostupno na: <http://www.zakon.hr/z/99/Zakon-o-porezu-na-dobit>

Porezno priznato vrijednosno usklađenje može se izračunati pomoću linearne metode amortizacije prema kojoj se godišnja svota amortizacije izračuna tako da se osnovica za amortizaciju sredstva (trošak nabave) pomnoži s godišnjom (redovnom) stopom amortizacije. Ako vrijednosno usklađenje prelazi taj iznos, višak iznad porezno priznatog iznosa bit će privremeno porezno nepriznat, pritom nastaju privremene računovodstvene razlike te će se u računovodstvu evidentirati odgođena porezna imovina. Odgođena porezna imovina je svota poreza na dobit koja će biti nadoknativa u budućim razdobljima, kada se ova odbitna stavka može koristiti kao umanjenje osnovice poreza na dobit (Kopun, 2009.).

Primjer 2.1. Smanjenje vrijednosti dugotrajne materijalne imovine (koja se naknadno vrednuje po metodi troška) do visine porezno dopuštenog iznosa

Nabavna je vrijednost tvorničke zgrade 5.000.000,00 kn, a amortizirana vrijednost iznosi 2.600.000,00 kn. Vijek trajanja zgrade procijenjen je na 25 godina pa je stopa amortizacije 4 %. Prema Zakonu o porezu na dobit (čl. 12. st. 5.) redovna amortizacijska stopa za građevinske objekte je 5 %, što znači da je porezno priznato vrijednosno usklađenje 250.000,00 kn.

1. Obračunata je amortizacija zgrade za tekuću poslovnu godinu po stopi od 4 % te je godišnji iznos amortizacije 200.000,00 kn ($5.000.000,00 \times 0,04$).

2. Procjenom je utvrđeno da je nadoknativa vrijednost tvorničke zgrade 2.100.000,00 kn. Neto knjigovodstvena vrijednost zgrade nakon obračuna amortizacije iznosi 2.200.000,00 kn (5.000.000,00 – 2.600.000,00 – 200.000,00). S obzirom na to da je nadoknativa vrijednost niža od neto knjigovodstvene vrijednosti, potrebno je provesti vrijednosno usklađenje, odnosno smanjenje vrijednosti tvorničke zgrade za 100.000,00 kn (2.200.000,00 – 2.100.000,00). Vrijednosno usklađenje u iznosu od 100.000,00 kn niže je od porezno priznatog vrijednosnog usklađenja koje iznosi 250.000,00 kn, stoga je cjelokupno smanjenje porezno priznato.

Knjiženje u glavnoj knjizi:

0231 Tvornička zgrada		0290 Akumulirana amortizacija tvorničke zgrade	
S° 5.000.000,00			2.600.000,00 S°
			200.000,00 (1
0281 Vrijednosno usklađenje građevina		4410 Troškovi vrijednosnog usklađenja	
	100.000,00 (2	2) 100.000,00	
4310 Amortizacija građevina			
1) 200.000,00			

Primjer 2.2. Smanjenje vrijednosti dugotrajne materijalne imovine (koja se naknadno vrednuje po metodi troška) iznad visine porezno dopuštenog iznosa

Nabavna je vrijednost tvorničke zgrade 5.000.000,00 kn, a amortizirana vrijednost iznosi 2.600.000,00 kn. Vijek trajanja zgrade procijenjen je na 25 godina pa je stopa amortizacije 4 %. Prema Zakonu o porezu na dobit (čl. 12. st. 5.) redovna je amortizacijska stopa za građevinske objekte 5 %, što znači da je porezno priznato vrijednosno usklađenje 250.000,00 kn.

1. Obračunata je amortizacija zgrade za tekuću poslovnu godinu po stopi od 4 % te je godišnji iznos amortizacije 200.000,00 kn (5.000.000,00 x 0,04).
2. Procjenom je utvrđeno da je nadoknativa vrijednost tvorničke zgrade 1.500.000,00 kn. Neto knjigovodstvena vrijednost zgrade nakon obračuna amortizacije iznosi 2.200.000,00 kn (5.000.000,00 – 2.600.000,00 – 200.000,00). S obzirom na to da je nadoknativa vrijednost niža od neto knjigovodstvene vrijednosti, potrebno je provesti vrijednosno usklađenje, odnosno smanjenje vrijednosti tvorničke zgrade za 700.000,00 kn (2.200.000,00 – 1.500.000,00). Vrijednosno usklađenje u iznosu od 250.000,00 kn porezno je priznato, a razlika iznad toga u iznosu od 450.000,00 kn porezno je nepriznata.
3. Dobit prije oporezivanja iznosi 700.000,00 kn. Obračunan je porez na dobit. Poreznu osnovicu potrebno je uvećati za porezno nepriznato vrijednosno usklađenje u iznosu od 450.000,00 kn.
4. Priznata je odgođena porezna imovina.
5. Utvrđena je neto dobit.

Tablica 2 Porezna bilanca

Porezna bilanca (pomoćna)	
Dobit prije poreza	700.000,00
Porez na dobit (20 %)	140.000,00
Neto dobit	560.000,00
Uvećanje porezne osnovice za nepriznate troškove	450.000,00

Uvećanje poreza (20 %)	90.000,00
Porez za plaćanje	230.000,00

Knjiženje u glavnoj knjizi:

0231 Tvornička zgrada	
S° 5.000.000,00	

0290 Akumulirana amortizacija tvorničke zgrade	
2.600.000,00 S°	
200.000,00 (1)	

0281 Vrijednosno usklađenje građevina	
700.000,00 (2)	

4410 Troškovi vrijednosnog usklađenja	
2) 250.000,00	

4310 Amortizacija građevina	
1) 200.000,00	

4415 Vrijednosno usklađenje nepriznato	
2) 450.000,00	

803 Porez na dobit	
3) 230.000,00	140.000,00 (5)
4) 90.000,00	

2430 Obveze za porez na dobit	
	230.000,00 (3)

0802 Odgođena porezna imovina	
4) 90.000,00	

800 Dobit prije poreza	
5) 700.000,00	700.000,00 S°

8040 Dobit razdoblja	
	560.000,00 (5)

Nakon priznanja gubitka od umanjenja imovine, amortizaciju te imovine treba uskladiti u budućim razdobljima na način da se sustavno rasporedi knjigovodstvena vrijednost imovine, umanjena za ostatak vrijednosti (ako postoji), za razdoblje njezinog preostalog korisnog vijeka upotrebe (Horvat Jurjec, 2009.). U idućoj godini poduzetnik ima pravo na vrijednosno usklađenje obračunano prema redovnoj stopi amortizacije. Ako u toj godini više nema vrijednosnih usklađenja, onda je smanjenje imovine jednako obračunanoj amortizaciji. U tom slučaju poduzetnik će moći ukinuti dio ili cjelokupnu privremenu razliku i vratiti (smanjiti) porez na dobit plaćen za porezno nepriznate rashode od vrijednosnih usklađenja (Belak, 2015.).

Primjer 2.3. Ukidanje privremenih razlika nakon porezno nepriznatog vrijednosnog usklađenja i korištenje odgođenom poreznom imovinom

Nabavna je vrijednost tvorničke zgrade 5.000.000,00 kn, a amortizirana vrijednost iznosi 2.800.000,00 kn. Prethodne je godine obavljeno vrijednosno usklađenje u iznosu od 700.000,00 kn. Odgođena porezna imovina iznosi 90.000,00 kn.

Neto knjigovodstvena vrijednost zgrade prije vrijednosnog usklađenja iznosi 2.200.000,00 kn (5.000.000,00 – 2.800.000,00).

Neto knjigovodstvena vrijednost zgrade nakon vrijednosnog usklađenja iznosi 1.500.000,00 kn (5.000.000,00 - 2.800.000,00 - 700.000,00).

Vijek trajanja zgrade procijenjen je na 25 godina pa je stopa amortizacije 4 %. Amortizacija je obračunana u iznosu od 200.000,00 kn godišnje. Kad se neto knjigovodstvena vrijednost

zgrade prije vrijednosnog usklađenja, koja je 2.200.000,00 kn podijeli sa 200.000,00 kn, vidi se da je preostalo još 11 godina amortizacije.

Iznos koji se amortizira smanjen je na 1.500.000,00 kn te ga je potrebno rasporediti na preostalih 11 godina.

Godišnji iznos amortizacije = $1.500.000,00 / 11 \text{ godina} = 136.363,64 \text{ kn} / \text{godišnje}$

Godišnja stopa amortizacije = $136.363,64 / 5.000.000,00 = 2,7272728 \%$

1. Obračunata je amortizacija zgrade za tekuću poslovnu godinu po stopi od 2,7272728 % te je godišnji iznos amortizacije 136.363,64 kn ($5.000.000,00 \times 2,7272728 \%$).
2. Porezno priznato je vrijednosno usklađenje u iznosu od 250.000,00 kn, što znači da se za taj iznos može smanjiti porezna osnovica. Dobit prije oporezivanja iznosi 1.000.000,00 kn. Obračunan je porez na dobit. Poreznu osnovicu potrebno je smanjiti za ukinutu privremenu razliku u iznosu od 250.000,00 kn.
3. Iskorištena je odgođena porezna imovina u iznosu od 50.000,00 kn.
4. Utvrđena je neto dobit.

Tablica 3 Porezna bilanca

Porezna bilanca (pomoćna)	
Dobit prije poreza	1.000.000,00
Porez na dobit (20 %)	200.000,00
Neto dobit	800.000,00
Smanjenje porezne osnovice za ukidanje privremene razlike	- 250.000,00
Smanjenje poreza (20 %)	-50.000,00
Porez za plaćanje	150.000,00

Knjiženje u glavnoj knjizi:

0231 Tvornička zgrada	0290 Akumulirana amortizacija tvorničke zgrade
S° 5.000.000,00	2.800.000,00 S°
	136.363,64 (1)
0281 Vrijednosno usklađenje građevina	4310 Amortizacija građevina
700.000,00 S°	1) 136.363,64
803 Porez na dobit	2430 Obveze za porez na dobit
2) 150.000,00 200.000,00 (4)	150.000,00 (2)
3) 50.000,00	
0802 Odgođena porezna imovina	800 Dobit prije poreza
S° 90.000,00 50.000,00 (3)	4) 1.000.000,00 1.000.000,00 S°
8040 Dobit razdoblja	
800.000,00 (4)	

3. Smanjenje vrijednosti dugotrajne materijalne imovine koja se naknadno vrednuje po metodi revalorizacije

Kada poslovni subjekt koristi metodu revalorizacije kao računovodstvenu politiku za naknadno vrednovanje dugotrajne materijalne imovine tada se dugotrajna materijalna imovina iskazuje prema revaloriziranom iznosu, koji čini fer vrijednost te imovine na datum revalorizacije, umanjena za kasniji ispravak vrijednosti i kasnije akumulirane gubitke od umanjenja (t. 31. MRS-a 16 i t. 32. HSFI-a 6). Fer vrijednost predstavlja tržišnu cijenu na točno određeni datum i nije procjena buduće vrijednosti već odražava uvjete na tržištu na dan sastavljanja financijskih izvještaja. Definirano je da se ta vrijednost utvrđuje u skladu sa zahtjevima MSFI-a 13 - *Mjerenje fer vrijednosti* prema kojem je fer vrijednost mjera vrijednosti temeljena na tržištu i označava cijenu koja bi bila ostvarena prodajom neke stavke imovine ili plaćena za prijenos neke obveze u urednoj transakciji između tržišnih sudionika na datum utvrđivanja vrijednosti (Cirkveni, 2013.). HSFI 6 u točki 7. navodi sljedeće: „fer vrijednost je iznos koji bi trebalo primiti za prodanu imovinu ili platiti za podmirenje obveze u uobičajenoj transakciji između sudionika na tržištu na dan mjerenja vrijednosti“.

Revalorizacija se treba provoditi dovoljno redovito kako se knjigovodstvena vrijednost ne bi značajno razlikovala od one do koje bi se došlo utvrđivanjem fer vrijednosti na datum bilance (t. 31. MRS 16 i t. 32. HSFI 6). Ako je poduzeće za naknadno vrednovanje dugotrajne materijalne imovine izabralo metodu revalorizacije, tada su moguća dva računovodstvena postupka evidentiranja smanjenja vrijednosti dugotrajne materijalne imovine ovisno o tome je li imovina bila revalorizirana jer se taj dio vrijednosti najprije ispravlja.

Kad se knjigovodstvena vrijednost imovine smanji zbog revalorizacije, to smanjenje treba priznati kao rashod od vrijednosnog usklađenja ako ne postoji revalorizacijska rezerva za tu istu imovinu. Ako postoji revalorizacijska rezerva za imovinu (imovina je ranije bila revalorizirana na višu vrijednost) tada revalorizacijsko smanjenje vrijednosti imovine umjesto na rashode izravno tereti revalorizacijsku rezervu do visine te rezerve (t. 40 MRS-a 16 i t. 38. HSFI-a 6).

Primjer 3.1. Revalorizacija poslovne zgrade

Poduzeće XY provelo je revalorizaciju vrijednosti poslovne zgrade 1. siječnja 2014. čija je nabavna vrijednost 1.000.000,00 kn, a akumulirana amortizacija 200.000,00 kn. Knjigovodstvena vrijednost zgrade iznosi 800.000,00 kn.

1. Procjenom vrijednosti nekretnine utvrđeno je da fer vrijednost poslovne zgrade iznosi 1.400.000,00 kn. Revalorizirana je nabavna vrijednost i akumulirana amortizacija te su priznate revalorizacijske rezerve koje su umanjene za iznos poreza na dobit koji će biti uključen u poreznu osnovicu u nekom sljedećem razdoblju.
2. Na kraju poslovne godine poduzeće XY obračunava amortizaciju zgrade po godišnjoj stopi od 2,5 %.
3. Dobit prije poreza iznosi 1.500.000,00 kn. Porezna osnovica povećana je za svotu amortizacije revalorizacije koja se prenosi s revalorizacijskih rezervi na zadržani dobitak. Proknjižena je obveza za porez na dobit.
4. Revalorizacijom su uvećani troškovi amortizacije u iznosu od 18.750,00 kn (za 15.000,00 kn smanjuje se revalorizacijska rezerva u korist zadržanog dobitka, a pripadajući porez na amortizaciju revalorizacije u iznosu od 3.750,00 kn prenosi se s odgođenih poreznih obveza na konto 803 radi umanjenja poreza na dobit koji tereti rezultat tekućeg razdoblja).
5. Utvrđena je dobit razdoblja (neto dobit).

Revalorizacija poslovne zgrade:

- Knjigovodstvena vrijednost zgrade = 1.000.000,00 - 200.000,00 = 800.000,00 kn
- Indeks revalorizacije = (Fer vrijednost / Knjigovodstvena vrijednost) - 1
- Indeks revalorizacije = (1.400.000,00 / 800.000,00) - 1 = 1,75 - 1 = 0,75 ili 75 %
- Istodobno se revalorizira nabavna vrijednost i akumulirana amortizacija naviše za 75 %:
 - Revalorizacija nabavne vrijednosti = 1.000.000,00 x 0,75 = 750.000,00 kn
 - Revalorizacija akumulirane amortizacije = 200.000,00 x 0,75 = 150.000,00 kn
 - Rezultat revalorizacije iznosi 600.000,00 kn i unosi se u revalorizacijske rezerve
 - Odgođena porezna obveza = 600.000,00 x 20 % = 120.000,00 kn

Obračun godišnje amortizacije:

- Amortizacija nabavne vrijednosti = 1.000.000,00 x 2,5 % = 25.000,00 kn
- Amortizacija revalorizacije = 750.000,00 x 2,5 % = 18.750,00 kn

Tablica 4 Porezna bilanca

Porezna bilanca (pomoćna)	
Dobit prije poreza	1.500.000,00
Porez na dobit (20 %)	300.000,00
Neto dobit	1.200.000,00
Povećanje porezne osnovice za povećanu amortizaciju	18.750,00
Povećanje poreza (20 %)	3.750,00
Porez za plaćanje	303.750,00

Knjiženje u glavnoj knjizi:

0230 Poslovna zgrada		02900 Akumulirana amortizacija posl. zgrade	
S° 1.000.000,00			200.000,00 S°
			25.000,00 (2)
02901 Akumulirana amortizacija revalorizacije		0281 Vrijednosno usklađenje građevina	
	150.000,00 (1a)	1a) 750.000,00	
	18.750,00 (2)		
9300 Revalorizacijske rezerve		2600 Odgođena porezna obveza	
1b) 120.000,00	600.000,00 (1a)	4b) 3.750,00	120.000,00 (1b)
4a) 15.000,00			
4310 Amortizacija građevina		434 Povećana amortizacija s temelja revalorizacije	
2) 25.000,00		2) 18.750,00	
800 Dobit prije poreza		803 Porez na dobit	
5) 1.500.000,00	1.500.000,00 S°	3) 303.750,00	300.000,00 (5)
		4b) 3.750,00	
2430 Obveze za porez na dobit		940 Zadržani dobitak	
	303.750,00 (3)		15.000,00 (4a)
804 Dobit razdoblja (neto)			
	1.200.000,00 (5)		

Odgođene porezne obveze se aktiviraju i postaju obveza za plaćanje realizacijom revalorizacijskih rezervi. Porez na dobit koji se prikazuje u računu dobiti i gubitka ne uključuje dio poreza koji se odnosi na oporezivanje prijenosa revalorizacijskih rezervi koji se prikazuje u poreznom izvještaju (Obrazac PD – Prijava poreza na dobit). Naime, taj porez će biti plaćen i on se prikazuje na kontu 2430 - Obveze za porez na dobit, ali on ne pripada obračunu poslovnog rezultata nego poreznom obračunu.

Primjer 3.2. Smanjenje vrijednosti poslovne zgrade u slučaju kada je zgrada ranije revalorizirana naviše

Nabavna je vrijednost poslovne zgrade 1.000.000,00 kn, a revalorizacija je nabavne vrijednosti 750.000,00 kn. Akumulirana je amortizacija nabavne vrijednosti nakon obračuna amortizacije do dana smanjenja vrijednosti 250.000,00 kn, a akumulirana amortizacija revalorizacije 187.500,00 kn. Revalorizacijske rezerve nakon prijenosa rezervi po osnovi revalorizacije iznose 450.000,00 kn, a odgođena porezna obveza 112.500,00 kn.

1. Na datum bilance 31. prosinca 2015. godine utvrđeno je da je nadoknadiva vrijednost 1.200.000,00 kn pa je potrebno smanjiti vrijednost poslovne zgrade. Knjiži se smanjenje revalorizacije i njezinih učinaka.

Smanjenje vrijednosti poslovne zgrade koja je prethodne godine revalorizirana naviše:

- Nabavna neto knjigovodstvena vrijednost zgrade = $1.000.000,00 - 250.000,00 = 750.000,00$ kn
- **Neto knjigovodstvena vrijednost revalorizacije = $750.000,00 - 187.500,00 = 562.500,00$ kn**
- Ukupna revalorizirana vrijednost zgrade = $750.000,00 + 562.500,00 = 1.312.500,00$ kn
- Nadoknadiva vrijednost = $1.200.000,00$ kn
- **Smanjenje revalorizacije = $1.312.500,00 - 1.200.000,00 = 112.500,00$ kn**
- Kad se smanjuje vrijednost prethodno revalorizirane dugotrajne imovine na teret revalorizacije, potrebno je koristiti indeks revalorizacije koji se izračuna na sljedeći način:
Indeks smanjenja revalorizacije = smanjenje revalorizacije / neto knjigovodstvena vrijednost revalorizacije
- **Indeks smanjenja revalorizacije = $112.500,00 / 562.500,00 = 0,2$ ili 20 %**
- **Revalorizaciju nabavne vrijednosti (vrijednosno usklađenje), akumuliranu amortizaciju revalorizacije, revalorizacijske rezerve i odgođene porezne obveze potrebno je smanjiti za 20 %:**
 - Vrijednosno usklađenje (revalorizacija nabavne vrijednosti) = $750.000,00 \times 0,2 = 150.000,00$ kn
 - Akumulirana amortizacija revalorizacije = $187.500,00 \times 0,2 = 37.500,00$ kn
 - Revalorizacijske rezerve = $450.000,00 \times 0,2 = 90.000,00$ kn
 - Odgođena porezna obveza = $112.500,00 \times 0,2 = 22.500,00$ kn

Knjiženje u glavnoj knjizi:

<div>0230 Poslovna zgrada</div> <div>S° 1.000.000,00</div>	<div>02900 Akumulirana amortizacija posl. zgrade</div> <div>250.000,00 S°</div>
<div>0281 Vrijednosno usklađenje građevina</div> <div>S° 750.000,00 150.000,00 (1)</div>	<div>02901 Akumulirana amortizacija revalorizacije</div> <div>1) 37.500,00 187.500,00 S°</div>

9300	Revalorizacijske rezerve
1)	90.000,00 450.000,00 S°

2600	Odgođena porezna obveza
1)	22.500,00 112.500,00 S°

U ovom slučaju revalorizacijsko smanjenje vrijednosti zgrade nije se knjižilo na rashode jer iznos smanjenja nije veći od revalorizacijske rezerve za tu zgradu.

Nakon smanjenja vrijednosti zgrade na nadoknadivu vrijednost, stanje u bilanci izgleda na sljedeći način:

0230	Poslovna zgrada
S°	1.000.000,00

02900	Akumulirana amortizacija posl. zgrade
	250.000,00 S°

0281	Vrijednosno usklađenje građevina
S°	600.000,00

02901	Akumulirana amortizacija revalorizacije
	150.000,00 S°

9300	Revalorizacijske rezerve
	360.000,00 S°

2600	Odgođena porezna obveza
	90.000,00 S°

Primjer 3.3. Smanjenje vrijednosti stroja ako stroj nije prethodno revaloriziran

Poduzeće ABC koristi stroj za potrebe proizvodnje čija je nabavna vrijednost 180.000,00 kn, a akumulirana je amortizacija nakon obračuna amortizacije do dana smanjenja vrijednosti 60.000,00 kn. Knjigovodstvena vrijednost stroja iznosi 120.000,00 kn (180.000,00 - 60.000,00).

1. Na datum bilance 31. prosinca 2014. godine utvrđeno je da je nadoknadiiva vrijednost stroja niža za 10 % u odnosu na knjigovodstvenu, stoga je potrebno provesti vrijednosno usklađenje vrijednosti stroja. Smanjuje se nabavna vrijednost stroja i akumulirana amortizacija za 10 %, efekt vrijednosnog usklađenja iznosi 12.000,00 kn koliko iznosi i razlika između knjigovodstvene (120.000,00 kn) i nadoknadiive vrijednosti (108.000,00 kn).

Knjiženje u glavnoj knjizi:

0301	Strojevi
S°	180.000,00

0390	Akumulirana amortizacija strojeva
	60.000,00 S°
	6.000,00 (1)

0380	Vrijednosno usklađenje strojeva
	18.000,00 (1)

4410	Troškovi vrijednosnog usklađenja
1)	12.000,00

4. Zaključak

Na svaki datum izvještavanja poduzetnik treba ocijeniti postoji li pokazatelj da neka dugotrajna materijalna imovina može biti umanjena. Ako takav pokazatelj postoji, poduzetnik treba procijeniti nadoknadiivi iznos imovine. Naime, svrha vrijednosnog usklađenja dugotrajne materijalne imovine je iskazivanje realnih i objektivnih vrijednosti u poslovnim knjigama i godišnjim financijskim izvještajima poduzetnika. Računovodstvo i financijsko izvještavanje u funkciji je korisnika informacija, odnosno računovodstvo nije samo sebi svrhom već je usmjereno širokom krugu korisnika koji na temelju informacija sadržanih u financijskim izvještajima donose poslovne odluke. Informacije sadržane u financijskim izvještajima moraju biti korisne u procesu poslovnog odlučivanja.

U ovom članku prikazani su računovodstveni i porezni postupci i knjiženja vezana uz smanjenje vrijednosti dugotrajne materijalne imovine te su prikazana knjiženja vezana uz priznavanje odgođene porezne imovine te uz iskazivanje odgođenih poreznih obveza. Odabrana metoda za naknadno vrednovanje dugotrajne materijalne imovine ima utjecaj na pozicije financijskih izvještaja, odnosno na računovodstvene informacije sadržane u financijskim izvještajima. Korisnici računovodstvenih informacija posebnu pažnju bi trebali usmjeriti upravo na to. Naime, korištenje metode revalorizacije u slučaju povećanja vrijednosti imovine poboljšava imovinski i financijski položaj poduzeća zbog povećanja ukupne imovine i kapitala na poziciji revalorizacijskih rezervi. S druge pak strane, rashodi od vrijednosnog usklađenja dugotrajne materijalne imovine prikazuju se u računu dobiti i gubitka smanjujući dobit tekuće godine. Osim toga, kod smanjenja vrijednosti dugotrajne materijalne imovine postoji mogućnost nastanka porezno nepriznatih rashoda koji povećavaju iznos poreza na dobit koji su poduzetnici obvezni platiti.

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Impairment of fixed assets

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Abstract. This paper analyses accounting and tax procedures and records related to the impairment of fixed assets and revaluation. Revaluation of tangible assets is the reduction of the asset's book value to market value, which may be higher or lower. However, the term "revaluation" in practice is typically used when the value of assets increases and for the revaluation on lower value terms, like "impairment" and "value adjustment". The consequences of the economic crisis are still present, so market value (fair value) of assets often decreases. The Republic of Croatia adopted the amendments to the Law on Profit Tax in 2014, and they have resulted in changes in the tax recognition of expenses that occur when the value of assets decreases. Regarding the above changes, this paper will show the calculation of profit tax and booking models related to non-deductible expenses from value adjustments of fixed assets, which lead to temporary differences, and deferred tax assets. Furthermore, procedures and records related to the impairment of revalued fixed assets will be shown.

Key words: *impairment, cost model, revaluation, deferred tax assets, deferred tax liability*

Indeks potrošačkih cijena u Republici Hrvatskoj za razdoblje od 1.1.2015. do 31.12.2015. godine

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Sažetak. Ovaj rad analizira indeks potrošačkih cijena u Republici Hrvatskoj (engl. *Consumer Price Index*, CPI) za razdoblje od 1. 1. 2015. do 31. 12. 2015.godine. Indeks potrošačkih cijena odražava promjene u razini cijena dobara i usluga koje u tijeku vremena nabavlja, koristi se njima ili ih plaća referentno stanovništvo (privatna kućanstva) radi potrošnje. U Republici Hrvatskoj izračunava se na temelju reprezentativne košarice koju čini oko 917 proizvoda i svakog mjeseca prikuplja se oko 36 700 cijena na unaprijed definiranu uzorku prodajnih mjesta na devet geografskih lokacija. Indeks potrošačkih cijena je službena mjera inflacije u RH te čini ciljnu varijablu monetarne politike Hrvatske narodne banke. Svrha rada je dati pregled indeksa potrošačkih cijena u razdoblju od proteklih 10 godina te provesti analizu za 2015. godinu. Rad isto tako uspoređuje harmonizirani indeks potrošačkih cijena u Republici Hrvatskoj s harmoniziranim indeksom potrošačkih cijena odabranih zemalja Europske unije.

Ključne riječi: indeks potrošačkih cijena, harmonizirani indeks potrošačkih cijena

1. Uvod

Indeks potrošačkih cijena (CPI - *Consumer Price Index*) računa se radi kvantifikacije promjene cijena dobara i usluga koje stanovništvo kupuje s ciljem potrošnje.¹ U Hrvatskoj je prvi put objavljen 18. 02. 2014. godine i on zamjenjuje dosadašnji indeks cijena na malo (RPI - *Retail price indeks*), indeks troškova života i indeks cijena ugostiteljskih usluga.² Indeks potrošačkih cijena može imati različite namjene i služiti za mjerenje inflacije, očuvanje vrijednosti kod ugovora s indeksom klauzulama (npr. za indeksiranje plaća u kolektivnim ugovorima, indeksiranje mirovina i slično), usporedbu kretanja cijena unutar zemlje između određenih gospodarskih sektora, kao osnova za deflacioniranje pojedinih kategorija nacionalnih računa i drugih statističkih serija te se primjenjuje za analitičke svrhe.

2. Skupni indeksi

U svjetskim ekonomijama svakodnevno se trguje milijunima različitih proizvoda i usluga. Fizičke i pravne osobe kupuju različita dobra i pritom se dio potražnje zadovoljava iz domaće proizvodnje, dok se dio pokriva iz uvoza. Opisani procesi odvijaju se uz vremenske fluktuacije količina i cijena dobara. S ciljem numeričkog izražavanja prosječne promjene relativnih cijena/količina promatrane košarice dobara u tekućem razdoblju u odnosu na neko prošlo razdoblje koriste se skupni indeksi.

Skupni indeks cijena je prosječna mjera promjene cijena skupine dobara u tekućem razdoblju u odnosu na neko prošlo bazno razdoblje. Skupni indeks količina je prosječna mjera promjene prodanih količina skupine dobara u tekućem razdoblju u odnosu na neko prošlo bazno razdoblje.

¹ Državni zavod za statistiku, www.dzs.hr (pristupano 3.12.2015.)

² Raiffeisen Bank, www.rba.hr (pristupano 3.12.2015.)

Najčešći oblici skupnih indeksa su Laspeyresov indeks cijena, Paascheov indeks cijena, Laspeyresov indeks količina, Paascheov indeks količina, indeks vrijednosti, Fisherov skupni indeks količina i Fisherov skupni indeks cijena.³ Nadalje, najviše upotrebljavan i najčešće korišten skupni indeks je indeks potrošačkih cijena.

3. Indeks potrošačkih cijena (Consumer Price Index, CPI)

Indeks potrošačkih cijena ima dugu povijest koja datira iz osamnaestog stoljeća. Laspeyresovi i Paascheovi indeksi, koji se još uvijek naširoko koriste i danas, prvi put su predloženi 1870. Koncept indeksa troškova života uveden je početkom dvadesetog stoljeća.⁴

Tradicionalno, jedan od glavnih razloga za sastavljanje CPI-a je nadoknaditi radnicima za inflaciju podešavanjem njihove stope plaća u odnosu na postotne promjene u CPI-u, postupak je poznat kao indeksiranje. Danas, indeks potrošačkih cijena ima različite primjene i može služiti za mjerenje inflacije, očuvanje vrijednosti kod ugovora s indeksnim klauzulama (npr. za indeksiranje plaća u kolektivnim ugovorima, indeksiranje mirovina i slično), usporedbu kretanja cijena unutar zemlje između određenih gospodarskih sektora, kao osnova za deflacioniranje pojedinih kategorija nacionalnih računa i drugih statističkih serija te se primjenjuje za analitičke svrhe.

Indeks potrošačkih cijena odražava promjene u razini cijena dobara i usluga koje u tijeku vremena nabavlja, koristi se njima ili ih plaća referentno stanovništvo (privatna kućanstva) radi potrošnje. U Republici Hrvatskoj izračunava se na temelju reprezentativne košarice koju čini oko 869 proizvoda. Svakog mjeseca prikuplja se oko 36 700 cijena na unaprijed definiranu uzorku prodajnih mjesta na devet geografskih lokacija.⁵ Objavljuje se jednom mjesečno, i to za prethodni mjesec.

CPI je indeks Laspeyresova tipa i izračunava se kao aritmetička sredina individualnih indeksa cijena promatranih dobara

$$CPI_t = \sum_{i=1}^k \frac{p_i^t}{p_i^0} \cdot w_i^0 \cdot 100,$$

Pri čemu je p_i^t cijena i -tog dobra u tekućem razdoblju, p_i^0 cijena i -tog dobra u baznom razdoblju, a w_i^0 relativna struktura vrijednosti prodaje i -tog dobra u baznom razdoblju

$$\left(w_i^0 = \frac{p_i^0 q_i^0}{\sum_{i=1}^k p_i^0 q_i^0} \right).$$

Konkretnije, ponderi w_i^0 su udjeli izdataka za potrošnju svakog pojedinog dobra u ukupnim izdacima stanovništva u određenom razdoblju.⁶

³Bahovec, V., Dumičić, K., Erjavec, N., Čizmešija, M., Kurnoga, N., Arnerić, J., Čeh Časni, A., Jakšić, S., Sorić, P., Žmuk, B., Palić, I. & Lolić, I. (2015). *Statistika : Analiza vremenskih nizova* (pp.143-172), Zagreb 2015., Element

⁴International Labour Office, Cpi manual, http://www.ilo.org/wcmsp5/groups/public/---dgreports/---stat/documents/presentation/wcms_331153.pdf (pristupano 11.1.2016.)

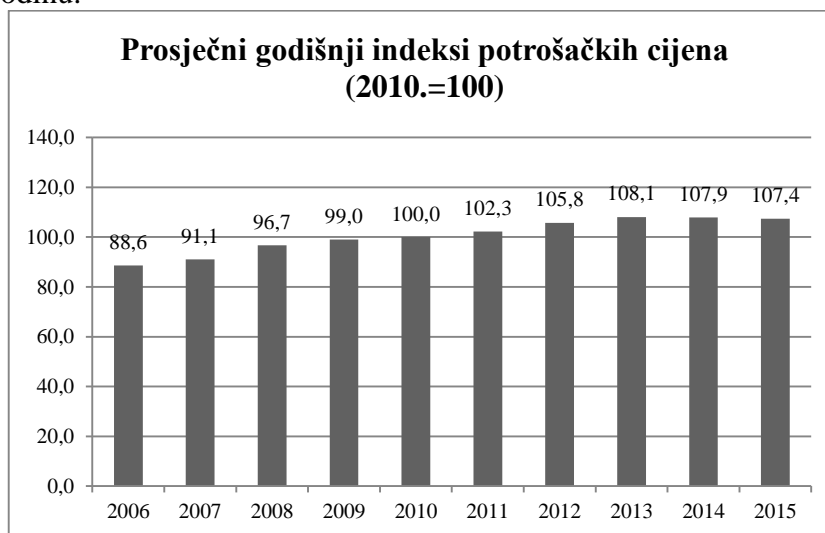
⁵Državni zavod za statistiku, www.dzs.hr (pristupano 3.12.2015.)

⁶Bahovec, V., Dumičić, K., Erjavec, N., Čizmešija, M., Kurnoga, N., Arnerić, J., Čeh Časni, A., Jakšić, S., Sorić, P., Žmuk, B., Palić, I. & Lolić, I. (2015). *Statistika : Analiza vremenskih nizova* (pp.143-172), Zagreb 2015., Element

Osnovni izvor podataka za izradu pondera za obračun indeksa potrošačkih cijena jest Anketa o potrošnji kućanstava, koju Državni zavod za statistiku redovito provodi od 1998. Za izračunavanje indeksa potrošačkih cijena od siječnja 2014. primjenjuju se ponderi koji se temelje na godišnjem prosjeku potrošnje kućanstava iz Ankete o potrošnji kućanstava od 2011. Ponderi obuhvaćaju cijeli teritorij Republike Hrvatske. Cijene se prikupljaju na devet lokacija (gradova) u zemlji (Zagreb, Slavonski Brod, Osijek, Sisak, Rijeka, Pula, Split, Dubrovnik i Varaždin) odabranih prema kriteriju broja stanovnika i reprezentativnosti za pojedinu jedinicu. Time se ukupno svakog mjeseca popišu cijene za više od 33400 proizvoda i usluga. Promatrana dobra podijeljena su u 12 osnovnih kategorija, u skladu s *Klasifikacijom osobne potrošnje prema namjeni* (engl. *Classification of individual consumption by purpose*, COICOP). Izdvojene kategorije dobara su: prehrana i bezalkoholna pića, alkoholna pića i duhan, odjeća i obuća, stanovanje, voda, promet, komunikacije, rekreacija i kultura, obrazovanje, ugostiteljske usluge te ostala dobra i usluge.⁷

4. Pregled indeksa potrošačkih cijena u RH od 2006.do 2016.godine

Indeks potrošačkih cijena u RH objavljuje se mjesečno u odnosu na prethodni mjesec, u odnosu na prethodnu godinu, u odnosu na 2010. godinu i u odnosu na dvanaestomjesečni prosjek. Na grafikonu su prikazani prosječni godišnji indeksi potrošačkih cijena u odnosu na baznu 2010. godinu.

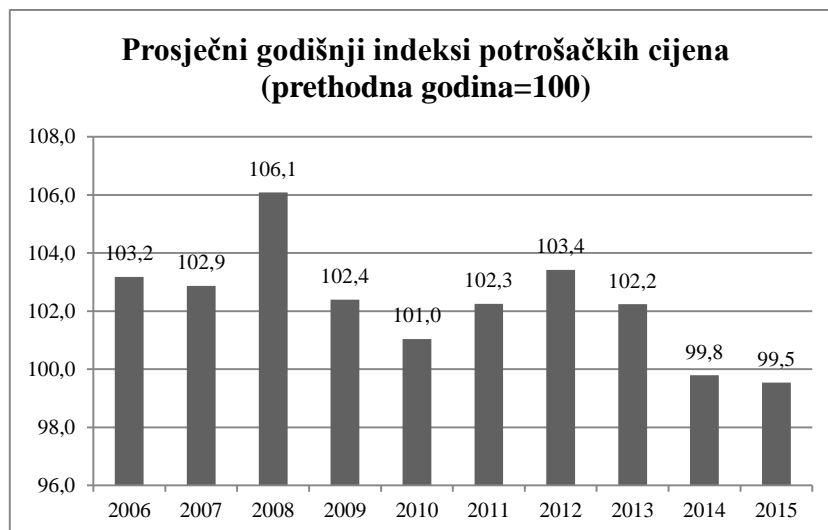


Slika 1. Prosječni godišnji indeksi potrošačkih cijena (2010.=100)

Iz tablice se može očitati da su prosječne godišnje cijene dobara i usluga za osobnu potrošnju, mjerene indeksom potrošačkih cijena u 2006. godini za 11,4 % niže, u 2007. su za 8,9 % niže, u 2008. su za 3,3 % niže, a u 2009. su za 1 % niže u odnosu na baznu 2010. godinu. Nadalje, u 2011. godini su za 2,3 % više, u 2012. godini su za 5,8 % više, u 2013. godini su za 8,1 % više, u 2014. godini su za 7,9 % više, dok su u 2015. godini za 7,4 % više u odnosu na baznu 2010. godinu.⁸

⁷ibid

⁸Državni zavod za statistiku,
http://www.dzs.hr/App/PXWeb/PXWebHrv/Selection.aspx?px_path=Cijene&px_tableid=T12_HR.px&px_language=hr&px_db=Cijene&rxid=fc9d580f-2229-4982-a72c-cdd3e96307d3 (pristupano 17.12.2015.)

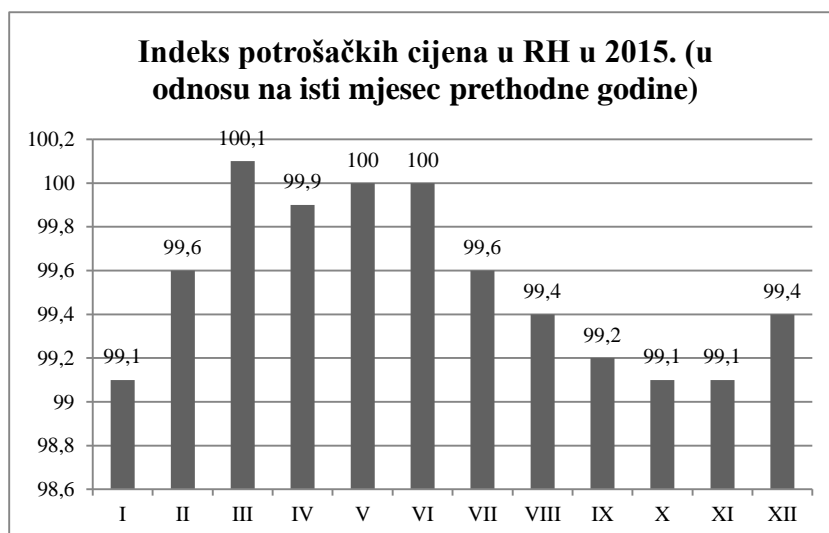


Slika 2. Prosječni godišnji indeksi potrošačkih cijena (prethodna godina=100)

Kada promatramo prosječne godišnje indkse potrošačkih cijena izračunate u odnosu na prethodnu godinu, vidi se da je najveći rast zabilježen u 2008. godini, indeks je viši za 6,1 % u odnosu na baznu 2007. godinu dok je najveći pad u 2015. godini, indeks je niži za 0,5 % u odnosu na prethodnu 2014. godinu.

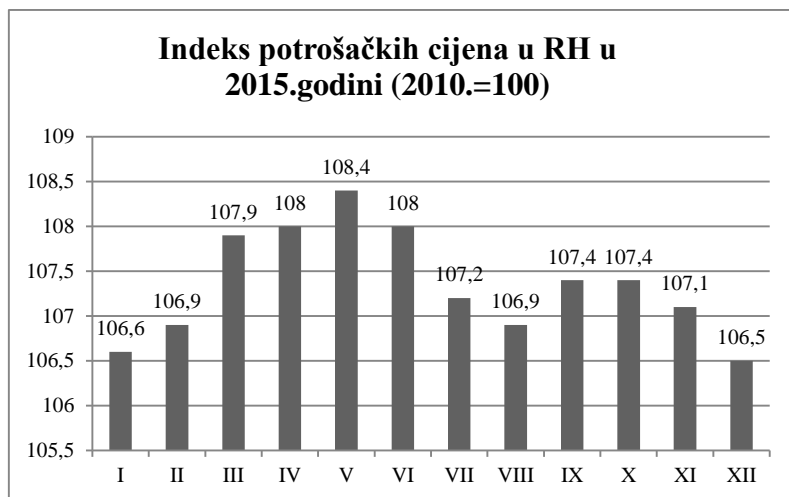
5. Indeks potrošačkih cijena u RH tijekom 2015.godine

U ovom dijelu promatrati ćemo indkse potrošačkih cijena tijekom 2015. godine po glavnim skupinama prema namjeni potrošnje i u odnosu na isti mjesec prethodne godine prethodni mjesec.



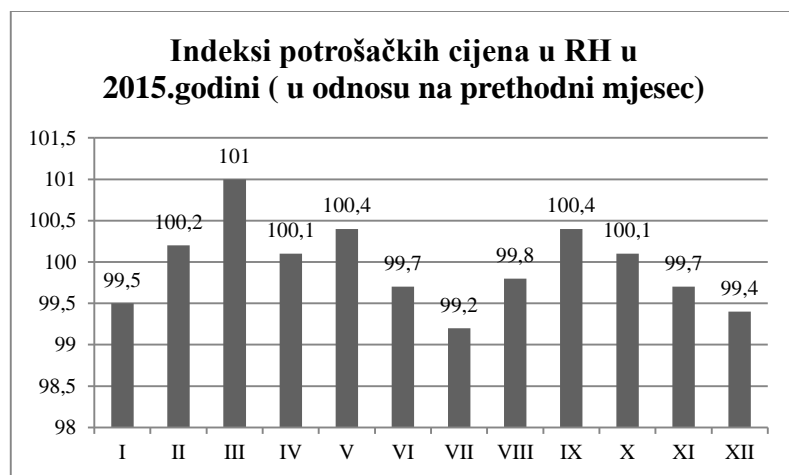
Slika 3. Prikaz indeksa potrošačkih cijena u RH u 2015.godini (bazno razdoblje je isti mjesec prethodne godine)

Kad uspoređujemo indkse potrošačkih cijena u 2015. u odnosu na isti mjesec u 2014. godini, vidimo da je on uglavnom niži. Jedini porast indeksa bilježimo u ožujku 2015., u odnosu na ožujak 2014. godine, i to 0,1 %. Najveći pad imamo u siječnju, listopadu i studenom, u odnosu na iste mjesec prethodne godine, i to za 0,9 %.



Slika 4. Prikaz indeksa potrošačkih cijena u RH u 2015. godini (u odnosu na 2010. godinu)

Kad uspoređujemo indekse potrošačkih cijena u 2015. godini u odnosu na baznu 2010. godinu, najveći prirast bilježimo u svibnju, indeks je veći za 8,4 % u odnosu na baznu 2010. godinu.



Slika 3. Prikaz indeksa potrošačkih cijena u RH u 2015. godini (u odnosu na prethodni mjesec)

U 2015. godini indeks potrošačkih cijena bilježi najveći porast u ožujku u odnosu na veljaču (viši je za 1 %), dok najveći pad imamo u srpnju, indeks potrošačkih cijena je u srpnju za 0,8 % niži u odnosu na lipanj.

Tablica 4. Indeks potrošačkih cijena u 2015.godini prema glavnim skupinama

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Indeks potrošačkih cijena	99,5	100,2	101	100,1	100,4	99,7	99,2	99,8	100,4	100,1	99,7	99,4
Prehrana i bezalkoholna pića	102	100,8	99,8	99,9	99,7	99,4	99,3	100,5	99,6	99,9	99,7	99,6
Alkoholna pića i duhan	100,1	100	99,9	101,6	100	100	100,1	100,1	100	99,7	99,7	99,9
Odjeća i obuća	91,8	99,7	110,4	103,2	100,9	97,1	89,7	97,7	113,9	106,6	100,4	94,5
Stanovanje, voda, el.en., plin i ostala goriva	99,6	100,2	100,4	98,9	100,3	99,7	99,9	99,9	101,2	99,8	99,6	100
Pokucstvo, oprema za kućanstvo i redovito održavanje kućanstva	100,6	100,4	99,2	100,2	100,1	99,7	99,6	100,1	100	100,8	100,4	99,1
Zdravlje	100	100,2	100,2	100,4	100,2	100,2	100,2	100,8	100	100	99,8	99,7
Prijevoz	94,9	99,6	104,1	100	102,4	100	99,7	97,6	97,7	99,4	99,3	99,3

Komunikacije	100,1	100	100	100,1	100,3	100	100	100	100	99,3	100	100
Rekreacija i kultura	100,2	100,2	100	100,5	100,4	100,1	100,7	100,4	99,2	99,7	99,7	100,2
Obrazovanje	100,1	99,8	100	100	100	100	99,2	99,9	99,9	100	100	100
Restorani i hoteli	99,9	100	100,2	100,4	100,3	100,2	100,3	100	99,8	99,9	99,7	99,9
Ostala dobra i usluge	100,2	100	99,9	100,1	99,9	100,5	99,9	100,4	99,8	99,7	100	99,9

Prema Državnom zavodu za statistiku cijene dobara i usluga za osobnu potrošnju, mjerene indeksom potrošačkih cijena, u siječnju 2015. u odnosu na prosinac 2014. u prosjeku su niže za 0,5 %. Najviše su pale cijene odjeće i obuće zbog sezonskih sniženja, koje su u prosjeku bile niže za 8,2 % i cijene prijevoza su bile niže za 5,1 %, dok su najviše porasle cijene prehrane i bezalkoholnih pića, koje su u prosjeku više za 2,0 %.

Indeks potrošačkih cijena u veljači 2015. u odnosu na siječanj 2015 u prosjeku su više za 0,2 %. Najviše su porasle cijene prehrane i bezalkoholnih pića, koje su u prosjeku više za 0,8 % (više cijene voća i povrća), dok su najviše pale cijene prijevoza, koje su u prosjeku niže za 0,4%.

U ožujku 2015. indeks potrošačkih cijena je u prosjeku za 1 % viši u odnosu na veljaču 2015. Najviše su porasle cijene odjeće i obuće, koje su u prosjeku više za 10,4 % (nova kolekcija odjeće i obuće) i cijene prijevoza, koje su u prosjeku više za 4,1 % (više cijene goriva za osobna vozila). Najveći pad bilježimo kod cijena pokućstva i opreme za kućanstvo i redovitog održavanja kućanstva, u prosjeku niže su za 0,8 %.

U travnju 2015. indeks potrošačkih cijena je u prosjeku za 0,1 % viši u odnosu na ožujak 2015. Najviše su porasle cijene odjeće i obuće, koje su u prosjeku više za 3,2 % (nova kolekcija odjeće i obuće. Porast indeksa potrošačkih cijena u travnju u odnosu na ožujak najviše su ublažile cijene stanovanja, vode, električne energije, plina i ostalih goriva, koje su u prosjeku niže za 1,1 %.

Indeks potrošačkih cijena u svibnju 2015. je u prosjeku za 0,4 % viši u odnosu na travanj 2015. Najviše su porasle cijene prijevoza, koje su u prosjeku više za 2,4 %, dok su najviše pale cijene prehrane i bezalkoholnih pića, koje su u prosjeku niže za 0,3 %.

U lipnju 2015. indeks potrošačkih cijena za 0,3 % niži je u odnosu na svibanj 2015. Najviše su pale cijene odjeće i obuće koje su u prosjeku niže za 2,9 % (sezonska sniženja), dok najveći rast bilježe cijene ostalih dobara i usluga, koje su u prosjeku više za 0,5 % (više cijene usluge smještaja).

U srpnju 2015. indeks potrošačkih cijena za 0,8 % niži je u odnosu na lipanj 2015. Najviše su pale cijene odjeće i obuće koje su u prosjeku niže za 10,3 % (sezonska sniženja). Porasle su cijene rekreacije i kulture, koje su u prosjeku više za 0,7% (povećanje cijena ulaznica za nacionalne parkove i pakete aranžmana).

Indeks potrošačkih cijena u kolovozu je za 0,2 % niži u odnosu na srpanj. Najviše su pale cijene prijevoza, koje su u prosjeku niže za 2,4 % (niže cijene goriva i maziva za osobna prijevozna sredstva. Najviše su porasle cijene u zdravstvu, koje su u prosjeku više za 0,8 % (više cijene bolničkih usluga).

U rujnu 2015. indeks potrošačkih cijena je za 0,4 % viši u odnosu na kolovoz 2015. godine. Najviše su porasle cijene odjeće i obuće, u prosjeku za više od 13,9 % (nova kolekcija odjeće i obuće). Porast su ublažile cijene prijevoza, koje su u prosjeku niže za 2,3 %.

U listopadu 2015. indeks potrošačkih cijena je za 0,1 % viši u odnosu na rujnu. Najviše su porasle cijene odjeće i obuće, koje su u prosjeku više za 6,6 % (nova kolekcija odjeće i obuće). Najviši pad bilježimo kod rekreacije i kulture, koje su u prosjeku niže za 2,2 % (niže cijene rekreativnih i sportskih usluga te cijene paketa usluga).

Indeks potrošačkih cijena u studenom 2015. je za 0,3 % niži u odnosu na listopad 2015.. Najviše su pale cijene prijevoza, koje su u prosjeku niže za 0,7 % (niže cijene goriva za osobna prijevozna sredstva). Pad indeksa potrošačkih cijena u studenom 2015. u odnosu na listopad 2015. ublažile su cijene odjeće i obuće te cijene pokućstva, opreme za kućanstvo i redovitog održavanja kućanstva koje su u prosjeku, po svakoj skupini više za 0,4 %.

U prosincu 2015. indeks potrošačkih cijena za 0,6 % niži je u odnosu na studeni. Najviše su pale cijene odjeće i obuće, koje su u prosjeku niže za 5,5 % (sezonska sniženja). Porasle su cijene rekreacije i sporta i one su u prosjeku više za 0,2 %, u odnosu na studeni.

6. Harmonizirani indeks potrošačkih cijena

Harmonizirani indeks potrošačkih cijena (Harmonized Index of Consumer Prices, HICP) je skup europskih indeksa potrošačkih cijena izračunati harmoniziranim pristupom, koristeći posebne definicije koje omogućuju usporedivu mjeru inflacije u eurozoni, Europskoj uniji, Europskom ekonomskom području te za zemlje kandidate. HICP jest ekonomski pokazatelj koji mjeri promjenu u razini cijena dobara i usluga koje u nekom vremenu nabavljaju, koriste se njima ili plaćaju kućanstva.⁹ HICP se za zemlje članice sastavlja od siječnja 1997. godine.¹⁰

Najčešće korišteni harmonizirani indeksi potrošačkih cijena su:

- Indeks potrošačkih cijena monetarne unije (*Monetary Union Index of Consumer Prices*, MUICP) - agregatni indeks koji pokriva zemlje u euro zoni.
- Europski indeks potrošačkih cijena (*European Index of Consumer Prices*, EICP) – pokriva eurozonu i ostale zemlje Europske unije.
- Nacionalni indeks potrošačkih cijena - za svaku od država članica Europske unije.

Osim nabojanih, tu su i Indeks potrošačkih cijena za europsko ekonomsko područje (*European Economic Area Index of Consumer Prices*, EEAICP) i privremeni indeks potrošačkih cijena za zemlje kandidate i zemlje pristupnice u EU.

Glavni cilj za harmonizacijski projekt indeksa potrošačkih cijena bio je upotreba HICP-a kao kriterija konvergencije i glavne mjere za promatranje stabilnosti cijena u euro zoni. Pomoću HICP-a se mogu najbolje usporediti potrošačke cijene pojedinih članica unutar Europske unije i eurozone. Izračun HICP-a je obavezan za sve zemlje članice EU.¹¹ HICP je indeks Laspeyresova tipa i računa se u odnosu na četiri bazna razdoblja: u odnosu na prethodni mjesec, u odnosu na isti mjesec prethodne godine, u odnosu na 2005. godinu i u odnosu na dvanaestomjesečni prosjek.

7. Harmonizirani indeks potrošačkih cijena u RH u 2015. godini i usporedba s odabranim zemljama EU

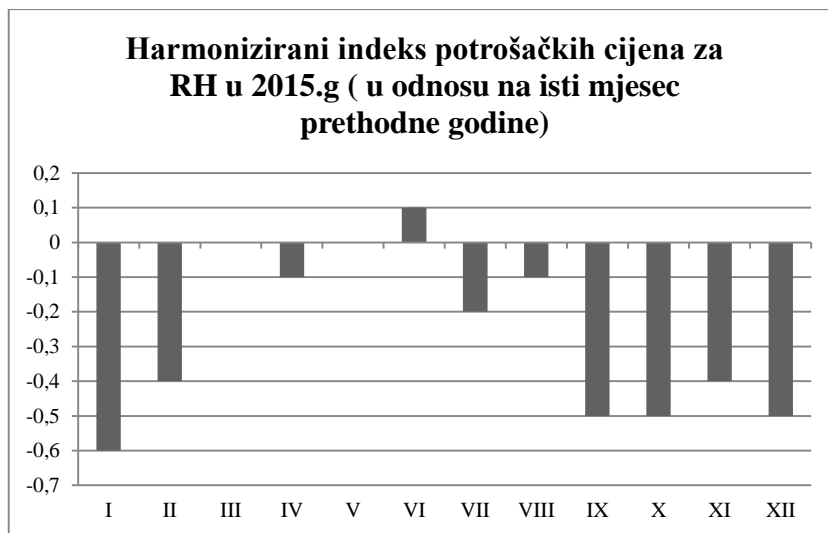
Kad promatramo harmonizirani indeks potrošačkih cijena za RH u 2015. godini (bazno razdoblje je isti mjesec prethodne godine) vidi se da je najveći pad zabilježen u siječnju,

⁹ International Labour Office, Cpi manual (2004.), http://www.ilo.org/wcmsp5/groups/public/---dgreports/---stat/documents/presentation/wcms_331153.pdf (pristupano 21.1.2016.)

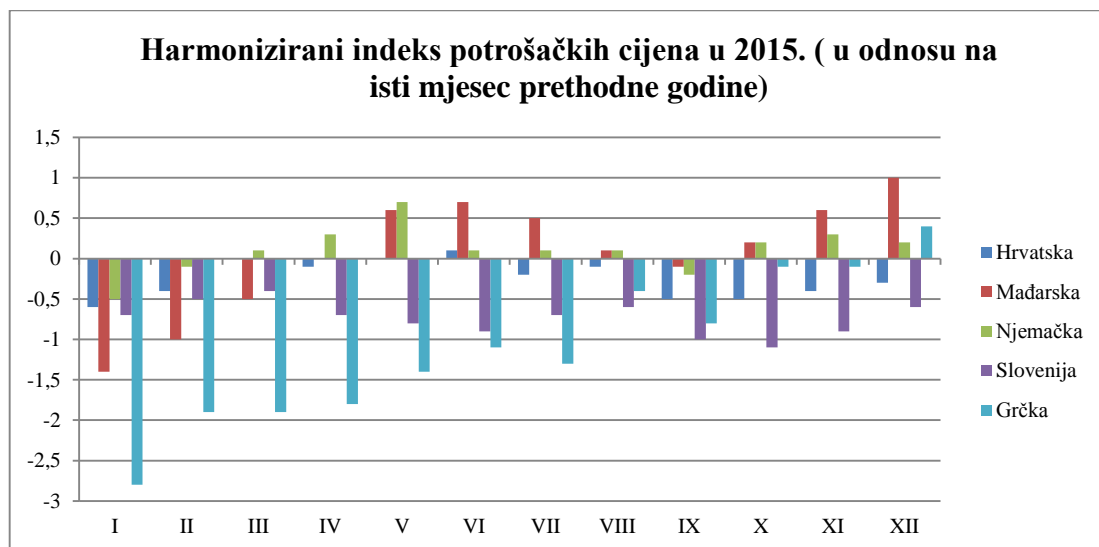
¹⁰ Botrić, V. (2001.), *Harmonizirani indeks potrošačkih cijena, koncept i implikacije za Hrvatsku*, Privredna kretanja i ekonomska politika, Broj 86/2001.

¹¹ International Labour Office, Cpi manual, http://www.ilo.org/wcmsp5/groups/public/---dgreports/---stat/documents/presentation/wcms_331153.pdf (pristupano 11.1.2016.)

indeks je niži za 0,6 % u odnosu na siječanj 2014. godine. Jedini rast bilježimo u lipnju, indeks je za 0,1 % viši u odnosu na lipanj 2014. godine.¹²



Slika 6. Prikaz harmoniziranog indeksa potrošačkih cijena u RH u 2015.godini (u odnosu na isti mjesec prethodne godine)



Slika 7. Prikaz indeksa potrošačkih cijena u RH u 2015.godini (u odnosu na prethodni mjesec)

Kad uspoređujemo neke druge zemlje, članice Europske unije (za potrebe ovog rada izabrala sam još Mađarsku, Njemačku, Sloveniju i Grčku), vidimo da je najveći pad u odnosu na prethodnu godinu kod Grčke, dok rast harmoniziranog indeksa potrošačkih cijena imamo kod Mađarske i Njemačke. Hrvatski indeks potrošačkih cijena je negdje pri sredini promatrane skupine.¹³

8. Zaključak

Indeks potrošačkih cijena u svojim statističkim sustavima imaju sve zemlje članice Europske unije. Glavni cilj praćenja ovog indeksa je mjerenje i predviđanje inflacije. Isto tako, koristi

¹²Eurostat, Europski ured za statistiku, ec.europa.eu (pristupano 15.1.2016.)

¹³ Eurostat, Europski ured za statistiku, ec.europa.eu (pristupano 15.1.2016.)

se za očuvanje vrijednosti kod ugovora s indeksnim klauzulama, za usporedbu kretanja cijena unutar zemlje te za analitičke svrhe. Harmonizirani indeks potrošačkih cijena promatra za usporedbu stabilnosti cijena među zemljama članicama Europske unije.¹⁴

Ponašanje indeksa potrošačkih cijena ima sezonske oscilacije koje, kako se navodi u tekstu, imaju veze sa sezonskim sniženjima, npr. pad cijena sezonske odjeće u siječnju i srpnju utječe na pad indeksa potrošačkih cijena. Isto tako, nove kolekcije odjeće i obuće u ožujku i rujnu imaju više cijene pa tako djeluju na rast indeksa potrošačkih cijena. Nadalje, tijekom lipnja i srpnja bilježi se rast cijena rekreacije i kulture, kao i cijena smještaja tijekom turističke sezone, dok u listopadu i studenom bilježimo pad cijena istih dobara.

Neki ekonometrijski modeli za 2016. godinu predviđaju pad indeksa potrošačkih cijena, odnosno pad cijena dobara i usluga u Republici Hrvatskoj.

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Consumer price index in the Republic of Croatia for the period from January 1 2015 to December 31 2015

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Abstract. This paper analyzes the Consumer Price Index (CPI) in the Republic of Croatia for the period from January 1 2015 to December 31 2015. CPI reflects changes in the prices of goods and services in the acquired, used or paid over time by a reference population (private households) for consumption purposes. CPI in the Republic of Croatia is calculated on the basis of a representative basket (consisting of over 917 products) every month, and around 36 700 prices of a fixed panel of outlets in nine geographical locations are collected. CPI is the official measure of inflation in the Republic of Croatia, and it makes the target variable of the monetary policy of the Croatian National

¹⁴ Čizmić, D., *Planovi uzoraka pri formiranju indeksa potrošačkih cijena i njihov utjecaj na grešku uzorka*, Ekonomski pregled, 2003.

Bank. The purpose of this paper is to provide an overview of the CPI in the period of the past 10 years, and an analysis for 2015. The work also compares the harmonized consumer price index in the Republic of Croatia with the harmonized consumer price index of selected EU countries.

Key words: *consumer price index, harmonized consumer price index*

The emergence and development trends of electronic payment systems in the Republic of Moldova

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Abstract. The rapid development of Internet in the Republic of Moldova has enhanced the development of electronic payments since its inception in 2005. The development of these systems has been a significant over the past ten years. At present, Moldova has different means of payment for goods and services, such as bank cards, internet banking, online payments, and through different websites (PayPal, WebMoney and others). Considering all the benefits of electronic payments, as opposed to cash payments - safety, speed, convenience and security - only 30-35% of the population carries out such payments. Even bank cards, that offer the possibility of withdrawing cash and payment, are most often used to withdraw money. This trend will be maintained as long as the world realizes the benefits the electronic payments bring.

Key words: *electronic payments, credit card, Internet*

1. Introduction

A payment always involves a transfer of funds; however, a transfer of funds is not always a payment [5; p.1].

In a broader sense, a payment is a voluntary execution of any obligation, but in a narrower sense this involves providing amounts of money. According to the Thesaurus Dictionary of the Romanian Language, a payment is way of offering someone a sum of money for a certain work, the counterpart of a purchased or used object.

The emergence and development of trade has contributed to the modernization of payment methods. Since ancient times the payment method was barter, i.e. exchange of goods, then exchange goods and services for gold, and later receiving payment in cash and or cashless payments: based on checks, payment orders, letters of credit. Cash and cashless payments are used up to nowadays; however, currently, electronic payments have a development trend.

Electronic payments represent the transfers of funds being based on different payment instruments, such as bank cards, electronic checks, payment instructions, wire transfers and all these types of payments can be performed at different payment terminals and are designed to pay the value of the purchased product or service.

2. The emergence of electronic payment systems in the Republic of Moldova

Currently, electronic payments in the Republic of Moldova are still developing, and individuals prefer making payments in cash. This can be explained by the fact that people do not realize the benefits of electronic payments versus cash payments or, they consider the disadvantages of electronic payments are more significant than the disadvantages of cash

payments. A number of factors have contributed to the emergence and growth of electronic payment systems in Moldova, such as:

- ✓ emergence and rapid development of the Internet in Moldova;
- ✓ emergence and development of information technologies;
- ✓ increase of number and value of payments;
- ✓ development of trade

Internet appeared in Moldova in the late 80s – beginning of 90s and since that time it is in continuous process of development. The 90s were not characterized by an intensive development of the Internet; however, the XXI century and especially starting with 2005-2006, Internet had a rapid progress. Various Internet providers such as Moldtelecom, StarNet and Sun Communications offer new Internet applications and facilitate the access of large masses of users to Internet. Nowadays, Information Technologies is one of the main areas of development in Moldova.

Moldtelecom is the national telecommunications operator and also the largest telecommunications company in Moldova. During its work, Moldtelecom has experienced a period of continuous development, initially as a state monopoly, and now it is a company open to collaboration, offering a wide range of services: fixed telephony, mobile telephony, Internet, data transmission and digital TV. At present, it is the leading company offering Internet access services (70.3%) and also first according to the sales volume on this market segment, with a share of about 57%. Moldtelecom annually invests MDL 700-800 million in the implementation of new technologies and new types of services [13].

StarNet, like Moldtelecom, is a telecommunications operator. The company was founded in 2003, providing Internet services, digital TV and fixed telephony in Chisinau and other cities. Currently, StarNet is part of the top companies in the field of electronic communications in Moldova and is one of the leaders of Internet providers, being the first provider in the country to offer Internet access and high-speed data transmission via optical fibre. During its activity, StarNet managed to develop and implement in Moldova a wide range of services of the latest generation needed in every home and business [13]:

- ✓ access to fast Internet and data transport over optical fibre;
- ✓ Wi-Fi network;
- ✓ corporate networks;
- ✓ Data Centre services;
- ✓ IP transit services for other operators;
- ✓ fixed telephony;
- ✓ digital television;
- ✓ licensed solutions to protect computers.

Sun Communications is the third largest Internet provider in Moldova. Besides that, the company is an operator of digital television and telephony. The company was created in 1993 and currently has over 110 thousand customers of different types of services. In 2001 Sun Communications updated its network by replacing the existing wired network with optic fibre [13].

Generally speaking, during 2007-2011 the Internet speed grew by 690%, thus ranking Moldova second in the world. Since 2010 and up to now Moldova has variable positions in the world's top 15 countries with the highest Internet speed [13].

In 2014 Audit Bureau of Circulations and Internet in Moldova (BATI) conducted a survey on the number of Internet users, their classification by age and sex, and other classifications [12].

According to the survey, the results are as follows:

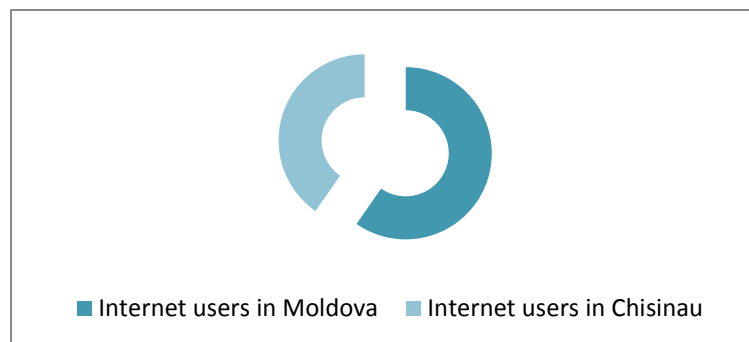


Figure 1. Internet users in Moldova

Source: <http://mediapoint.md/wp-content/uploads/2014/05/unde-locuiesc.jpg>, accessed 5/8/2015.

According to Figure 3.3, we conclude that about half of the Moldovan population accesses the Internet for different purposes, and about half of this population (45%) are residents of the capital city. No wonder this because the headquarters of the main Internet providers are in Chisinau.

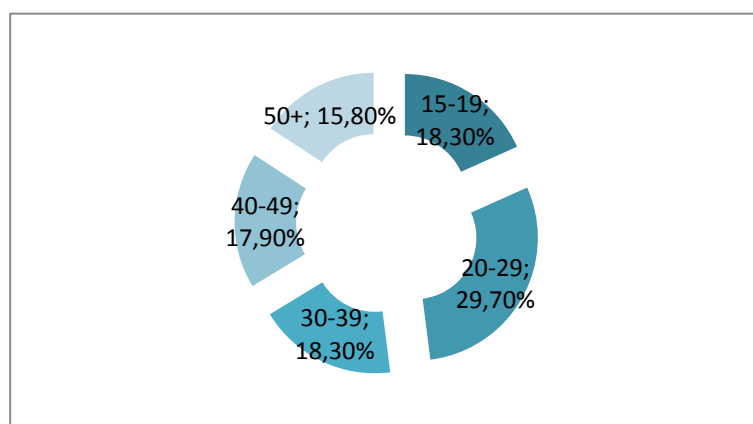


Figure 2. Classification of Internet users by age

Source: <http://mediapoint.md/wp-content/uploads/2014/05/virste.jpg>, accessed 5/8/2015

According to the above figure we can see that in 2014 most Internet users age 20-29 (30%), followed by teenagers and people aged 30-39 years (18.3% each), followed by people aged between 40-49 years (17.9%) and persons under the age of 50 years (15.8%).

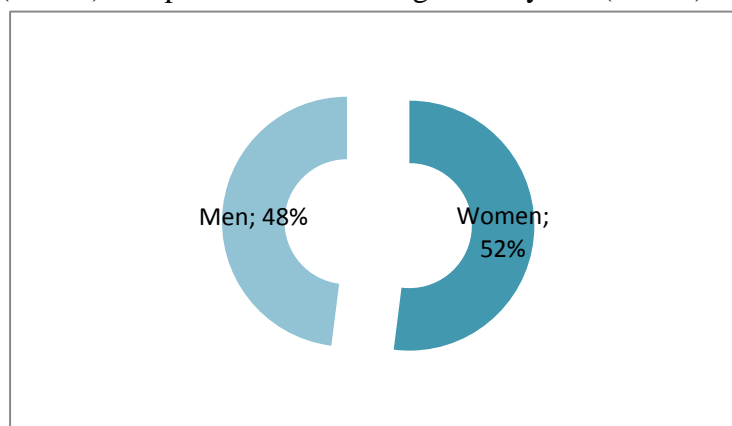


Figure 3. Classification of users by gender

Source: <http://mediapoint.md/wp-content/uploads/2014/05/sexe.jpg>, accessed 4/8/2015.

According to the survey conducted by the Audit Bureau of Circulations and Internet in Moldova (BATI), women access the Internet more often. Concerning the electronic payments in electronic trade, the figure below presents the results of the survey.



Figure 4. Electronic payments in e-commerce

Source: <http://mediapoint.md/cine-sunt-utilizatorii-internetului-din-republica-moldova-pentru-luna-martie2014/>, accessed 4/8/2015.

According to the above mentioned, we can observe the major influence of the factor that contributed to the development of electronic payment systems. Basically, without the Internet it would be impossible for electronic payment systems to exist, and also it would be impossible the existence of the concept of electronic payment. Thus, the Internet is the main factor that contributed to the emergence of electronic payments and contributed to their development through new technologies. According to the survey, 36% of Internet users are buying goods online. Although this number is low compared to developed countries, where more than 80% of payments are electronic payments, these 36% show that there is a development trend in this segment, which is considered as being positive.

Another important factor that contributed to the advancement of electronic payment systems in Moldova is developing techniques and technologies. Payments are made via various electronic devices: computer, mobile phone, tablet, payment terminals. All these devices are imported by Moldova from developed countries in this type of industry, such as: the USA, Japan, South Korea, Taiwan and China.

The increase of payments and of their value is directly related to the wide range of goods and services that are offered to citizens. Payments may be different, cash or cashless, but when performing considerable payments it is likely to lose this amount. Typically, large payments are made between organizations, different companies and in case of loss or theft of money, the person bears responsibility for it. So, people began to invent faster and safer ways of payment. This is how electronic payments appeared, which, to some extent are based on primary documents: payment order, checks, letters of credit, i.e. according to the principle of non-use of banknotes.

The development of electronic payment systems in the Republic of Moldova is one of the state's major plans. In 2013 was adopted the Government Decision no. 857 on the National Strategy for Information Society Development "Digital Moldova 2020", according to which any legal or official document can be achieved by using electronic signature in the ID [2].

3. The modalities of electronic payments in the Republic of Moldova

Similarly, any bill can be paid online from anywhere in the country, just by entering the code on bank card. The initiative belongs to the e-Government Centre, aiming to facilitate people's access to public services. Experts in information technology, mention that due to such business methods there is no longer needed to present stacks of documents. According to Strategy "Digital Moldova 2020", cash payments will be replaced by electronic payments. Thus, the world will be able to make various payments in a quicker way and receive notifications without losing time standing in queues at counters [1].

Although electronic payments have a development trend in Moldova, individuals still prefer to make cash payments in our country. A great number of population has not realised the benefits that electronic payments bring, others do not even know about the existence of such payments. The update of electronic payment systems in the Republic of Moldova cannot be compared to that of developed countries. This significant difference can be explained by the following factors:

- Moldova does not have such advanced technologies as the USA, China, Japan and other developed countries;
- intensive development of the Internet and technology has begun in the XXI century while in the world in the mid-late of 80s;
- Moldovan citizens have more confidence in cash payments, and, the more they trust the cash payments, the slower the electronic payments will develop.

However, electronic payments in Moldova are not something out of the ordinary and they can be made through the following instruments:

- Credit cards;
- Payments via the Internet;
- Internet banking;
- Payment terminals

Bank cards are issued by commercial banks in Moldova, whose activity is regulated by the National Bank of Moldova. Thus, the entire banking system in Moldova consists of the Central Bank and commercial banks.

Bank cards can be issued to both individuals, as well as legal persons. In order to do so, any person should contact any branch of one of the commercial banks and submit the necessary documents.

For *individuals* are necessary the following documents:

- ✓ Account opening application;
- ✓ ID.

For *legal entities* are necessary the following documents:

- ✓ Account opening application and for the use of bank cards;
- ✓ contract on MasterCard Business card usage;
- ✓ copy of the ID of the cardholder;
- ✓ other documents required for account opening.

Once the person has obtained the bank card and has a certain amount of money on its account, he can perform different payments, such as booking a hotel, making a ticket reservation, pay his cheque in a restaurant etc. This person can also withdraw money from ATMs. The figure below shows the structure of cards use by purpose.

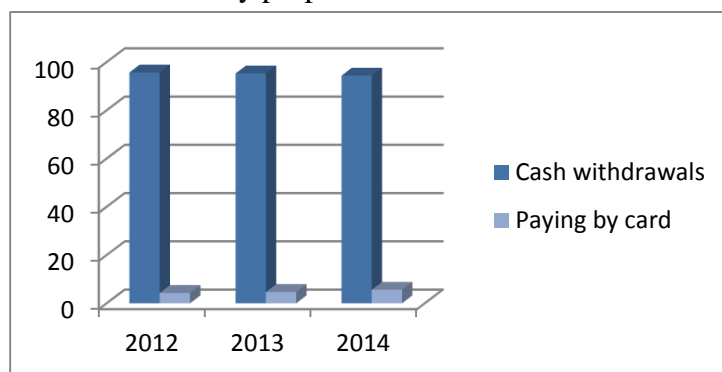


Figure 5. The value of transactions in Moldova with cards issued in Moldova for 2012-2014

In 2012, out of the value of card transactions in Moldova with cards issued in Moldova, the biggest share is given to cash withdrawals (MDL 19,170,073. 5 out of MDL 20,038,111. 6, about 96%). In 2013, the tendency of paying by card increased, but not significantly (from 4.3% to 4.7%). In 2014 compared to 2012 and 2013, the share of card payments has increased at a higher rate, but this increase was not significant. In 2014, card payments represent 5.62% of all card operations.

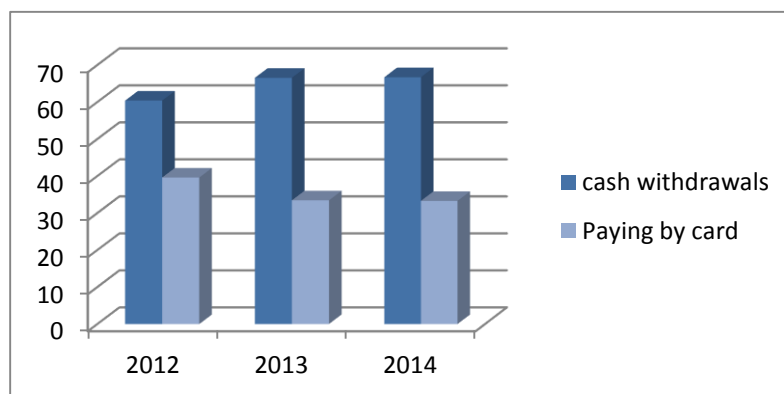


Figure 6. Transactions in Moldova with cards issued abroad for 2012-2014

Out of the value of transactions with cards issued abroad and transactions made in Moldova a higher percentage is given to cash withdrawals. On average, about 65% of transactions carried out in Moldova with cards issued abroad, represent the cash withdrawals, while payments amounted to about 35%. Foreigners prefer to withdraw money than pay by card, which demonstrates the growth of cash withdrawals during the last 3 years (from 60.4% to 66.71%).

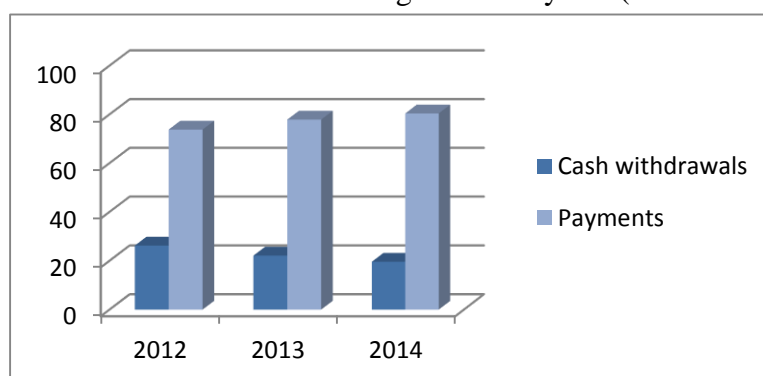


Figure 7. Average value of transactions made abroad with cards issued in Moldova

The value of transactions carried out abroad with cards issued in Moldova is characterized by the fact that the share of payments exceeds the average share of withdrawals – 77%. However, the value of payments is higher only abroad, while in Moldova individuals prefer withdrawing cash, especially those with cards issued in the country and making payments here. This again demonstrates the high level of development of electronic payment systems outside the Republic of Moldova. This can be explained by people's confidence in security and efficiency of electronic payment systems while being abroad, which is currently not specific for electronic payments in the country.

According to statistics presented by the National Bank we see an increase in the number of cards in circulation for the last 3 years, from 1,011,673 cards to 1,150,969 and 1,302,225 cards, which means an increase by 13.8% in 2013 compared to 2012 and 13.1% in 2014 compared to 2013. Both types of transactions, with cards issued in Moldova and abroad and carried out in the country or abroad, had an increasing trend. The value of all these transactions varies depending on the place of operations and the country of issuance. The number of payment devices, namely ATMs and POS-terminals during these three years was

only growing. This growth emphasises that banks and different economic entities offer more possibilities for card payments, thus making easier the process of payment for services and promoting cash payments limiting policy.

Internet payments are made through certain websites. In Moldova the largest sites where payments can be made online are:

- ✓ www.paypal.com (PayPal);
- ✓ www.wmtransfer.com (WebMoney);

PayPal is considered the largest company processing online payments globally. It is the biggest site that deals with brokering of transfers and electronic payments to and from users of this site. Through this website individuals can buy different products from various online stores that accept PayPal. In order to perform a payment via PayPal, the person must open an account on this site and charge his account using a bank card that is compatible with online payments. In this way the money from the traditional account is transferred to the electronic account. PayPal added Moldova to its list in June 2014. Taking into account that PayPal has recently appeared in Moldova, it is not very popular in our country. For example, in developed countries PayPal enables money transfers through mobile phones. Its appearance in Moldova is considered a great advantage for the economy, because besides facilitating money flow, it encourages the development of trade in the country and abroad [9].

WebMoney system is most widespread in CIS countries and in Moldova. In order to use this system, it needed to have installed the WebMoney program on the computer which is called “WebMoney KeeperClassic” [9].

Once this program is installed, the person can perform the following operations:

- ✓ pay for various products and services: mobile telephony, television, utilities;
- ✓ visualize the account;
- ✓ receive messages from different users of the system and also receive messages from the system.

Account replenishment is carried out similar to the PayPal system, i.e. via a bank card compatible with online payments [13].

On account of the individual can have several deposits in different currencies and for each currency he can create a special electronic wallet:

- WMR for Russian rubbles;
- WME for Euro;
- WMZ for USD.

According to statistics provided by this site, more than 55% of users have at least one electronic wallet. The problem is that the transfer of funds can be done only between the wallets of the same type [13].

Besides PayPal and Web Money, there are other sites but of a smaller size, which also can make instant payments. These sites are:

- www.oplata.md;
- www.dostavka.md;
- www.darwin.md;
- www.plati.md

Just as with PayPal and WebMoney, they allow making payments for services like:

- ✓ mobile and fixed telephony;
- ✓ utilities, financial services, Internet;
- ✓ television;
- ✓ games, social networking donations.

Internet banking is an information solution offered by the bank to its customers, which allows the bank account holder to remotely access resources available on this account for electronic payment transactions, to obtain information on performed payments, as well as visualizing the account statements. Internet banking allows the use of banking services anytime and anywhere. It also gives the possibility avoids queues and go to the counter. This payment instrument enables the remote management of finances quickly and affordable [10].

In order to access the online account through Internet Banking is needed a computer, a mobile phone, a tablet or any other device connected to the Internet. All financial institutions in Moldova offer the possibility to perform various transactions online. The figure below renders the use of Internet banking scheme.

Payment terminals represent payment devices offered by some companies. Payment is made through different payment instruments; the person chooses the required service and then enters the data required for payment. In Moldova these terminals are provided by the following companies:

1. QIWI;
2. Netto Pro;
3. Premier Telecom;

QIWI company is a market leader, offering its subscribers a convenient, safe and fast method of payment for mobile operators, Internet providers, digital television, IP telephony. Its purpose is to provide consumers a modern, safe and convenient payment service. QIWI brand was established in 2007 and became the first brand on the instant payments market. The priority of QIWI brand is the final user. QIWI has created for its users a unique system of payments, which combines almost all worldwide used payment technologies, providing a simple, fast and convenient way to pay a wide range of services anytime and anywhere in the world. International payment service QIWI appeared on the Moldovan market in 2011 and offers Moldovan users a technology of micro payment collection points, operating 24 hours a day, 7 days a week [7].

Among the services that can be paid through the terminals QIWI are: utilities, Internet, lotteries, games, social networking, donations, E-money, banking service, online payments, cable TV, flight tickets, mobile phone charges, State taxes and fines, etc.

Netto Pro Company is a big processing centre, which has more than 300 terminals in Moldova in more than 15 cities. The company was founded in 2007 and registered its first transaction in the system in March 2008. The company was founded in order to meet the payments system that will meet the entire cycle of technical, legal and financial projects in the field of payments acceptance; achieve a stable increase in the volume of accepted payments based on active incorporation of new technologies, that would enable the development of electronic payment market segments that have not been yet covered. Currently, the company's terminals allow the payment of more than 20 services. The company's terminals were used by more than 500 000 users, and the number is constantly growing. Compared with QIWI terminals, Netto Pro terminals offer a more restricted range payment services, including:

- Mobile telephony
- Cable Television
- Internet and IP telephony
- E-Commerce
- Utilities, etc.

Premier Telecom specializes in the development of telephone communications and IP-telephony worldwide. The purpose of this company is to provide a high-quality telephone connection and customer satisfaction [8].

Terminals offered by this company are called MMPS and its services are:

- International connection;
- Lease of phone numbers abroad;
- Classic IP-telephony;
- IP-telephony for mobile phones;

The payment of these services can be made through the following instruments:

- PayPal;
- Bank transfer to the company's bank account;
- Directly through MMPS terminals;
- Via www.oplata.md web site;

The company also offers a wide range of benefits, such as cheap calls, call forwarding, additional bonuses, calls statistics, etc.

Moldova has also implemented a special service for the payment of utilities. This service is called Government e-payment gateway (MPay Service).

MPay service represents a unique mechanism of electronic payment of public services available via such payment instruments like: credit card, Internet banking or even cash. Operation of this service is performed by "E-Government Centre" and in terms of providing technical and technological platform for the technical infrastructure, required for electronic payments, is responsible S.E. "Special Telecommunications Centre" [1]. The participants of the MPay Service are:

1. public service providers and payment services (Ministries, other central administrative authorities subordinated to the Government and organizational structures);
2. payers (individuals and businesses);

Any payer decides on the payment instrument of public services and the following actions to be taken depend on the chosen payment instrument. For example, if he chooses to pay with a bank card, the MPay service will identify the bank which will carry out the transaction, after which it will offer the payer to choose the bank that issued the card and will direct the payment to the accepting bank that serves the bank that issued the card. If the issuing bank cannot be identified, MPay Service will distribute equally the transactions between banks participating in MPay service [1].

The Government e-payment gateway offer to individuals and businesses the following public services: criminal record, payment for standard forms of primary documents, Apostille services, identification means for domestic animals, transport authorizations, payment of police fines, payment of income tax, licensing activity, services of SE "CSIR "Registru", e-Visa, service SE "Cadastru", payment of real estate tax, payment for civil services, payment for AGEPI services, eSignature.

4. Tendencies of development of electronic payment systems in the Republic of Moldova

Electronic payment systems in Moldova are developing and their development is hampered by the mass use of cash payments. It is obvious that cash payments are still popular, as most of Moldova's population hitherto only knew about the existence of this type of payment. A more intensive development of electronic payments is due to the rapid development of the Internet in Moldova, i.e. since 2005. During the last 10 years, the development of these systems has been significant. Currently, different payment instruments are available for the payment of goods and services, such as bank cards, Internet banking, online payments through different sites: PayPal, WebMoney and others. Although the advantages of electronic payments are obvious, compared to the cash payments: safety, speed, convenience, security,

only 30-35% of the population carries out such payments. Even bank cards that offer the possibility of cash withdrawal and payment; it is often used to withdraw money. This tendency will persist, as long as the individuals shall not realise, the benefits of electronic payments.

Another reason in favour of cash against electronic payments is the low level of security of electronic payments in Moldova. Even though in developed electronic payments are also subject to fraud, however, the security measures are at a higher level, encouraging people to conduct electronic payments. Thus, the problems that determine a poor use of electronic payments in Moldova are:

- ✓ lack of information about the benefits of electronic payments;
- ✓ low security level determined by attacks on electronic payments;
- ✓ e-commerce is not developed;
- ✓ mass use of cash payments;

If we solve these four big problems, electronic payments have a chance of rapid development. Considering separately each issue (mentioned above) we can establish measures to solve them:

- a wide range of information sources are currently available: newspapers, magazines, books, television, Internet. People must be informed about the availability of these payments, about the way they are performed, the instruments used for these payments and of course about the benefits they bring. Billboards can be displayed all over the city and also information brochures can be edited, offering useful information about these services.
- offering bonuses for electronic payments.

For example, in October of 2014 a campaign was launched by the E-Government Centre, in partnership with the National Bank of Moldova and with the support of VISA, offering a bonus of MDL 25 lei on the mobile phone to those paying for the public services via MPay and using VISA card. Anyone paying for a service a minimum of MDL 100 can benefit of this offer, thus promoting cashless payments [4, p.14].

The security of electronic payments can be enhanced through advanced technology, but since Moldova still lacks such technology, combating fraud such as skimming, creating ghost web pages, cloning of cards, the following measures can be taken:[3; p.18]

- a) purchase products only in trustworthy stores with security certifications;
- b) using a credit card instead of a debit card;
- c) while shopping online, make sure the financial information is transmitted via SSL - Secure Sockets Layer - which provides a secure connection without interfering with the process of sale;

Limiting cash payments can also be achieved by implementing certain laws. Once the person violates the law, he will be liable to pay a fine or risk years in prison. Thus, we can implement a Law limiting cash payment, just as it was implemented in some European countries [6; p.287].

Development of e-commerce will have a positive impact on the development of electronic payment systems. For example, transactions between businesses generally represent high value transactions. The greater is the number of successful value transactions, the less will be fear of making small value payments. Development of e-commerce can be encouraged by the following measures, carried out by companies:

- ✓ operate non-stop;
- ✓ be present on the Web;
- ✓ maintain regular contact with customers, partners, employees, suppliers;

- ✓ have network storage solutions that enable the management of huge volumes of information [11];
- ✓ have solutions for virtual applications, which ensure permanent availability, scalability, performance and security [11].

If talking about the role of government, there are two aspects:

- The first is related to financial literacy;
- The second is related to infrastructure development, especially in rural areas.

The problem is not just that people withdraw cash from ATMs, but also that there are no businesses willing to accept cards. We cannot blame people for not using cards, as they actually do not have where to use them [14]. Government should encourage businesses, especially smaller ones, to accept payments by cards.

In this situation, the state is interested in cashless payments, as cash payments bring prejudice to the state budget. The card is a key product in the banking business and these institutions are interested in promoting them in the first place [14].

5. Conclusion

In conclusion we can say that the implementation of such measures would contribute significantly to the development of electronic payment systems. Their development is necessary for the country's economy, as electronic transactions have become an important component of economy and the modern world. These payment systems can remove some processes that cause state regress, like: the shadow economy and tax evasion.

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Financial management of risks as a vital condition for the economic and financial stability for an enterprise

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Abstract. Today, under the influence of the globalization process of the financial international markets and the instability of the global financial situation, sound financial management of enterprise risk is needed more than ever. The financial risks management objective consists in their minimization through realizing a proper strategy for obtaining the financial stability of the enterprise. It is necessary to mention that the risk evaluation represents the quantitative calculation of the level of risk, of its characteristics, its causes, and possible consequences as a result of the influences on enterprise performance. An entrepreneur constantly faces problems regarding the elaboration of the strategy for avoiding the threat of a potential crisis situation. Therefore, the entrepreneur has to estimate the potential possibilities of a dangerous situation, to forecast the risk of apparition of insolvency or bankruptcy, to elaborate and to adopt measures in order to assure the financial stability of its activity.

Key words: *financial risks, entrepreneur, strategy, insolvency, financial management*

1. Introduction

According to the economic doctrine, each person has a patrimony that includes the active side, for example- rights and the passive side - obligations. It is well known that to start an entrepreneurial activity, people have to put in circuit some material values, that represent the entrepreneur's initial assets.

As the purpose of economic activity, the entrepreneur seeks to increase the value of assets put into circuit, whose surplus represents the profit of the entrepreneur. If the debts exceed the revenues, the entrepreneurial activity is ineffective, does not achieve the intended purpose and should be suspended.

At the same time, the entrepreneurial activity is performed partially on borrowed money and therefore, the participants in the various contractual relationships have the responsibility to honor its obligations in time. Unfulfilling an inefficient activity can lead the entrepreneur to a state of cessation of payments and failing to honor its obligations, getting to the maturity of a bill.

This is the outward manifestation of the difficulties faced by the entrepreneur, because they are felt immediately by the creditors.

Thus, at any stage of activity, enterprise managers are forced to estimate the potential possibilities of occurrence, of the destabilizing situation, forecasting the state of insolvency

and bankruptcy. They have to develop and adopt measures, to ensure the security of their activity.

As a result, we can mention, that the entrepreneur, permanently, is faced with problems related to the development strategy of avoiding the crisis situation of the company.

2. Considerations regarding the particularities of financial management of firms being in crisis situations.

Management instability and develop strategies avoidance of the financial crisis, must include measures and recommendations, in order to diminish the consequences, that may arise from taking various decisions.

This would allow the manager to evaluate the economic agent status, related to uncertainty, which may result in failure on goals set, and to obtain valuable information, on possible damage.

Therefore, the environment activity imposes the enterprise a new variable, which must be taken into account in maintaining the level of liquidity, namely - the risk it means the enterprise uncertainty from the results obtained. It has been founded, that the current concerns of research in Financial Management, is the problem of risk and inflation.

Starting from this, the risk is addressed in correlation with inflation, interest rate rises, leading to both, to an increase of capital cost, as well as, reducing the potential of an investment, to produce profit.

The risk may be defined, as a probability, and the expected outcome may differ from the actual return. The person who makes the decision, however, may predict, whether the obtained outcome, will compensate the effort.

The risk assessment, determines the degree of comfort, of the person, which is taking the decision, being abreast with the negative outcomes that can arise. In this context, the risk should be viewed as a possibility of loss or income.

So, in the scientific literature, the risk is characterized as "an opportunity to be exposed to dangers, it deals with troubles or losses, potential danger," it can be calculated and assumed, by the initiator of the business, and has a reward, the discounted profit of the business. It reflects the degree of probability, associated with failure, and the key character of the business development, is the entrepreneur, himself.¹

It is well known, that the future always is uncertain, so any decision taken, regarding the future, involves a higher dose or low of risk, it is a measure of concordance between different possible outcomes, more or less favorable or unfavorable, for a future action.

On the other hand, the entrepreneur is faced with uncertainty often just he contributes to its occurrence. Uncertainty (lack of certainty, insecurity, doubt, hesitation), of several types, it is manifested at various levels, represents an assembly of the potential events susceptible to occur, and which can be expected, thus affecting the company's activities.²

Bearing in mind, that the driving force of the development of entrepreneurship activity are uncertainty and risk, which have an objective character, we can mention, that they are the result of the influence of the external environment factors and, for these reasons, the focus is

¹ Marchesnay, M., Julien, A. (1988) - La petite entreprise, acteur de la stratégie industrielle. -In: Julien, P.; Marchesnay, M. (org.). *La petite entreprise: principes d'économie et de gestion*. (pp. 63-83). Paris: Librairie Vuibert, Editions G.Vermette

² *Dicționarul explicativ al limbii române*, (2000) București: Editura Univers Enciclopedic..

on ensuring mutual connection, between the forecasting process and the outcome of the current reality.

The external environment includes the objective conditions of: economic, social and political nature, within the limits, which the company operates, and the dynamics, which is required to adjust.

Concerning the question of uncertainty, we can assert, that it persists at all stages of the lifecycle of enterprise, due to the multitude of participants in the business process, whose behavior in different situations, cannot be predicted precisely.

At the same time, the enterprise activity, is influenced by the strategies, goals and criteria that cannot be invariable at the appropriate level of performance. Also, the activity of the economic agent is permanently affected by uncertainty of economic conjuncture, on which stand the instability of supply and demand, factors of production, combining capital for making investments.

In this context, a firm in difficulty is the result of a long series of deficiencies, regarding the business management, financial policy, and human resources management etc. But, for a normal activity, it is important to take into account, the value of risk exploitation, then for less profitable enterprises, and in loss, this assumed risk, is extremely high. Less profitable companies, have a lower market value, than of the net asset. For them, Trade Fund, being "badwill".³

A business owner of the company in loss assumes the risk, failing to recover it, and even to liquidate the company. However, for these cases, there is a limit, when the recovery is uncertain and when the recovery is achievable, but at great expense funds.

We also consider, that the financial risk indicators, give us a clear overview, over some phenomena of the negative influence of risk factors, and on this basis, may be elaborated the forecasts, in order to avoid or minimize the future risks, within the enterprise. As a result, the risk of insolvency issues, focuses on two financial conditions, namely: the state of the working capital and solvency status, highlighted by several installments.

In the case of insolvency risk, for managing the activity, a great importance, rests to the use of contemporary insurance methods and the usage of reserve funds and their distribution systems.

In this chapter, we can mention that, according to some opinions, insolvency, under economic aspect, represents a reflection of the insufficient situation, of gross income, intended to cover incurred expenditure. But in case, as the criterion of the enterprise insolvency, it serves the incapacity of production factors utilization, with some level of effectiveness, ia registers functioning in loss, of the economic agent, it may be made by the following findings:

- Unsatisfactory condition of the company, caused by the effect of loss, does not characterize the phenomenon of insolvency, as it could be the result of the marketing strategy of the economic agent, because, in this case, the losses committed, with the purpose of achieving a long-term stability, have a short duration character.
- Profitable enterprise activity, cannot serve as a guarantee, for maintaining the efficiency and solvency of the managerial object, as the incorrect investment policy, inefficiency of organizational and management structure, and the other factors, could attract the decrease in profitability.
- As a result, may occur the situation, when the economic agent, maintaining technical potential state and production, will become insolvent, as a subject of entrepreneurship. So unprofitability, reflects only final criterion insolvency side, when unfavorable situation of the company, becomes visible to all the business partners.

³ Dumitrescu D., Dragotă V., Ciobanu A. (2002). *Evaluarea întreprinderilor*, București: Editura Economică.

So, from the above, can be noted some causes of insolvency. One of which, is to reduce long-term demand, related to the completion of the life cycle of production or changing demand for the production of enterprise, which may transfer the price level, in the segment, located below the level of average costs.

The second cause assumes that, after spontaneous growth of the permanent expenditure or of those variable, may be increased the global costs to a level, which exceeds the price of the commodity.

As can be seen, the first cause of insolvency refers to the field of marketing and states, where the marketing strategy, is the starting point of the overall plan, of financial reconstruction of the economic agent. The second issue, concerns the financial sector and financial restructuring strategy, which is the final point.

Thus, we conclude, that the concept of risk management insolvency, involves a procedure in which, in a certain way, it is stipulated the danger crisis. It is performing the analysis of its peculiarities, and it is elaborated measures pertaining, to reduce the consequences of the crisis, and the use of factors, that will influence the enterprise development.

It should be noted, that at different stages of the crises development, and at the different variations of the economy, for ensuring the financial stability of the enterprise, it has to be adjusted and corrected. For an efficient achievement of the financial crisis management, it is necessary, to apply the following measures:

I. Prevention measures of the crises at the enterprise;

II. Measures to overcome the crisis.

The anti crisis management at the enterprise can be shown by the following figure:

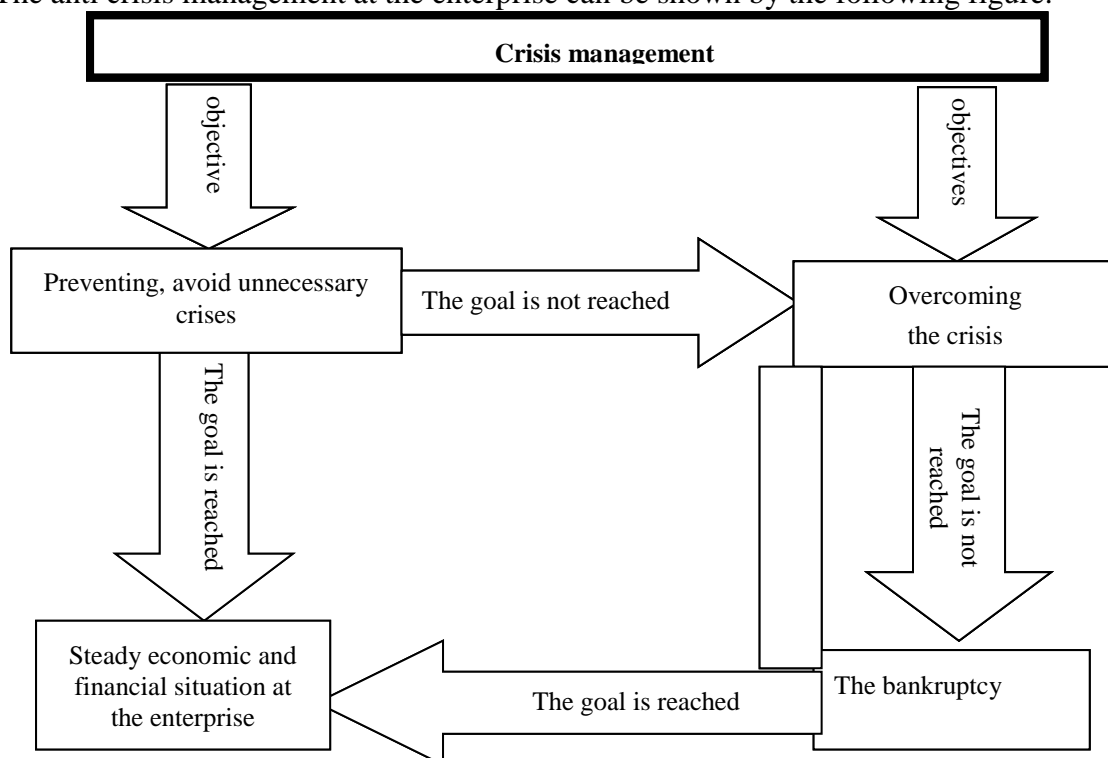


Figure 1. The anticrisis management

In this context, drawing up the strategy, regarding to the enterprise financial situation implies a process of an effective economic management, of the patrimony, which involves a complex of organizational, technical and financial resources, that will enable optimum correlation of

production factors. Not least of these, is the manager skills, to mobilize the team, to overcome the crisis situation and of avoiding panic spirits.

3. Methods of anticipating, avoiding and reducing the negative effects of the financial crisis at the enterprise.

We think that a big issue in the insolvency process is assigned to the company leadership which sometimes, is enough to change the administration and implementation of anticrisis management, in order to obtain financial growth. Therefore, regular payment of wages and extinguishment of the debts to the budget. From here, the conclusion is apparent that, for the formation of the own financial resources, is sufficient to go through a period of rehabilitation.

Therefore, the entrepreneur assumes the responsibility for drawing up an individual program of action that would avoid its insolvency. By activating in the competition environment, the economic agent is imposed to provide its customers the facilities, to the sale of goods, ia goods to sell on credit, which conditioned probabilistic character and high degree of risk.

The economic-financial management of entrepreneurship is a complex correlation, which is formed in the development process and conduct of business activities, between different elements of the material structure, technical potential and of the labor force, which expresses the possibilities of the economic agent, the way they are used, and which are the obtained results.

At the same time, it is necessary to compare them with the achievable level, depending on the existing potential. Thus, using the economic management, need to ensure constantly, a set of correlations, allowing a balance between:

- Capital goods and labor force;
- Production capacity and production obtained;
- Labor productivity and average wages;
- The volume of achieved production and its market demand;
- The investment allocated and the obtained results from thereof.

Referring to the economic management, we consider that it may be treated as a specific process, which consists of a set of planning activities, organization and control, aimed at establishing and plotting goals, which have to be achieved. And the interaction of economic means, will allow to achieve these goals, in which it is included a complex of forms, of an effective management, of the entire patrimony of the company.

The actions on the chosen strategic directions cannot be funded solely from internal resources, which, of course, are not enough in the crisis situations.

Respectively appear necessary, to hiring the sources from outside the enterprise, which is quite difficult, since the financial crisis at the enterprise requires its insolvency, respectively very few, are willing to risk and provide means, to such an enterprise.

It is very important for the enterprise, not to close its activity that, after this, will proceed to the other anticrisis measures. In this direction, the organization may use the following measures and actions, to overcome, the crisis situation:

- Reducing the enterprise consumptions and expenditures;
- Increasing and accelerating, the entrances of funds at the enterprise;
- Restructuring or rescheduling of financial debts;
- Establishment of a new enterprise development strategy, towards overcoming the crisis;
- Performing the reorganization and restructuring of the company.

Currently, the problem of evaluation, analysis, management instability and financial crisis of the enterprises activity, in Moldova, requires a survey, which would include theoretical and practical aspects, which should become a key element of the theory, of economic management.

The management procedure, allows the appreciation of ways and ensuring possibilities, of the economic stability of the enterprise, of its ability to resist to the unfavorable events. In the process of studying the problems of the financial crisis occurrence, it is necessary to take into account first of all, the level, at which the enterprise is, and the stage of its life cycle.

Anticrisis management, implies the elaboration of a prior plan, with the aim of avoiding critical situations, insurance against the risks, and at liquidating the consequences produced. There is a difference between steady planning, which is based on the use of certain resources and between planning restoring of the enterprise normal activity, before unpredictable and unpleasant events. It allows the economic agent, in a short-term, to rebuild its solvency and to meet its commitments, towards the partners.

In order to determine the financial stability, it is necessary to calculate the indicators that characterize the sources of patrimony formation. One of the indicators is the coefficient of the correlation, between own and borrowed sources. The greater the size of the coefficient is, the greater the risk of entrepreneurship is, which imposes the implementing methods, of reduction and avoidance of risk.

Among these methods, we can mention the diversification, that allows a greater stability in the financial performance, thus reducing the vulnerability of the company.

This consists of, capital allocation in various areas of activity, the results of which are not in the direct interdependence. Due to the multiplication of production, can be mitigated the impact of the favorable cyclical fluctuations in the sector, diminishing risks, connected with imperfect foresight, the market downturn or the appearance of new competitors.

When it supports the loss in a field of activity, it can gain a profit from another sector. From here, we can say, that the diversification, preserves the enterprise stability, regardless of internal and external factors, that have a negative influence. Another method, is the assurance of risks, by an insurance company; often using the hedging, ie the insurance of the commodity price, against the risk or unforeseen reduction for producers, and the unsatisfactory increase for consumers.

The method of limiting, entails the establishment of a limit, for the amount of expenses, selling credit and capital investment amounts..

Formation of resources, reserved for covering unexpected expenses, is done by correlation between potential risk and increasing expenditures, for incurring such risks.

This method, as a rule, is used in the implementation of various projects. The risks are divided between project participants, the longer the period of investment is, (modern technologies are innovated), and the greater the risk of the project is. As a method of the risk sharing, factoring operations occur, which ensure high risks.

The efficiency decrease of an enterprise, and the loss of market segment, creates a negative state. The management proposals are numerous, of "successful solutions", in order to prove their managerial potential, still not exhausted, and the financial exigency, includes the fulfillment of at least two conditions: the cost of implementing the proposal and earnings, brought by the respective proposal.

In the specialized literature, the achieving process, in confrontation procedures of financial crises, related to borrowers- enterprises activity, it is appreciated, as a process of avoiding the crisis, which in conditions of market economy, is considered, as a controlled process.

This situation emphasizes two concepts: management against crisis, and realization of actions against the crisis. The first is a microeconomic category, which represents all forms and methods of implementation of procedures, to avoid the crisis, within the corresponding company and reflects the production relations, which is formed at the stage of sanitation or of its liquidation.

The second, being the macroeconomic category, includes organizational, economic, legal and regulatory measures, aimed at protecting, against the crisis situations, preventing insolvency or liquidation of enterprises, in the case of unprofitable business.

In this context, in specialized literature, the focus is on preventive procedures, to avoid financial crisis, and anticrisis management, is aimed at avoiding insolvent situations, of the company.

According to data approach, determining the essence of anticrisis management, it is manifested in a certain extent, in the narrow sense, since it provides the management process, under the existing financial crisis, and it is directed, towards the redressing situation data.

Directly, the main cause in the management of the financial crisis is to ensure the conditions, in which financial difficulties cannot have a permanent and stable character.

So, in our view, the concept of anticrisis, involves the operation of the company management system, with systemic and complex character, which aims, is to prevent or avoid unfavorable phenomena for business, implementation and realization, throughout the economic agent, of a strategic special program, that allows overcoming the temporal difficulties, maintaining and extending from the own sources, in different circumstances, of the subject positions to the market.

However, such a formulation of this category, does not allow the management structure, the disclosure of avoiding the crisis, and does not determine the importance, of financial restructuring, in case of the company sanitation. The theories of management, determines that, the management of avoiding financial crisis, needs to overcome and prevent the insolvency of the company. Using management procedures, allow insurance, over a long period of time. Level of competitiveness that will create conditions, to produce the required goods on the market, and ensure sufficient cash flow, to pay all the bonds. Based on the above, the management of financial crisis can be divided, into the following modules:

- ✓ external environment analysis of the internal potential of competing priorities;
- ✓ a preventive diagnosis of the creation crisis situations reasons, in financial and economic processes of the enterprise;
- ✓ complex analysis of economic and financial situation of the company, in order to establish methods of financial rehabilitation;
- ✓ business plan for the company's financial sanitation;
- ✓ management procedures of avoiding financial crises and controlling their performing.

Thus, this anticrisis management determination reflects the structure and its contents, as for the first three modules, they are oriented towards determining the current state of the enterprise, and the last two, are aimed at moving out of crisis.

From this point of view, the enterprise management activity, in conditions of insolvency, can be studied, as a process guided toward preventing or avoiding the crisis, based on objective tendencies of development.

In this context, anticrisis management problems in the financial situation of the company can be grouped as follows:

1. Issues related to the state of insolvency detection ;
2. Methodological, economic and financial issues, that comprise the key areas of the company's volatility.
3. The problems of forecasting crises.

Thus, the notion of Anticrisis management, consisting in the financial restructuring of the company and shaping processes, can be related to different groups of issues.

Those mentioned above, allows to conclude, that insolvency, represents a complex characteristic, that reflects the internal processes, deployed within the enterprise, which finally reflects on its financial condition.

In turn, for the most of the management subjects, management mechanism should not be directed towards avoiding crisis, but towards the expectation, in order to prevent, insolvency and the ensuring possibility, also to prevent the bankruptcy.

At the same time, concerning the insolvent enterprises, both, those from national economy as well, as those from the system of consumer cooperatives, we can mention, that the main direction of anticrisis management, consists in financial restructuring.

It is well known, that any management decision, is taken, when the results are still not known and information is limited, therefore, should be considered some principles of risk reduction, namely: you should not risk more, than allowing your capital, you must not forget ,about the consequences of the risk, do not risk more, in order, to obtain less.

4. The elaboration and implementation of stabilization programs, as a mechanism for enterprises management, being in an insolvent state.

The financial condition of the enterprise stability is in a relationship with bankruptcy and with the aim of avoiding financial crises. Thus, each company is imposed to develop a strategy that would allow operation, in a timely manner.⁴

The process of formulating a strategy of avoiding financial crisis, must take into account the managerial policy, regarding to the organization and production process, marketing policy, investment and personnel management.

In turn, management policy combines, production management, technical and scientific policy, technology policy, politics assortment and producing competitive goods.

So, through organizational management, is carried out the direct management of the company, taking into account the main goal of reaching it, namely expanding market segment.

This objective is confirmed by position of launching on the market, of certain types of products. As an element, we can mention, the operative management, which involves determining the conditions and means, that ensure supporting process of execution, stimulate industrialization trends, in production and maintenance of scientific potential and personnel employed, in order to avoid crisis.

For performing functions, that underlie the organization of the production process, it is necessary to take into account, a multitude of factors, namely: ecological, territorial, social and economic, as well as plans and programs, relating to the future development of both, the enterprise data, as well as, associated businesses, that can ensure, the normal operation of the economic agent.

Referring to the investment process, for a relatively short period, we highlight that, it consists in the elaboration and implementation of programs, on renewal of the technical potential, creating stocks of material resources, by an appropriate volume, training and retraining of managerial and production staff.

⁴ Гаген А. (2007) *Антикризисное управление предприятием. Основные моменты*. Информационное Агентство "Финансовый Юрист, from http://www.financial-lawyer.ru/newsbox/economistu/financial_management/132-528135.html

Concerning the solving problems, related to a long-term funding initially, it is assumed a preventive analysis, regarding to the study of marketing, under which is determined the production potential, that would ensure market demand simultaneously, it is necessary to examine the possibility of the company placement.

The organization of the exercise process includes:

- the establishment of modern manufacturing processes of production and creating the best placement of the enterprise;
- developing such a management structure and production of the enterprise subdivisions, that would allow to achieve the best results.

Technical and scientific policy is based on the intangible management assets, which are: patents, licenses, trademarks, information assurance, improvement measures of the exercise process, new scientific and technical elaborations etc.

To achieve the objectives set, and the appropriate use of these assets by insolvent enterprises, are necessary the processes of inventory and analysis, of the effectiveness of using the scientific basis and the development of the appropriate management measures, related to intangible assets.

The positive effect obtained in the process of exercise as a rule, is determined by increasing the level of use, within the enterprise data assets. Another very important particularity for enterprise is referred to the investment attractiveness of intangible assets. They serve as the basis, for ensuring the appropriate level of liquidity, and for determining the type and degree of risk, for the elaboration of measures, for preventing the risks of investment projects. Mechanism of the elaboration strategy, for avoiding insolvency and financial crises, stipulates preventively, purposes of, technical, and scientific and technological policy. In this chapter, we can note, that the main goals are:

- the formation of a progressive structure of production;
- implementation of new technologies as the basis for increasing the competitiveness of the products offered on the market;
- the potential use of the applied sciences and innovation support.

Technical integrity of science and technology policy within the enterprise, contributes to attracting investments and project financing of technical renewal. In planning for the financial reconstruction, the enterprise must provide for the use the advanced technologies.

For supporting its vitality, the company, is imposed to renew the production assortment, proposed permanently to consumers. Taking into account the possibility of offering basic and auxiliary assortment, ia goods, which depends largely on the scope and level of production, investment size and know-how.

Taking into account the crisis situation of the enterprise, it is necessary to elaborate policy measures assortment, increasing the volume of production that can be presented on the market. For this purpose, it requires traditions analysis and consumer requirements, the possibility of using new technologies and expansion of production potential.

Simultaneously, it must be determined the marketing mechanisms of production, and the possibility of organizing sales procedure, through the third parties.

Organizing the activity on avoidance of financial crises, requires the implementation of measures, for restoring the production process, determination of the optimum parameters of the activity, assessing the possibilities for an efficient use of surface, analysis the production base of technological processes, costs, related to the enterprise supply, with the necessary resources etc.

As a separate direction, of enterprise managing ,in a state of difficulty, it can be highlighted the elaboration problem of a financial reconstruction plan, which must be based on a complex set of measures, related to the formation of an optimal marketing strategy. Under this strategy, related to the avoidance of crisis, is highlighted the following⁵:

- assortment policy, including policy renewal nomenclature, based on the analysis of enterprise competitiveness;
- optimal pricing policy;
- Promotion Policy for goods and stimulating sales.

The marketing strategy should be based on the cost recovery marketing programs, both entirely, as well as its component parts.

As the particular problem, it can be highlighted the marketing strategy, which is a complex of activities, which represents a system of views and actions, related to the study of the needs and possibilities of exercise process, and the exchange of manufactured products, with the aim of meeting their market demand, using a minimal volume of resources and ensuring as full effect of consumption.

In this case, vision system, ie the concept of management under current conditions, must be oriented towards consumer.

This requirement is implemented in practice through marketing related tools, which are based on a special technique, for the analysis of market processes.

Thereby, marketing as an integral process, which represents the theory and practical management tool of the market economy at microeconomic and macroeconomic level.

Marketing programs require the elaboration of a strategy, which could correspond to the state economic policy, and at the same time, would ensure the commercial structures, an adequate level of efficiency, cost effectiveness and material incentives.

Using marketing methods, allow coordination of interests and goals of entrepreneurship of management structures, with the purposes and state interests, which ultimately, will contribute to the economic development and for diminishing the risk of bankruptcy.

Management activities, permanently, is faced with the problem of balancing the necessities and the needs of the real possibilities of their sufficiency; distribution of resources for fulfilling the particular economic tasks, ensuring the appropriate level of efficiency.

For the study of marketing, it is necessary, the use of planning procedure, as a management flexible lever, of the market process.

Marketing tools – offer. audition, price, being the main market regulators, are in a permanent correlation, reflects the law of supply and demand actions, ia their level of balance and compliance, in the viewpoint of volume, structure and period.

A frequent analysis of market segment and its expansion possibilities and forecasting the changes in the main market instruments, enabling enterprise in time, to form a strategy for avoiding the financial crisis.

5. Conclusion

So far, the financial crisis management of the company was constrained by the insufficient development of information base, in this direction.

⁵ Zugrav, I. (2009). *Reflecții privind insolvabilitatea întreprinderilor sistemului cooperației de consum și perfecționarea mecanismului de gestionare a acestora*. Unpublished doctoral dissertation, Trade Co-operative University of Moldova, Republic of Moldova

In this context, not only native experience, but also the global experience, has shown that, the use of crisis situations management, is quite difficult from the practical point of view, ie, it requires a development and perfection in the methodological plan.

This would allow a more profound understanding of the crisis phenomena that underlie the causes of occurrence at enterprises, at the same time, it would generate a more appropriate reaction, upon the crisis factors, that endanger the attainment of the objectives;

Finally, it would ensure the increased efficiency of anticrisis actions and measures, applied by economic agents. In the current conditions of the domestic economy, this is one key issue, determining in a large extent, the survival of businesses in the national economy.

The global crisis of the recent years has made the financial risk management, to become one of the most popular terms of the economic life. The situation difficulties are confirmed by the worsening of financial state of enterprise, of the losses increase, and of the number of firms, being on the brink of insolvency.⁶

This makes an extremely actual issue, of the efficient management organization of the enterprise activity, to choose the management methods of crisis situations, and its transformation into an effective tool, of the entrepreneurial activity.

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Searching for optimal financing opportunities for cooperative enterprises in adverse economic conditions

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Abstract. In the current economic situation, achieving financial stability is an essential condition to every company, regardless of property form or their field of activities. This is even truer for the entrepreneurs or for cooperative consumer enterprises that are facing cash flow problems often. Identifying optimal financing sources is not an easy task, but every financial manager should give special attention to this issue. In practice, there is not a universal recipe of the optimal financing structure but, in this paper, we will try to present some theoretic aspects on this subject and identify some financing solutions for the local consumer cooperatives enterprises. Internal financing, borrowing and/or equity issue, which is the best alternative to raise money or improve the cash flow for the entrepreneurs and cooperatives in the Republic of Moldova.

Keywords: *financing, debt, plowed back, equity, cash flow*

1. Introduction

Any company has to adapt to the business environment where activates, maintaining at the same time the internal cohesion and reducing the risks implied by transformations generated through the internal and external factors. Obviously, it is vital for any company is vital to be wisely financed in order to function properly.

Financing a company is the process of gathering financial funds from different sources, in the determined conditions, reimbursable or not, at a specific cost. Choosing the right financing sources for the cooperative enterprises is crucial, because the capital, borrowed or equity, implies costs that are reflected directly in the financial results of those entities.

The ratio between equity and borrowed capital has a significant impact on the financial performances of the cooperative enterprise because they have different characteristics such as costs, maturities etc.

Depending on the specific activity area of the cooperative enterprise, different sources of financing are used. Experience, observation and systemic analysis of the financial markets play an important role in deciding which financing sources are the best for the consumer cooperative enterprises.

2. General consideration regarding the financing of the consumer cooperatives enterprises

The adverse economic conditions, that manifested in the past and still exist in the national economy, have deep implications on the economic activity of the consumer cooperative system from the Republic of Moldova. From this perspective, the consumer cooperative enterprises need to permanently and carefully trace any negative conditions that can result in potential threats to the cooperative consumer enterprise.

The problematic financial situation of the cooperative consumer enterprises is determined, to some extent, by its own characteristics: statute, ownership, democratic member control, social orientation, management hierarchy, multiple management strategies etc.

Empirical analyses and theoretical research indicate that any enterprise has the following goals: survival, maintaining an optimal liquidity level, satisfactory balance sheet structure, profitability and, finally, maximization of the enterprise value.

The enterprise development is influenced by the proposed strategies and objectives. The ultimate objective of an enterprise is represented by the profit that can be distributed to the owners or retained for future investments in new equipment, new technologies and so on.

The cooperative consumer enterprise is one of the few associations of different individuals that do not have an objective to obtain the maximum profit, but the satisfaction of the material and spiritual needs of its members under the condition of reimbursement of the expenses. Therefore, we can observe that the main financing sources for the consumer cooperatives enterprises are the membership fees and the profit that results from their activities.

The economic reform regarding the consumer cooperatives system ruined the production planned system related to the commercial relations, determined the reduction of agricultural and industrial production, disturbed the financial and monetary system and resulted in increased prices. Moreover, the state has stopped regulating commerce and acquisitions, passing from planned relations to contractual relations with the consumer cooperatives. This fact had a negative impact on the financial situation of the cooperative enterprises and on their unions. The cooperative enterprises were not capable to fully adapt to the market economy rules and now they have found themselves in a difficult financial situation characterized by low liquidity.

The consumer cooperatives are still running in Moldova based on the old system. The commercial activity often is not profitable and the introduction of the payment in advance forced many cooperative organizations to sell enterprises in order to obtain working capital, because the interests on the loans were too high. As a result, it might be necessary to use short term financing that will increase the net working capital and would accelerate the insolvency.

At the same time, powerful competition arises for the consumer cooperatives that tend to monopolize the market and to push out the cooperatives even from their traditional segments: buying and processing the agricultural products, selling in the rural areas etc.

The consumer cooperative enterprises are not able to perform their activities unless they dispose of the resources, like physical and human capital. Physical capital, that includes financial and real assets, is involved in a continuous process of transformation through which financial assets are converted into real assets and vice versa. Financial assets are necessary for buying real assets and human capital, while real assets together with the human capital are producing goods and from their selling they get the financial assets.

The efficient use of one enterprise resources requires that every monetary unit that was invested has to bring profit and not to exist unused assets. Therefore, the exact estimation of

material and financial resources , as well as getting them at the lowest cost, represent one of the main responsibilities of the financial management in any enterprise.

The peculiarity of the consumer cooperative enterprises is the fact that individuals can do better things in groups than separately.

Nowadays, the consumer cooperatives are facing a lot of problems in Moldova. First of all, the inflation that affects both, the buying and the selling price. Also, the inflation makes it difficult to correctly estimate the dynamics of changes in expenses and incomes. Altogether, these factors make it difficult to forecast precisely the efficiency of the cooperative enterprise.

Secondly, the production expenses record is not separate for inputs and outputs, and more than that, it would be necessary to conduct a separate record for every activity.

Evaluating the enterprise activity consists in evaluating their assets. In order to compare, the assets value they have to be evaluated at their current value. In order to evaluate the investment profitability we need to calculate the return on equity.

In the Republic of Moldova, like in other countries that were characterized by a centralized and planned economy, accumulating financial funds for starting an enterprise is a true challenge for an entrepreneur. The advantage of little competition in some areas is annihilated by the scarcity and limited access to the financing sources.

In addition to the importance of the accumulation of financial funds for starting a business, correct and complete financing represents an essential condition for the future development of the enterprise. The volume of the required financing depends on the type and the characteristics of each specific business.

If an enterprise does not have enough financial resources, it will make its survival on the market difficult, even if the acquisition and the selling process are well organized. From this point of view, we can mention that a delayed payment from a customer, can create a financial obstruction for the creditor who cannot pay his own obligations and this fact might lead, in some situations, even to insolvency.

3. Optimal financing opportunities for consumer cooperative enterprises

We can say that nothing created by the man is perfect. This is true also in relation to the management of the consumer cooperatives' activities. Even if, the decision appears to be perfect at the beginning, the rapid changes in the economy, on the markets or the imperfections of those who execute it, demand periodical corrections of this decision, and sometimes for the whole decision chain.

In our opinion, the main obstacle for a successful financial management of the cooperative enterprises is represented by one truly efficient investment policy. The economic growth can be achieved only through the reduction of the bureaucratic barriers, stimulation of the investments and reorganization of the insolvent enterprises.

In many countries, the development of the cooperative enterprises is done by innovation, while in Moldova cooperative entrepreneurship is in crisis due to wasting of the huge potential resources. This fact led to a significant decrease in the cooperatives contribution to the national budget and to the formation of the GDP.

In former times, in the planned economy the enterprises used to receive financial subsidies from the state without reimbursing them and often producing noncompetitive goods.

Today, the consumer cooperatives system is in full process of restructuring. The consumer cooperatives are searching for new forms and methods of activities, elaborating new organizational and management strategies, finding solutions for consolidating the relations

with the cooperative members, as well as for increasing the efficiency of the whole activity in general.

The financial situation of the cooperative enterprises depends on the sources of financing, internal available resources and their placement. According to the data available, the consumer cooperative system is characterized by the major proportion of equity in the total of the financing resources. At the same time, we can observe that in the consumer cooperatives system, little investments are made on the account of the long term debts.

After choosing the business idea and elaborating the business plan, follow the search and the accumulation of the necessary capital for financing the project. Depending on the specificity of the business, different types of financing can be identified and examined. Each of these sources requires a different approach and lately, a different management. Also, significant differences will be in the financing costs depending on each source.

Basically, any enterprise can choose between three main sources: internal financing, new equity and debt. The choice between these sources is a difficult task, especially between equity and debt. The managers have to find an optimal financing combination that minimizes the cost of capital and maximizes the enterprise value.

Easy to say, but we don't have a magic formula for finding this optimal capital structure. However the FRICTO analysis can help. FRICTO analysis framework was developed in the 1960' at the Harvard Business School and this is an acronym for six important factors that we can take in consideration when fundamenting the financing decision: Flexibility, Risk, Income, Control, Timing and Other¹.

The FRICTO analysis raises questions related to these factors and answering these can help the managers to better fundament their financial decisions²:

F - Which of the financing sources assures a better flexibility for the enterprise in case of difficult situations?

R - What is the risk level that the enterprise can accept?

I - What is the interest or dividends level that can be supported by the enterprise?

C - To what extent the current shareholders and the management are willing to share the property rights?

T - What opportunities can be found currently on the monetary or the capital market?

O - Which are other factors that can help find the optimal financing combination?

The majority of the financing, even in the United States³, but also in some other well developed economies like Germany, Japan or United Kingdom, comes from internal sources that are represented mostly by the plowback profit and the cash flow allocated to depreciation.

The optimal capital structure is difficult to be defined properly, because financing decisions are taken by persons, who act differently, according to their own perception of the business environment. The optimal capital structure has to lead to maximization of the enterprise value. This can be appreciated through the model that reflects the impact of the debt financing on the enterprise profitability. Thus, we have an equation with two unknown elements:

1. The weight of the equity in total capital - measured with the financial leverage. When the leverage is big, the debt is the same and the return on equity is high.

¹Kester G., McKellar J., Mulcahy J. (2010). *The Application of FRICTO Analysis to Making Financing Decisions in Practice: Two Case Examples in Australia*. Journal of the Academy of Business Education from <http://abeweb.org/proceedings/proceedings10/kester.pdf>

²Silbiger St. A. (2006). *MBA în zece zile*, București: Casa de Editură Andreco Educational Grup , p.214-215

³Brealey R., Myers S., Allen F. – *Principles of Corporate Finance*, 11th edition, McGraw Hill Irwin, 2014, p.349

2. The interest to be paid that directly influences the net profit. The enterprises with high debts have larger financial expenses and, in the end, the net profit will be lower. In this case, the return on sales will be lower and this will decrease the return on equity.

The economic growth ratio indicates the efficiency in using the assets and shows the changes in the sales and assets volumes. It is important for the enterprise to know the required effort to increase the sales and this is more positively perceived that the assets increase.

Regarding the flexibility, we can mention two approaches: a defensive one that is receptive and can adapt to all modifications in the economic conjuncture and an offensive one that offers the enterprise the opportunity to make changes in the internal economic environment searching for the most efficient investments.

Flexibility should impose to the manager a way of thinking that will permit him to efficiently allocate the financial resources. The main ratios that characterize the financial flexibility are: debt ratio, internal financing capacity, expenses structure, unused asset level.

The consumer cooperatives model, compared with other spheres of the national economy, can create a real climate to overcome the negative aspects regarding the goods sold on the market. This model focuses on serving the most vulnerable social categories with low incomes.

The consumer cooperatives model is based on the "open economy" model that can influence the dynamic of the evolutionary process that is characterized by an external "shock" which is supported by the system. We are talking, on the one hand, about the competition level in the private sector, and on the other hand, about the inflationist process. Among the most frequent characteristics that can highlight when evaluating the cooperative enterprises activities one can mention:

- enough incomes for the co-associated persons;
- principles of the democratic goals and activities;
- adopting special rules when dealing with the capital.

Taking into consideration that the activity of the cooperative system is done mostly on internal accumulations, this should be developed on the basis of innovation and investment policies that can ensure a structural orientation under the influence of the elastic demand of the market segment. This supposes the elaboration and implementation of a flexible model of activity that operatively adapts the production process, the commercial volume, the structure and quality of the liquid demand of the market

The consumer cooperative enterprises have to use, rationally and according to their destination, the investment and material resources, including those related to the acquisition of new technologies, creating a modern production flow that can keep pace with the competition. In the absence of this, it will be difficult for the consumer cooperatives system to get enough market shares from an already oversaturated market.⁴

In addition to the regular sources of financing, the cooperatives systems have their own mechanisms for financially helping each other's through associations, like the Central House of Credit Cooperatives.

The Central House of Credit Cooperatives is a credit institution that is created through the association of cooperatives in order to manage their common interests, to follow how the legal issues are respected, to supervise and control their administrative, technical and financial

⁴ Zugrav, I. (2009). *Reflecții privind insolvabilitatea întreprinderilor sistemului cooperației de consum și perfecționarea mecanismului de gestionare a acestora*. Unpublished doctoral dissertation, Trade Co-operative University of Moldova, Republic of Moldova

organization and functioning.⁵ As an example, we propose the following financial mechanism presented in the Figure no.1.

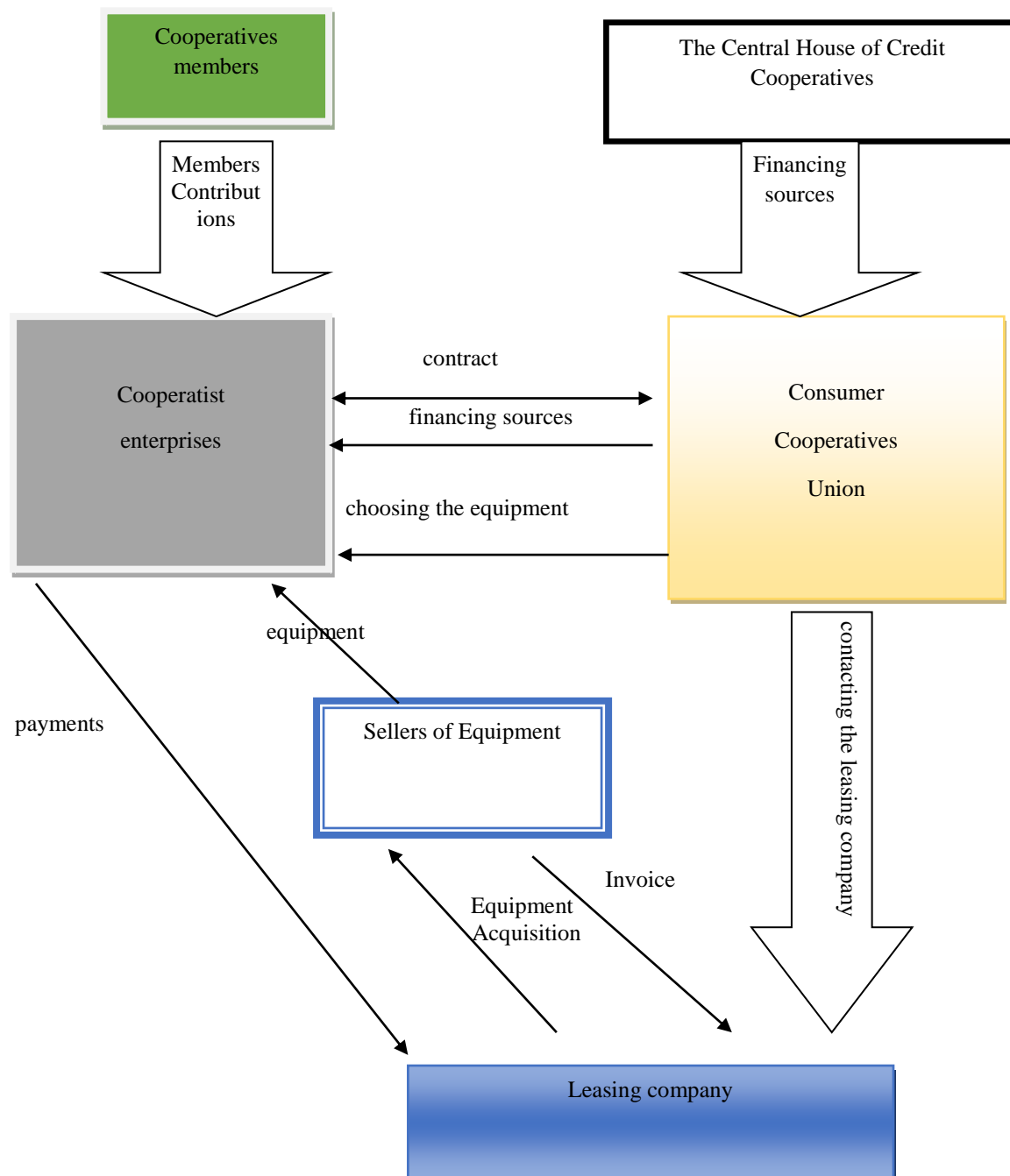


Figure 1 Financial mechanism of consumer cooperative enterprises

The liquidity of cooperative enterprises can be sustained with the help of internal reserves because the cooperative enterprises are limited in their opportunities of attracting financial funds. In crisis conditions, the increase in production and selling costs is usually more

⁵ Смирнова Н. (2011). *Что такое кредитный кооператив и зачем он нужен*. Новый бизнес: социальное предпринимательство. from <http://www.nb-forum.ru/business/advice/что-такое-кредитный-кооператив-и-зачем-он-нужен.html>

intensive than the increase in the profit of the cooperatives, derived from the assets and goods rotation.

Therefore, we can conclude that, ensuring the financial stability of consumer cooperative enterprises, in the strategic development stage, can be obtained when an equilibrium level is reached.

The maximal period of stable functioning, in the situation of a financial equilibrium, can be determined by the period corresponding to the equity increase with the values estimated based on the stable economic growth model. Any deviation from the ratios calculated can lead to the unbalancing of the financial situation and to insolvency.

The stable economic growth of an enterprise can be achieved through these main parameters, when they correspond to the estimated levels, such as follows:

- the coefficient for the return on sales;
- capital structure policy formation, reflected with the aid of financial dependence coefficient;
- assets policy formation, determined by the assets rotation ratio.

By changing any parameter related to the financial strategy, the consumer cooperatives can achieve different levels of economic growth in the financial equilibrium conditions.

All the parameters of the economic growth are fluctuating over the time. From this point of view, in order to ensure the financial equilibrium one enterprise has to make periodical corrections, taking into consideration internal development conditions, changes on the financial markets and other factors from the external environment.

Therefore, the financial strategy parameters of the consumer cooperatives enterprises system regarding the stability and development process have to be accordingly corrected, taking into account the increasing opportunities of the equity. In these situations, the financial stability is considered to be achieved, if following the increase in economic growth, the equity increase is ensured in the future periods.

4. Conclusions

Any enterprise can finance its activities from three main sources: internal financing, equity and debt. As we saw before there is no magic formula for the best financing combination, but we have indicated some important principles to take into consideration when making the financing decision.

The financing of cooperative enterprises has some particularities compared with other types of enterprises. We saw that internal financing represents the major source of cash for investments for most of the companies, even in the most developed countries. This is even more important in case of the consumer cooperative enterprises that have no pressure to distribute dividends, so that they can almost always plowback the profit, which together with the cash flow allocated to depreciation represents the most important source of financing.

Internal financing offers many advantages for the consumer cooperatives: it is the cheapest source of financing, you don't need to pay interest on it, and you don't have to share control or ownership with others and so on. Thus, this financing source offers flexibility, safety and independence. Also, this is an advantage in the perspective of attracting external financing, proving that the enterprise is serious and uses wisely its own capital.

As the main external financing source, debt can come in many forms: various loans, bonds, payables, leasing and so on, with different interest or maturities. Out of these, we consider that operational leasing represents a good financing opportunity for the consumer cooperatives, because in this case they do not have to block too much capital in assets.

A good form of loans for cooperative enterprises is the loans that can mutually borrow one from each other or from their associations. In the short term, financing with payables can be a solution in difficult times, but for limited periods and with their agreement. Also, financing with receivables, notable through factoring, can be a short term financing solution for the cooperative enterprises.

In the entrepreneurial activity of the consumer cooperative enterprises, they can find themselves very often in difficult financial situations. That can be the result of wrong financial decisions and incorrect actions with major impact on the financial resources of the cooperative, which can lead in extreme situations, even to insolvency or bankruptcy. Therefore, finding the right financing solutions is vital for the consumer cooperative enterprises, especially in difficult times.

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Investments and venture capital as an option to development and innovation in the consum cooperative enterprises from the Republic of Moldova

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Abstract. Currently, the success of ensuring economic growth firms in the consumer cooperatives of Moldova is totally dependent upon the technical modernization and restructuring potential, which is bounded by increasing funding opportunities and investment projects that can be performed through investment and venture capital. The use of venture capital investment requires the preparation and implementation of investment policies related to investment potential, which allows selecting the optimal financing, taking into account the cost effectiveness and risk. Financing investments is a significant step in the investment process, in which financial resources are embedded in the investment budget and can be used to achieve the project following the investment decision. Efficiency investment process is influenced by the amount and quality of resources and the size of the output of enterprises. But in terms of economic instability, namely the opportunity of undertaking investment policy depend potential enterprise level providing technical, structural reorganization possibilities. Based on this reason, venture capital investments impose to elaborate, to develop and implement an investment policy related to the enterprises investment potential and economic growth. One of the innovative ways in RM and an important external source of financing investments other than bank financing is venture capital.

Keywords: *business, investment in venture capital funding, investment project*

1. Introduction

Currently, within the national economy, the servicing of the rural sector population is carried out by business structures that are part of the system of consumer cooperatives in Moldova. These entities represent a viable alternative for promoting the interests of the member of these cooperatives and for covering their consumer needs. Under the local Moldovan legislation, the consumption cooperation system is a system of cooperative organizations and cooperative enterprises designed to meet the needs of members of these organizations, and other consumer and the creation and development of infrastructure, expansion of consumer cooperatives, consumer protection.

Consumer cooperatives in Moldova represents one of the largest organized systems in the country. During its economic activity for almost a century and a half this system was stated as one of the most stable segment in cooperatives, impacting not only economic but also social. In this regard it needs to be mentioned that unlike other forms of cooperative activity, consumer cooperatives economy is highly social. It has continually expanded its areas of activity becoming permanent multi sectoral and developed its own infrastructure, which penetrates the entire geographical area of the country.

Currently the main focus of consumer cooperatives keep developing the main areas of activity, including: trade, public catering, procurement, investment activity, exports and imports of goods and products.

Implementation and development of market relations was accompanied by the development of competition in cooperative entities and could not face the first stage, and this resulted in downsizing of this sector and decreasing performance indicators of the business.

Thus, starting with commercial services providing for members and with selling varieties of goods, mostly goods for life necessity, the consumer cooperatives in the Republic of Moldova came to perform various activities whose development mostly depends on investment activity, which can be achieved by attracting investment and availability of venture capital instrument.

2. The methods and techniques of the applications

For preparing this study research were used various methods, including as follows: systemic, regulatory, statistics, dynamics, and other research methods such as synthesis; economic analysis; induction and deduction, dialectic applied knowledge aspect investigated and other processes, instruments and methods of economic research, such as statistical and economic comparison.

The methodological and theoretical research is the basic concepts of financial theory and economic concerning the possibilities of financing business structures laws and regulations of the Republic of Moldova and documents developed and adopted by the governing bodies of consumer cooperatives, Strategy development of consumer cooperatives and others.

3. Conceptual issues regarding the funding of the cooperative enterprises through investment and venture capital

The economic potential of a country, its ability to meet the needs of economic and social population, the place it occupies in the national economy and the extent of participation in the GDP depend on the efficiency of the economic activities of the business, in which a special place belongs businesses system of consumer cooperatives. Their activities are conducted in accordance with Consumer cooperatives Law No.1252-XIV from 28.09.2000, which in terms of sustainable development is influenced by increased competition, changes in technology, fluctuations in interest rates and exchange rates, inflation, loss monopoly held in rural areas that have major impact on sustainable development entities in the system.

The viability and efficiency of development of these cooperatives depends on economical and rational and prudent management of financial mechanisms, under which, among the most important is the investment process. Within the economic activities of the cooperatives these processes require rigorous quantitative and qualitative substantiation, as they prepare capabilities and production conditions to be achieved in the future and that are measured in terms of resources consumed for the purposes of project activities.

During the period of 2008 - 2014 years, based on the data analyses of the dynamic of economic activity of the consumption cooperative system of RM, which was performed using the consolidated balance sheet and financial information of the Central Union of Consumer Cooperatives in Moldova "Mold Coop", they have achieved the value of assets of 766.4 million lei, registering an increase from 27.8 million lei in 2013 year to 43.8 million lei compared to 2008. Total value of current assets of the cooperative system of RM at the end of 2014 is constituted of 235.1 million lei, which is high by 18.1 mln lei compare with the results of 2013. Comparing 2014 year performances with 2009 results, we can observe an increase of value of assets by 98.7 mln lei, while comparing with 2008 performances, we have observe an increase is only 16.3 million lei.[10]

The value of equity is increasing over the years from 442.9 mnl in 2008 to 471.7 million lei in 2014. The value of payables at the beginning of 2015 is constituted of 223.4 mln lei, increased versus the same period of the previous year by 17.8 million lei. Looking at bank loans in 2014 their value was at 23.4 million lei and increased by 1.0 million lei, and an decrease by 7.6 million lei compare with 2008.

The volume of turnover in 2014 constituted of 796.7 million lei, or 102.5% over the previous year. The volume of wholesale during of 2014 constituted 104.7 million lei, growing by 19.9 million lei or 23.4% compare with 2013. The volume of purchases in 2014 was achieved of 80.1 million lei, or by 103.9% more compare to 2013. The total volume of service income in 2014 amounted of 150.3 million lei or 106.5% compared to 2013. Gross profit from the sale of goods, products and services was registered the amount of 182.6 mln lei or 106.6%. The return on sales in 2014 was 20.7% compared to 20.1% in 2013 and to 2014.

Over the period of 130 years of economic and operational activity of Consumption Cooperative System of RM always has been and continues to remain as one of the largest non-governmental public organizations. To achieve and realize of its tasks, they need to ensure their growth and development of all economic aspects, the main ones being: trade, services industry and catering industry, including also the acquisition activity.

From this point of view the purpose of applying the financial mechanisms is in connection with optimal correlation between equity and borrowed funds; net profit and risks related to the objectives of solvency and investment portfolio flows; assets and the risks for each kind of asset in terms of their influence on each financial performance.

The success of investment activity is largely determined by its financial insurance and financial performances. Financing of investments is a significant step of the investment process, in which, following the decision making process of investment, financial resources are integrated in the investment budget and can be used to achieve the performances of the project.

The efficiency of the investment process is influenced by the amount and quality of resources and the size of the output of enterprises. But within of economic instability, the mean role are investment policy of the company, which depend by the technical potential of enterprise, the reconstruction capacity and depend by the level of assets capacity. For this reason, venture capital - financial investments impose the elaborate of and develop of an n investment policy related to the investment potential of enterprise and economic growth.[10]

Due to the fact that the main objective of venture capital instrument is to maximize profits, the companies must fully to identify and estimate the financing needs at the right time. This requires selecting the most appropriate way of meeting this need. When choosing this alternative take

account of a wide spectrum of factors, among which the most important are: the cost of capital raised, the return on his capital, in terms of maintaining financial independence, the level of risk. Recently, in practice the entrepreneurship, for the examination of investment funding issues can be used a variety of methods.

The simplest method is the profit achieved level, including ROA and ROE during the life cycle of the investment project, which compares the volume of investments. The method allows the selection prompt the projects, but does not allow to establish the project preferably in situations where several projects have the same amount of profit, but different sizes investment, whereas ignore such costs as depreciation and income from the sale of assets which are replaced with Other new possibilities for reinvestment of earnings, time value of money.[3]

The investment project net present value method is used when analyzing projects with different sizes of cash flows. But it is necessary to take into account the size of this indicator can not be considered as a criterion sure if the choice of project cost high initial and initial costs low in situations where projects are contrary to the terms of the actuarial value, net during recovery thereof. It does not allow to determine the safety threshold and the rate of financial return of the project. Method marginal efficiency of capital project involves updating value based on internal profitability. The drawbacks of the method are apparent both in complexity and by not always allow to highlight the most profitable situation, as it involves reinvesting capital at all the intermediate stages in the rate of marginal income.

In practice the use of these methods for evaluating investments allow entrepreneurs to appreciate some specific parts of the project, to highlight the specific nuances. In developed countries, to assess the effectiveness and determinations as to economic investment are used as methods that: comparing the amount of capital invested to the amount of income received during the life of the investment and comparing the rate of return of the project (ROR) interest rate, or other criteria like. In a market economy the organizational form of the investment process is the investment project, which is the basic document that determines the need for investment, describing the main features of the project and financial indicators related to its realization. The investment project is a comprehensive plan of action that includes substantiation of rationality investments aimed at widening, upgrading or training of a new mode of production of goods or services for profit or social effect hoped.[1]

Funding in this case is generally through fund participation in the share capital of the company. The investment fund is not interested in taking over the business, but reserves the right to be consulted on major decisions being taken in the company with the investment. In principle, an investment fund seeks to place a sum of money for a limited period, while high rates of return. Selecting the investment required in terms of projects studying the commercial, financial, technical, fiscal and personnel. After studies and evaluation of the main characteristics is possible to use financial criteria to investment decision. They can be selected a number of financial criteria for approving the optimal variant of the investment, including a special place belongs: profitability criterion, criterion of liquidity and risk criteria.

The profitability criteria is in connection with selecting of the best project investment is more favorable available funds. This is the most important criteria for the in order to approve the investment project. In this context, the return of assets ratio (ROA) should be higher than the cost of their own funding sources or borrowed. Net present value - the difference between the present values of future income streams and expenses.

Liquidity criteria. is the ability of the company to monetizing assets at its disposal. The liquidity criteria for selecting investment projects aims to recover the investment as soon as possible, ie the investor to take possession of the invested capital and profitability expected within shortest possible to use it to initiate other projects. Typically, liquidity is determined by number of years to recover the invested capital, reporting initial value of the project to the amount of the annual financial flow positive input or the exploitation project. If annual positive financial flows are unequal, then proceed to summing up year by year flows reach baseline or very close to it without exceeding it and the resulting number of years of recovery.

The risk criteria, currently, the performance of their entrepreneurial consumption cooperation system is characterized by complex and diverse industries, which are influenced by a complex of economic and social factors, such as rising prices for material resources, salary increase, variability of sales volume, increased competition etc. This phenomenon requires a balancing of the risk with the results of the enterprise, as acceptance of risks and their control is the key point in ensuring business performance. Such balancing is possible only if they are reasonable, can be controlled and not exceed the amount of financial means. Incorrect assessments of the risks or lack of possibility to oppose them sufficiently effective measures involve undesirable consequences for all business partners.[2]

From a conceptual aspects, the risk can be characterized as a set of methods, procedures and measures by which to behave highlighting, assessing and sizing consequences of its impact on his business. It can be characterized by the following features: it is an uncertain event, but possible, which is based on uncertainty; phenomenon manifests itself as detrimental, both materially and morally; its effects, once produced, can not be removed and can occur as a result of entrepreneurial activity. It is important to highlight that the theory and practice of global risk category as deals with a certainty of uncertainty, that even if there is the risk has some probability of manifesting.

When examining issues relating to risk, a primary interest posed questions regarding the diversification of risk categories in terms of the probability of their occurrence and extent of their impact on enterprise activity, the main ones being: economic risk, financial risk, liquidity risk, solvency risk and others. Examination of economic risk can be performed through a model that can be achieved on three coordinates: variability, cost and its treatment. Variability of losses reveals size, severity and size of phenomena producing all consequences of the loss and the cost of economic risk that assesses the size of expected losses for businesses.

Economic risk treatment includes set of techniques applied to reduce the consequences, and hence the cost of risk. These techniques consist of preventive actions, forecasting and risk transfer. One of the most effective technics administration and supervision of economic risks is the technique that was realized for the first time in the US during the '70s as "Assets and Liabilities Management" and was widespread in other countries, as' asset-liability management. " One such way is to look for the business management of all forms of manifestation of risk.

Assets and liabilities management tools (ALM) covers all financial risks (interest rate, exchange rate, liquidity, currency risk, risk of bankruptcy) and the methodologically involves the following steps: inventory, assessment, strengthening financial risks that their coverage through options depending on the degree the risk that the bank is exposed.

The financial risk reflects the sensitivity of earnings to changes because financing conditions of business entity. He is the risk borne by the owners as a result of the company's decision to use borrowed capital. Financial risk assessment policy must design an appropriate mechanism for

assessing the possibility of accomplishment and risk prevention. For cooperative enterprises in the interest of operational risk measurement methods, ie the probability that the volume of work will not cover the total expenditure incurred due to their structure. In this case, the procedure of risk analysis involves distribution costs compared to the dynamics of production costs and expenses variable nature of conventional constant.

In terms of ensuring the company's financial performance very important is liquidity risk estimation problem, which reflects the probability that the company will honor its obligations to business partners due to maturity disconcordanței resources collected with maturities of investments made. The indicator reflects the possibility of losing part of the value of the claim or to devalue its total non-performance due to the payer. Getting liquidity A greater effort to improve the performance and efficiency of the indicators and methods for determining resource needs by calculations based forecast. Therefore, the main task of the economic entity is to estimate and fully cover liquidity needs provided for.

No less important for the enterprise is the solvency risk or overall debt ratio (debt-to-Assets Ratio), which measures the company's assets financed by debts. A higher value of this indicator means that high indebtedness or financial risk and higher probability of bankruptcy. In examining the issues concerning the size and scope of hedging, we note the need to examine quantitative and qualitative indicators of the risk, the causes of and possible consequences resulting from the impact of various risk categories on the output of cooperative enterprise.

From this point of view, the quantitative assessment is established likelihood of identified risks, the size of losses, the impact of different factors on the risk situation and the qualitative assessment identifies provocative actions risk zones are established risk, changing its dynamics, is outstanding statements related to achieving positive and negative risk decision. No less important is the problem of determining the size of tolerable risk, which will allow you to compare the result with the optimum size for a specific situation.

We have recorded that in order to assess risk and determine the effects of the level of risk you can use a set of methods and systems of indicators. This phenomenon requires management companies to analyze the types of risk in terms of the worst possible scenario. To function optimally, permanent cooperative enterprises must ensure a balance between profitability, liquidity and risk.

In terms of practicality in entrepreneurial activity, any strategy must have both performance programs and management procedures and risk assessment to minimize the likelihood of them oriented. [8]

Thus, at present, the main objective of entrepreneurship, is to maximize the company's market value and minimize risk. However, the impact on the efficient functioning and economic growth potential firms in the consumer cooperatives timely returns of investment policy and directions for use of spectrum resources investment.

In order to evaluate the results of the investment, in addition to indicators is required and a financial estimate on the dynamic characteristics of business as a result of the use of invested capital. This study should be conducted in terms of ensuring efficiency and stability of enterprise operation. Therefore, there is need to develop and use a financial model quasi-static, would appreciate such as "getting profit from sales", "the plight of Business", "leverage operational and financial", "financial leverage" etc. [10]

Therefore, in order to correctly assessing the financial performance, it is useful to implement a full financial model for estimating the efficiency of invested capital, which includes the following three models: the financial situation; Circuit model of resources and effective model of ownership

and sales. It allows to obtain information on the results of the lower level to the upper hierarchy in terms of dynamic, static and quasi-static. Economic policy promoted in the consumer cooperatives will support the development of all branches of activity of this system and encourage the initiation and development of other fields necessary to achieve the objectives of the cooperative. The support for economic growth and sustainable development will ensure investment in fixed capital, rehabilitation of the industrial, commercial and financial management efficiency and Heritage, which will increase the volume of turnover. Implementing innovative strategies is related to the high volume of investment. According to economic theory profitability of the enterprise is directly proportional to the size of capital investment. Taking into account the specific investment project dynamics and meeting the difficulties in assessing the viability of each stage of the project, we propose the system for evaluating the effectiveness of investment strategies to be considered in dynamic while under the influence at every stage of the project. At the moment t_0 for elaboration of investment project, the profitability of the investment project can be calculated/estimated in according to the following formula:

$$R_I /_{t=t_0} = \frac{\int_{t_4}^{t_8} \frac{CF_t^0(t)}{(1+k(t))^t} dt}{\int_{t_0}^{t_4} \frac{I_t^0(t)}{(1+(t))^t} dt} \quad (1)$$

where $CF_t^0(t)$ means volume of forecasted cash flow during the period t_4 - innovating marketing phase and up to the time t_8 - amortization at the end of on completion of the operation stage product innovation; $I_t^0(t)$ - Forecasted investments during t_0 function – indicates the moment when the project preparation stage innovation is initiating and t_4 – means the stage of finishing the investments; $k(t)$ - function change in coefficient of analysing period.

Also is not overlooked the probability of obtaining $RI/t=t_0$ the result of profitability P ($R_I/t=t_0$). Simultaneously need to estimate the expected effect of trading following the implementation of investment strategy, means the difference between costs and results of operation of the system:

$$E/_{t=t_0} = P/_{t=t_0} - S/_{t=t_0}; \quad (2)$$

where $P/_{t=t_0}$ - is the estimated economic and financial results at the moment t_0 for the period $T_{8-4} = t_8 - t_4$ of implementing the investment project; $S/_{t=t_0}$ - the forecasted value of expenditures of financial-economic activity of the entity at the time t_0 for the period T_{8-4} .

After finishing of the first phase of investment project the duration $T_{1-0} = t_1 - t_0$, additionally need to made a forecast of the project profitability based on the data from the period T_{1-0} used in the following formula:

$$R_I /_{t=t_1} = \frac{\int_{t_4}^{t_8} \frac{CF_t^1(t)}{(1+k(t))^t} dt}{I_{1-0} - \int_{t_0}^{t_4} \frac{I_t^1(t)}{(1+(t))^t} dt} \quad (3)$$

where $CF_t^1(t)$ means the volume of forecasted cash flow at the moment $t = tI$ for time period to time T_{8-4} ; I_{I-0} - means real investment amount during the period T_{I-0} ; $I_t^1(t)$ - means the investment function currently forecasted for the period T_{4-1} .

Simultaneously calculates the probability of obtaining $R_{I/t=tI}$ the result of profitability $RI/t=tI$ $P(R_{I/t=tI})$ and projected the effect of operational activity:

$$E_{/t=tI} = P_{/t=tI} - S_{/t=tI}; \quad (4)$$

where $P_{/t=tI}$ - is the projected economic and financial results for the period T_{8-4} currently functioning investment strategy; $S_{/t=tI}$ - Expenditures of the forecast value of financial-economic activity of the entity at the time tI for the same period T_{8-4} .

But it should be noted that the actual situation it is necessary to analyze the dynamic influence on the profitability and the expected effect.

The next stage sizes are determined deviations calculated with the planned and predicted:

1. profitability deviation within the first phase of the investment project:

$$\Delta R_I(t_{1-0}) = R_{I/t=tI} - R_{I/t=t0} = \frac{\int_{t_4}^{t_8} \frac{CF_t^1(t)}{(1+k(t))^t} dt}{I_{1-0} - \int_{t_0}^{t_4} \frac{I_t^1(t)}{(1+(t))^t} dt} - \frac{\int_{t_4}^{t_8} \frac{CF_t^0}{(1+k(t))^t} dt}{\int_{t_0}^{t_4} \frac{I_t^0(t)}{(1+(t))^t} dt} \quad (5)$$

2. comparison of the achieved profitability with the forecasted data:

$$\Delta P(R_{I/t=tI}) = P(R_{I/t=tI}) - P(R_{I/t=t0}); \quad (6)$$

forecast of the deviation $\Delta E_{/tI-0}$ when $t = tI$ taking into account the reference of the results conducted by developing and implementing investment strategy:

$$\Delta E_{/tI-0} = E_{/t=tI} - E_{/t=t0} \quad (7)$$

The next step is realising the control of deviations compare with the prediction obtained from:

$$\Delta R_I(t_{I-0}) \nabla \delta_R, \quad (8)$$

where δ_R - is admissible deviation of projected profitability, where the company is not need to change their investment strategy. In case $\Delta R_I \geq \delta_R$, forecasted profitability increases or still to the same level. In our point of view, for the companies on the one hand is positive result, on the other hand, increased profitability should be constantly checked. The development and implementation of investment strategy arises normally when $\Delta R_I > \delta_R$ și $\Delta P(R_{I/t=tI}) > \delta_R$ and the companies can analyze the effect of innovations. In the situation when $\Delta R_I > \delta_R$ și $\Delta P(R_{I/t=tI}) < \delta_R$ the enterprise must analyze the factors that influenced the decrease in profitability projections.

Thus, the algorithm constitutes the basis of the evaluation of the efficiency system and investment strategies and can be implemented for assessing the effectiveness of investment projects in the Moldovan system of consumer cooperatives.

At present the choice of any external sources of financing must be a serious argument, since the investor must predict the consequences of debt settlement formats and this influence on the final results of its work. Financing investment has a content unit, but complex, reflecting the use of resources in connection with the technique of their formation and mobilization. It represents a

significant stage of the investment decision, in which financial resources are embedded in the investment budget and can be used to achieve project investment

The mechanism of financing investments involves several actions regarding:

- Determination of financing;
- Establishing appropriate capital structure;
- Assessing the cost of resources for financing medium and long term.

External financing is an alternative for investors when the self-financing capacity is below investment program. This is ensured by banks, investment institutions, public sector bodies and private. One of the innovative ways in RM and an important external source of financing investments other than traditional funding source in the form of bank credit is risk capital (venture capital). [7]

Facilitators financial theory made clear references to financial risk, having one at the center. Scientists F. Modigliani and M. Miller in his works have analyzed the formation of revenues under risk. This research was continued by M. Miller who formulated a new concept called "risk capital" (venture capital). According to this scholar's vision is venture capital available to the company's long-term unsecured (ie only based a business plan and the prospects for profit enterprise). This capital can be helpful, especially for businesses that can not be listed.

The competitive advantage of venture capital to the investors strategy has addressed the manner in which enterprise development investee as this capital does not require collaterals instead. Unlike strategic investors seeking to maintain its share of participation of venture capital funds provide businesses a means of financing the system in order to develop them. Venture capital funds provided by investors, are a category of private capital attracted by enterprises for their business development. As investors may be equity partners include persons and institutions possessing a large amount of capital and funds diponibil private or state pensions, donations, foundations, insurance companies, investment funds, called mutual funds.

Unlike traditional financiers (banks, etc.), venture capital bidder get a profit from the growth and high profitability of an enterprise. Traditional funders claim interest and repayment of term debt, regardless of the existence of a profit or loss.

Usually the process is performed by changing the financing of venture capital on a considerable part of the package of shares in an amount that may vary between 20% and 49%, or a share capital funded company. In practice, the most commonly used form of investment Joint venture, whereby part of capital funding is allocated as a shareholder other form of investment credit. As it is usually the medium-term investment and involves a high degree of risk.

Venture capital is reimbursed only at the end of the investment period and do not generate interest costs, so there appears no free cash-flows. Bidders capital are business partners that supports its risks and supporting the experience and advice.

Thus, venture capital ones is constituted capital, usually from the contributions of investors, which represent an important source of funding ăntreprinderilor growth prospects, but no money. Individual investors can buy financial instruments programs providing venture capital companies or invest in investment funds specialized in this field.

As a holder of a part of shares of the company capital, venture capital investors will share the risk for the business. This type of financing is conducted principle of risk spreading between the owners of capital. Given the high degree of risk, investors will show interest only if convinced that there will be real opportunities for obtaining a high return on its investment.

This type of business financing has become an important development in recent years and is advantageous in many ways, being used especially for small firms at the beginning of the road. Equity participation in a new business called venture capital funding (venture capital) and it is provided by specialized companies, individuals or investment funds.

Getting venture capital financing is not easy. The first step is to prepare a business plan. It describes the product, market potential, production method, the necessary resources for the business to succeed. When developing a business plan, it is important to those wishing decision of such type of financing to invest money in the business itself, providing an important signal about the confidence it has in the success of the business. Venture capital can play a vital role in financing firms in the consumer cooperatives in Moldova through capital injections (in exchange for their share) higher than they are willing to invest, usually, business angels.

A type of venture capital investment is desirable and multiplier effect: after ensuring rounds of financing from a venture capital fund recognized, access to financing and other credit type financing becomes easier. However, in the current economic situation, venture capital remains, as well as other funding sources, often inaccessible.

The competitive advantage of venture capital to strategic investors lies in the manner in which it approached the development of enterprises in the system. Venture capital funds are financial partners. Normally, unlike strategic investors, funds in their portfolio no similar business activities and operates similar businesses in which they invest.

Strategic investors and venture capital funds presents the diferent time of horizons on investment in an enterprise. To capture the interest of the investor, the entrepreneur must demonstrate a knowledge of the industry and the firm's operations, ability to present business convincingly knowledge of financing alternatives through capital investment, the ability to reduce risk perception by investors .

Compare with traditional financiers (banks, etc.), venture capital investors get a profit from the growth and high profitability of an enterprise. Traditional funders claim interest and debt repayment term, irrespective of the existence of a profit or loss. The profit made by the tenderer risk capital depends on company profits.

Based on the tipe of destination highlights several categories of venture capital as follows:

- Seed funding: the development and application of a concept in enterprise, one prototype production and financing the research, before the product is ready for market.
- Start-Up Financing: Financing for product development and implementation of a marketing concept, nmai especially for new enterprises, which are the foundation and there is even less time, without having sold products.
- Funding for Expansion for the growth and expansion of established companies (finance increased capacity, product development, market, etc.)

Thus the benefits and advantages of the venture capital funding are:

1. possibility of funding when other resources are not available;
2. Do not pay interest or installments funding for the period for which the contract was signed original financing;
3. collateral is not required;

4. financing solution in situations where it is considered that leverage loans would limit the growth of businesses;
5. helps maximize company value by improving the structure visible through financial and strategic advice;
6. increase business visibility for customers, partners, other investors.
7. venture capital is less present in Moldova, but with the right incentives from the state, such funding could develop visible.

4. Conclusion

While venture capital funds have become increasingly important external source of financing that remains fragile. Venture capital sector in Europe does not benefit fully from a single market and is also less profitable and efficient than in the US.

In order to increase the number of foreign operations, it requires a regulatory framework more flexible and adaptable that would help reduce costs and increase fund structuring venture capital flows in Europe.

A uniform European approach would be for investors in venture capital to be treated in the same way as direct investors in each investee company important.

Venture capital companies would benefit from more efficient operations, both in terms of attracting funds and in terms of investments, enabling them to benefit from economies of scale and specialize.

In order to correctly assessing the financial performance, it is useful to implement a full financial model for estimating the efficiency of invested capital, which includes the following three models: the financial situation; Circuit model of resources and effective model of ownership and sales. It allows to obtain information on the results of the lower level to the upper hierarchy in terms of dynamic, static and quasi-static.

Economic policy promoted in the consumer cooperatives will support the development of all branches of activity of this system and encourage the initiation and development of other fields necessary to achieve the objectives of the cooperative. And support for economic growth and sustainable development will ensure investment in fixed capital, rehabilitation of the industrial, commercial and financial management efficiency and Heritage, which will increase the volume of turnover.

Venture capital can play a vital role in financing firms in the consumer cooperatives in Moldova through capital injections (in exchange for their share) higher than they are willing to invest, usually, business angels.

A type of venture capital investment is desirable and multiplier effect: after ensuring rounds of financing from a venture capital fund recognized, access to financing and other credit type financing becomes easier. However, in the current economic situation, venture capital remains, as well as other funding sources, often inaccessible.

European venture capital markets are more efficient that could promote growth and competitiveness, to contribute in particular to the creation of new jobs, the design and use of new knowledge and technologies.

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Financijska ponašanja dobnih skupina

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Sažetak. Stanovništvo u Republici Hrvatskoj prema različitim istraživanjima provedenim od strane OECD-a i drugih relevantnih institucija pokazuje nisku razinu financijske pismenosti. Promjene društvenog uređenja, orijentacija prema tržišnoj ekonomiji u posljednje dvije dekade unijele su čitav niz promjena u poziciji odgovornosti pojedinca za svoju financijsku budućnost. Odlazak u mirovinu predstavljao je u prošlim vremenima ulazak u period života koji su karakterizirali smanjeni, ali dostatni i sigurni prihodi. Međutim, današnje vrijeme uz čitav niz nepogodnih demografskih trendova, visoku stopu nezaposlenosti, usporen gospodarski rast, stavlja pred sektor stanovništva nove uloge odgovornosti u pogledu financijske budućnosti svakog pojedinca. Poznavanje financijskih proizvoda i njihovih performansi važan je korak u kreiranju zrelih financijskih odluka. U ovom radu istražit će se financijsko ponašanje pojedinaca pripadnih različitim dobnim skupinama.

Ključne riječi: *financijsko ponašanje, financijski proizvodi, financijska reforma*

1. Uvod

Na današnjem dinamičnom i složenom financijskom tržištu, financijsko obrazovanje mora biti cjeloživotna potraga koja omogućuje potrošačima svih starosnih dobi i financijskih položaja da ostanu usredotočeni na promjene koje se pojavljuju u njihovim financijskim potrebama i okolnostima te da iskoriste proizvode i usluge na način koji najbolje odgovara njihovim potrebama.

Financijska edukacija važan je proces koji omogućuje svakom pojedincu da unaprijedi svoje razumijevanje financijskih proizvoda i svih informacija koje su s tim povezane, a kojima se pridonosi razvijanju svijesti o financijskim rizicima i mogućnostima. S obzirom na razvoj financijskog tržišta i svakodnevnu pojavu novih proizvoda i usluga, potreba za financijskom edukacijom sve je izrazitija i neophodna je za donošenje kvalitetne odluke o izboru pojedinoga financijskog proizvoda ili usluge primjerenih vlastitim mogućnostima i očekivanjima.

S obzirom na demografsku strukturu stanovništva RH vidljivo je da udio mladog stanovništva u procesu osnovnoškolskog i srednjoškolskog obrazovanja malen u odnosu na zrelo i staro stanovništvo, tj. preostaje još veliki broj građana koji neće biti u mogućnosti se upoznati s pojmom financijske pismenosti kroz redovno osnovnoškolsko i srednjoškolsko obrazovanje već će se o tome morati samostalno educirati.

Kako bi se primjereno zaštitili pojedinci i podigla razina njihove financijske pismenosti, Vlada Republike Hrvatske pristupila je izradi Nacionalnog strateškog okvira te je objavila prijedlog

Akcijskog plana prema kojem bi se trebalo ustrojiti i provoditi sveobuhvatno financijsko obrazovanje pojedinaca svih uzrasta, od predškolske djece do osoba starije životne dobi.

U ovom radu istražit će se financijsko ponašanje pojedinaca pripadnih različitim dobnim skupinama te će se analizirati podaci iz ankete (istraživanja) koja je provedena u gradu Splitu na neprobabilističkom uzorku.

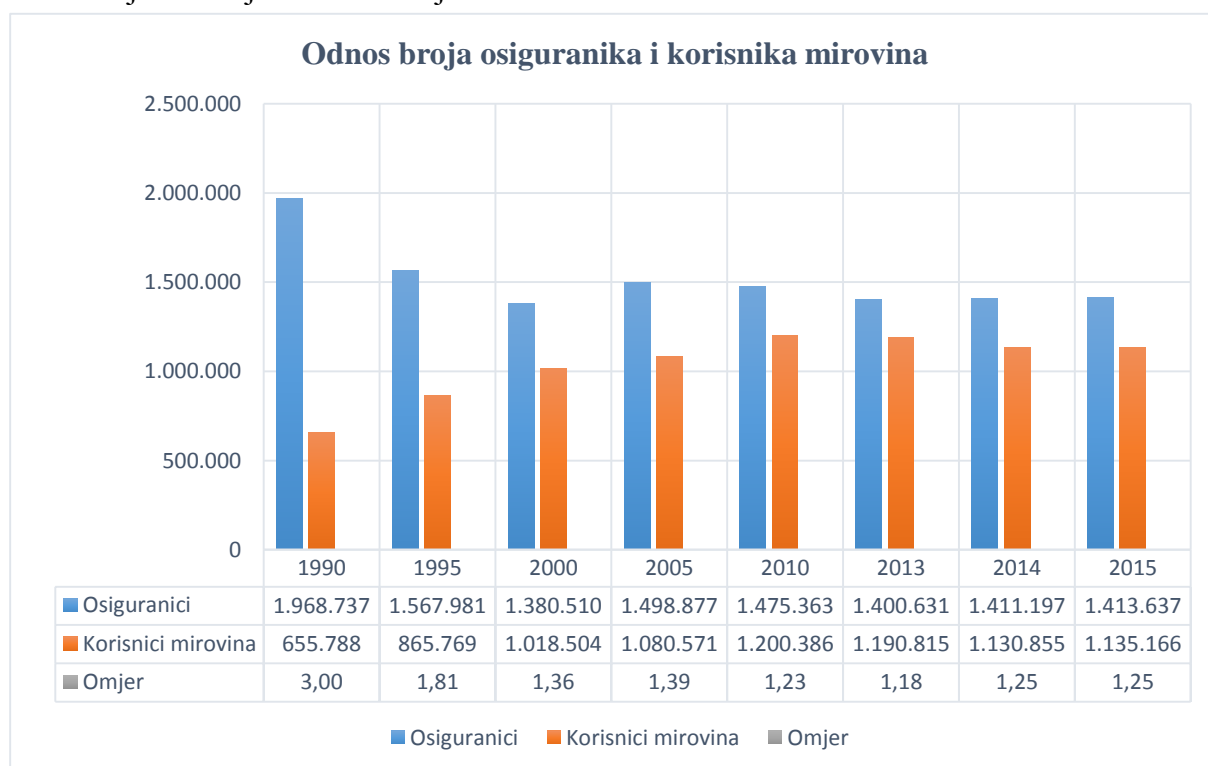
2. Financijska budućnost sektora stanovništvo u Republici Hrvatskoj

Posljednjih godina, zbog izrazite gospodarske recesije i problema s gospodarskim i tehnološkim viškovima radne snage, uočava se trend priljeva umirovljenika što ugrožava gospodarstvo, a mirovinski sustav dovodi do ruba. Mirovinski sustav se nalazi pred krupnim izazovima, kao što su negativni demografski trendovi, financijski pritisak radi postizanja konkurentnosti, promijene na tržištu rada te snažan otpor stanovništva u provedbi mirovinskih reformi. Sve to govori o potrebi konstantnog nadzora, analiziranja, otklanjanja nedostataka te u konačnici reformiranja postojećeg mirovinskog sustava.

2.1 Nepovoljni trendovi

Hrvatska mirovinska reforma provedena je 2002. godine zbog neodrživosti postojećeg stanja unutar mirovinskog sustava. Kao glavni razlog provedbe mirovinske reforme navode se nepovoljni demografski trendovi iako postoji čitav niz razloga. Nepovoljni demografski trendovi odnose se na povećanje udjela starijeg stanovništva u ukupnom stanovništvu te opadanje stope nataliteta. Kao posljedica toga dolazi do populacijske neravnoteže zbog koje malobrojniji mlađi i srednji kontingent moraju uzdržavati sve brojniji stariji kontingent stanovništva.

S obzirom na to da danas ljudi žive sve dulje, produžava se i razdoblje njihova korištenja mirovinskih prava. Upravo iz tog razloga su nastale velike promjene u odnosu broja osiguranika i umirovljenika koje možemo vidjeti na slici 1.



Slika 1 Odnos broja osiguranika i korisnika mirovina

Izvor: vlastiti rad prema podacima HZMO-a

Iz grafa možemo vidjeti da je odnos između zaposlenih koji plaćaju doprinose i umirovljenika u stalnom smanjenju sve do 2013. godine. U posljednje dvije godine odnos se malo popravio, ali time nisu otklonjeni problemi unutar mirovinskog sustava. S obzirom na današnju situaciju, teško je očekivati da će se ovakav trend promijeniti. Ovakav nepovoljan odnos uvjetuje povećanje jaza između visine uplaćenih doprinosa i potreba za isplatom mirovina.

Pored demografskih, postoje i ekonomski razlozi provedbe mirovinskih reformi. Oni se svode na to da u sadašnjem mirovinskom sustavu ne postoji nikakva izravna veza između visine uplaćenih mirovinskih doprinosa i visine isplaćene mirovine budući da se sve uplate troše na izdržavanje današnje generacije umirovljenika. Takav oblik preraspodjele sredstava unutar mirovinskog sustava uvelike utječe na njegovu pravednost.

Uz navedene razloge, Hrvatska je bila suočena s dodatnim problemima. Prvenstveno se radi o pojavi pojačanog prijevremenog umirovljenja i invalidskog umirovljenja. Poseban problem predstavlja izbjegavanje plaćanja doprinosa zbog bujanja nelegalnog sektora, rada na crno, loše državne uprave, rasta korupcije u državi i sličnih problema. Dodatni ključni razlog potrebe za reformom mirovinskog sustava u Hrvatskoj je smanjenje oslanjanja na državni proračun (Alibegović J., 2000.).

2.2 Mirovinska očekivanja

Mirovinska reforma u Hrvatskoj potaknula je građane da se sami pobrinu o vlastitoj socijalnoj sigurnosti, tj. oslobodila ih je sindroma ovisnosti o državi. U prilog tome govori činjenica da su u porastu životna osiguranja i drugi oblici štednje. To ipak ne znači da državu treba potpuno isključiti od uloge jamca socijalne sigurnosti građana. Ključ je, dakle, u pronalasku odgovarajuće kombinacije državne intervencije i individualne odgovornosti za socijalnu sigurnost.

Mirovinski sustav utemeljen na tri stupa, kakav je danas u Hrvatskoj, dizajniran je tako da se stopa izdvajanja za drugi stup polako podiže sa trenutnih 5 % na 6 % izdvajanja. Mirovinska društva već dugo predlažu da se stopa izdvajanja za drugi stup poveća za jedan postotni poen nakon svake godine u kojoj bi BDP rastao iznad 2 %. Time bi se deficit u državnom proračunu povećavao samo u godinama s gospodarskim rastom. Povećanje stope izdvajanja za drugi stup za jedan postotni poen povećalo bi mirovine iz drugog stupa za točno 20 % za novozaposlene članove drugog stupa. Istovremeno, državni proračun bi bio u deficitu milijardu kuna. Povećanje izdvajanja za drugi stup dio je gospodarskog programa Vlade, ali do današnjih dana to nije učinjeno.

Nadalje, za očekivati je da će se mijenjati regulacija ulaganja obveznih mirovinskih fondova, budući da je imovina mirovinskih fondova prerasla veličinu hrvatskih kompanija. Mirovinski fondovi se moraju aktivnije uključiti u upravljanje kompanijama u kojima su vlasnici. Mirovinska društva trebaju sudjelovati u infrastrukturnim projektima, privatizacijama, dokapitalizacijama, uz uvjet da je prihvatljiv odnos rizika i dobiti. Ulaskom Hrvatske u Europsku uniju ograničenja ulaganja izvan Hrvatske nestaju. S obzirom na to, vrlo je važno otvoriti veći prostor za ulaganje jer će, uz postojeći uzak prostor, sve više imovine odlaziti izvan zemlje na likvidnija tržišta. Za mirovinske fondove kuna zarađena u Hrvatskoj vrijedi više nego kuna zarađena vani. Time se stvaraju nova radna mjesta, a nova radna mjesta znače nove članove u fondovima. Kuna zarađena u Hrvatskoj povećava plaće, čime se povećava i uplata na osobni račun u mirovinskom fondu. Također, ulaganjem obveznih mirovinskih fondova u Hrvatskoj jačaju javne financije u čije obveznice mirovinski fondovi znatno investiraju.

Štednja u obveznim i dobrovoljnim mirovinskim fondovima je privlačna, ali u uvjetima rasta gospodarstva, tj. u uvjetima u kojima je stopa rentabilnosti mirovinskih fondova veća od stope rasta gospodarstva. Međutim, takav oblik štednje vrlo je rizičan što se ne smije zanemariti. To poglavito dolazi do izražaja tijekom posljednje gospodarske krize u 2011. godini kada su

mirovinski fondovi imali značajne gubitke te na taj način poljuljali povjerenje osiguranika. Na dugi rok kapitalizacija mirovina je isplativa, tako da od nje najviše mogu profitirati najmlađe generacije, dok je na kratki rok vrlo rizična.

3. Istraživanje

U ovom poglavlju prezentirana je analiza podataka prikupljenih tijekom istraživanja koje je bilo usmjereno na građane Splitsko-dalmatinske županije.

Istraživanje je provedeno pomoću anketnog upitnika *google forms*. Anketni Upitnik je namijenjen svim punoljetnim fizičkim osobama neovisno o drugim kriterijima. Anketni upitnik fizičkim je osobama poslan e-poštom i preko društvenih mreža. Rezultati prezentirani u ovom radu bazirani su na odgovorima 198 ispitanika što čini 0,054 % ukupne ciljane populacije. Usprkos tome što je uzorak neprobabilistički, nepostojanje prijašnjih rezultata na ovu anketu daju važnost ovom istraživanju. Istraživanje je provedeno tijekom veljače 2016. Anketni upitnik sastoji se od 19 pitanja koja su otvorenog tipa te pitanja višestrukoga odabira.

Metodologija istraživanja

Kao instrument primarnog istraživanja korišten je anketni upitnik proveden pomoću alata *Google forms*.

Online, za razliku od terenske ankete, ima neke specifičnosti koje proizlaze iz dostupnosti Interneta i e-adresa. Generalno, uzorci se najčešće dijele po kriterijima reprezentativnosti u odnosu na populaciju, to jest, je li svakoj statističkoj jedinici populacije garantira jednaku vjerojatnost ulaska u uzorak ili ne. Oni u kojima to postoji zovu se probabilistički nasuprot neprobabilističkom, tj. prigodnom uzorku. Najveći broj online istraživanja koristi uzorke koji se ne baziraju na vjerojatnosti. (*Tvoj stav, Centar online istraživanja, 2015.*,

http://www.tvojstav.com/online_surveys_basics.html)

Zbog nedostupnosti okvira za izbor uzorka, ovo istraživanje se bazira na neprobabilističkom uzorku, nazvan prigodni uzorak, najčešće korišten u studijama iz oblasti menadžmenta i biznisa (Bryman and Bell, 2007.). Prigodni uzorak podrazumijeva ne slučajnu selekciju dostupnih elemenata istraživanjem utvrđene populacije. To je laka, brza i troškovno efektivna tehnika, no glavni nedostatak je nereprezentativnost u odnosu na populaciju (Churchill, 1995; Saunders et al., 2012.). Korištenje uzorka je opravdana alternativa provođenju istraživanja nad cijelom populacijom što je nepraktično zbog vremenskih, prostornih i novčanih ograničenja (Saunders et al., 2012.).

3.1 Rezultati provedenog istraživanja

U ovom dijelu će se razmotriti je li dob ispitanika utječe na razinu rizika koju su spremni prihvatiti.

Razina rizika	Dob		UKUPNO
	≤29	≥30	
Minimalna razina	63	38	101
Srednja razina	61	23	84
Visoka razina	11	2	13
UKUPNO	135	63	198

Ho – dob ispitanika ne utječe na razinu rizika koju su spremni prihvatiti

H₁ – dob ispitanika utječe na razinu rizika koju su spremni prihvatiti.

Elementi ocjene hipoteze:

U tablicama broj stupnjeva slobode je jednak (broj redaka-1)*(broj stupaca-1). U ovom primjeru je broj stupnjeva slobode $(3-1)*(2-1)=2*1=2$.

Empirijska vrijednost χ^2 testa = 3,95

Granična vrijednost $\chi^2_{0,05}(2) = 5,99$

Nivo značajnosti $(\alpha) = 0,05$

Iz tablice hi-kvadrat možemo očitati da je granična vrijednost hi-kvadrat testa uz 2 stupnja slobode na razini značajnosti od 5 % jednaka 5,99.

Budući da je empirijska vrijednost hi kvadrat testa manja od granične vrijednosti ($3,95 < 5,99$), ona pada u područje prihvatanja nulte hipoteze. Znači da se uz nivo značajnosti 5 % prihvata nulta hipoteza, odnosno da dob ispitanika statistički ne utječe na razinu rizika koju su spremni prihvatiti.

U ovom dijelu će se razmotriti je li dob ispitanika utječe na iznos koji žele ulagati na mjesečnoj razini.

Željeni iznos ulaganja	Dob		UKUPNO
	≤ 29	≥ 30	
0-1000	103	38	141
1000-2000	27	18	45
>3000	5	7	12
UKUPNO	135	63	198

H_0 – dob ispitanika ne utječe na iznos koji žele ulagati na mjesečnoj razini

H_1 – dob ispitanika utječe na iznos koji žele ulagati na mjesečnoj razini.

Elementi ocjene hipoteze:

U tablicama broj stupnjeva slobode je jednak (broj redaka-1)*(broj stupaca-1). U ovom primjeru je broj stupnjeva slobode $(3-1)*(2-1)=2*1=2$.

Empirijska vrijednost χ^2 testa = 6,81

Granična vrijednost $\chi^2_{0,05}(2) = 5,99$

Nivo značajnosti $(\alpha) = 0,05$

Iz tablice hi-kvadrat možemo očitati da je granična vrijednost hi-kvadrat testa uz 2 stupnja slobode na razini značajnosti od 5 % jednaka 5,99.

Budući da je empirijska vrijednost hi kvadrat testa veća od granične vrijednosti ($6,81 > 5,99$), ona pada u područje odbacivanja nulte hipoteze. Znači da se uz nivo značajnosti 5 % prihvata alternativna hipoteza, odnosno da dob ispitanika statistički utječe na iznos koji žele ulagati na mjesečnoj razini.

U ovom dijelu će se razmotriti je li dob ispitanika utječe na iznos koji trenutno ulažu na mjesečnoj razini.

Iznos ulaganja	Dob		UKUPNO
	≤ 29	≥ 30	
0-1000	117	48	165
1000-2000	15	9	24
>3000	3	6	9
UKUPNO	135	63	198

H_0 – dob ispitanika ne utječe na iznos koji trenutno ulažu na mjesečnoj razini

H_1 – dob ispitanika utječe na iznos koji trenutno ulažu na mjesečnoj razini.

Elementi ocjene hipoteze:

U tablicama broj stupnjeva slobode je jednak $(\text{broj redaka}-1) \cdot (\text{broj stupaca}-1)$. U ovom primjeru je broj stupnjeva slobode $(3-1) \cdot (2-1) = 2 \cdot 1 = 2$.

Empirijska vrijednost χ^2 testa = 5,96

Granična vrijednost $\chi^2_{0,05}(2) = 5,99$

Nivo značajnosti $(\alpha) = 0,05$

Iz tablice hi-kvadrat možemo očitati da je granična vrijednost hi-kvadrat testa uz 2 stupnja slobode na razini značajnosti od 5 % jednaka 5,99.

Budući da je empirijska vrijednost hi-kvadrat testa manja od granične vrijednosti ($5,96 < 5,99$), ona pada u područje prihvatanja nulte hipoteze. Znači da se uz nivo značajnosti 5 % prihvaća nulta hipoteza, odnosno da dob ispitanika statistički ne utječe na iznos koji trenutno ulažu na mjesečnoj razini.

U ovom dijelu će se razmotriti je li dob ispitanika utječe na način ulaganja.

Način ulaganja	Dob		UKUPNO
	≤ 29	≥ 30	
Ne ulažu	56	19	75
Obrazovanje	32	1	33
Nekretnine	14	10	24
Bankovna štednja	11	9	20
Životno osiguranje	2	8	10
Ostalo	20	16	36
UKUPNO	135	63	198

H_0 – dob ispitanika ne utječe na način ulaganja

H_1 – dob ispitanika utječe na način ulaganja.

Elementi ocjene hipoteze:

U tablicama broj stupnjeva slobode je jednak $(\text{broj redaka}-1) \cdot (\text{broj stupaca}-1)$. U ovom primjeru je broj stupnjeva slobode $(6-1) \cdot (2-1) = 5 \cdot 1 = 5$.

Empirijska vrijednost χ^2 testa = 30,08

Granična vrijednost $\chi^2_{0,05}(5) = 11,07$

Nivo značajnosti $(\alpha) = 0,05$

Iz tablice hi-kvadrat možemo očitati da je granična vrijednost hi-kvadrat testa uz 2 stupnja slobode na razini značajnosti od 5 % jednaka 11,07.

Budući da je empirijska vrijednost hi-kvadrat testa veća od granične vrijednosti ($30,08 > 11,07$), ona pada u područje odbacivanja nulte hipoteze. Znači da se uz nivo značajnosti 5 % prihvaća alternativna hipoteza, odnosno da dob ispitanika statistički značajno utječe na način ulaganja.

4. Zaključci i preporuke

U Hrvatskoj je i dalje prisutno mišljenje kako se država dužna pobrinuti za socijalni status stanovništva. Međutim, zbog problema unutar mirovinskog sustava u budućnosti će se odgovornost za socijalni status u potpunosti prenijeti na pojedince. To znači da će pojedinci morati donositi odluke koja će dodatna ulaganja poduzimati žele li osigurati socijalni status pri umirovljenju.

Na temelju dosadašnjeg iskustva mješoviti, odnosno djelomično kapitalizirani mirovinski sustavi osiguravaju višu razinu mirovina od sustava koji se isključivo temelje na međugeneracijskoj solidarnosti. Zbog toga mnoge zemlje, a među njima i Hrvatska, razmatraju mogućnost povećanja izdvajanja stope doprinosa u drugi kapitalizirani mirovinski stup. Iz razloga što je stopa povrata obveznih mirovinskih fondova veća od stope rasta plaća pa se na temelju toga osiguravaju veće mirovine. Međutim, treba napomenuti kako kapitalizirani mirovinski fondovi stvaraju pozitivne rezultate samo u uvjetima gospodarskog rasta, što znači da nose određeni rizik. Unatoč svemu, možemo zaključiti kako je diversifikacija mirovinskih izvora pravac u kojem mirovinski sustavi trebaju ići kako bi postigli međugeneracijsku ravnotežu i socijalnu sigurnost umirovljenika.

Rezultati istraživanja, koje je provedeno u ovom radu, pružaju mnogo informacija o financijskom ponašanju različitih dobnih skupina. Utvrđena su karakteristična obilježja i obrasci ponašanja mlade populacije do 30 godina i starijih, na području Splitsko-dalmatinske županije.

Došlo se do zaključka da postoji značajna razlika u iznosu željenog ulaganja ove dvije skupine. Premda mlađa populacija nije u mogućnosti ulagati mnogo, na mjesečnoj razini, statističkim testovima je potvrđeno da ni starija populacija ne ulaže značajno više. Podaci govore da mladi imaju različite preferencije u pogledu izbora financijskih instrumenata za ulaganje. Velika većina mlade populacije nije se financijski osamostalila, a financijski ovisna mlada osoba i ne može izdvojiti velike iznose za ulaganje i uglavnom ulažu u obrazovanje. Zrelije osobe (stariji od 30 godina) ulažu u nekretnine ili bankovnu štednju. Ulaganje potiče pojedinca na rad, posebno kada rezultati postaju vidljivi. Ulaganjem osoba napreduje. Iako danas nisu svi u mogućnosti ulagati, prisutna je težnja k ulaganju.

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Financial behavior of age groups

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Abstract. The population in Croatia, according to various surveys conducted by the OECD and other relevant institutions, indicates a low level of financial literacy. Changes in social structure and the orientation towards a market economy in the last two decades have brought on a number of changes in the position of individual responsibility for personal financial future. Retirement used to represent the process of entering a period of life that could be characterized with reduced, but sufficient and secure income. However, with a series of unfavorable demographic trends, high unemployment, sluggish economic growth, delegates to household sector new roles of responsibility in regard to the financial future of each individual. Knowing the financial products and their performance is an important step in making mature financial decisions. This paper will explore the financial behavior of individuals belonging to different age groups.

Keywords: *financial behavior, financial products, financial reform*

Swiss franc mortgage loans from the perspective of Polish borrowers

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Abstract. Foreign currency loans, especially denominated in Swiss franc, were commonly granted in many countries of Central and Eastern Europe in period 2004-2009. In majority, such type of loans was used for financing the purchase of flats or houses but in some countries Swiss currency loans were financing also consumption. In Poland loans denominated in Swiss franc become the most important type of credits used for housing purposes and thus the most significant type of asset in the banking sector. Despite initial high benefits generated for borrowers due to interest rate disparity Swiss franc loans due to strong appreciation of Swiss currency become volatile and strongly influencing financial condition of majority of borrowers. The aim of the paper is to evaluate influence of changes of exchange and interest rates for Swiss currency onto repayment and relative financial condition of borrowers which took mortgages denominated in francs in years 2005-2012. i.e. when such loans were available in Poland. The paper compares costs and benefits of Swiss franc loans against loans in Polish zloty and euro. To assess the relative financial condition of borrowers, the author uses differential indices based on model of mortgage repayment in annuities indexed by exchange rates and interbank reference rates. The results of the research show that Swiss currency mortgage loans, despite strong appreciation of Swiss currency, are beneficial to Polish borrowers taking loans up to 2007 and from 2009 to 2012.

Key words: *foreign currency, loans, Poland*

1. Introduction

Foreign currency loans (FCL) are some of the most important types of financing used in many CEE countries. Since mid 2000s such loans, due to lower interest rates and predictable valuation of foreign currencies, become prevailing in financing of real estate and in case of some countries they were used also for purchase of cars and consumption. The main reason behind taking of such loans was lower costs of interest and thus lower value of monthly instalments. In some countries of CEE, especially where local currencies rates were fixed to euro (Estonia, Latvia, Lithuania, Bulgaria) the dominant currency of financing became euro. Other countries (Poland, Hungary, Croatia) received substantial share of Swiss franc as the currency of crediting (mostly for mortgages) [Yeşin P. 2013]. The choice of the Swiss currency was determined primarily by the highest interest rate disparity and hence the possibility of implementing carry trade strategy on the real estate market and belief in its stability as a safe heaven asset. Very often such loans were promoted by banks owned by foreign investors, which had an easy access to foreign exchange funding on international markets [Brown and De Haas 2012]. Amongst them Austrian banks were some of the most active in almost whole CEE region [Pann et al 2010]. In Poland Swiss franc loans became crucial types of assets in the banking sector and also dominant type of mortgages with repayment period between 20 and 30 years. Due to very favourable conditions of the Polish economy in period 2004-2008, rising salaries and decreased unemployment, stable and profitable banking sector, as well as an easy access to foreign sources of financing, banks in Poland started to liberalise credit policy and increased sales of mortgages in foreign currencies. The choice of foreign currencies, predominately Swiss

francs, was motivated on the one hand by the lower instalments and foreseeable lower total costs of the loan for the borrower and on the other hand by higher profits for the banks comparing to the mortgages denominated in domestic currency. The disparity of interest rates in case of many borrowers prevented them from taking loans in Polish zloty but gave possibility to get CHF-denominated financing [Biała 2015]. As Polish zloty and Swiss franc pricing has been floating, the risk of foreign currency loans has been materialising since July 2008, i.e. when five years long trend of depreciation Swiss currency against Polish zloty reversed [Buszko 2013]. As Polish currency started to loose value in the long-term, the repayment of the CHF denominated loans become more difficult for the borrowers as instalments calculated in Swiss currency required significantly higher repayments in PLN. The subprime crisis in 2009, the Greece public finance debt crisis in 2011 as well as the decision of Swiss National Bank to cease peg to euro in 2015 influenced the abrupt revaluation of Swiss franc deteriorating the terms of repayment of the instalments calculated upon the current exchange rates CHF/PLN. As in Poland most of the FCL were indexed with CHF LIBOR 3M or 6M rate the negative effects of the increase of the exchange rate in some part had been compensated by the strong reduction of the interest rate of Swiss currency, what maintained the level of instalments at the amount able to repay. Despite FCL in many countries are treated as risky, negatively influencing financial safety and condition of the borrowers and banks as well as stability of whole financial system, such loans has not been neither negatively influencing the results of Polish banking sector nor distressing majority of borrowers, although the volume and value of such loans remains significant.

2. Research methods and hypothesis

The paper focuses on the problem of the influence of changes of economic conditions onto repayment of Swiss franc mortgage loans and thus onto financial condition of borrowers. In particular, the main goal of the paper is to investigate the influence of changes of exchange and interest rates of Swiss currency onto repayment terms, especially absolute and relative value of instalments and then financial condition of borrowers which took mortgages denominated in franc in period 2005-2012. i.e. when such loans were available in Poland. The paper compares repayment of Swiss franc loans against loans denominated in Polish zloty.

In the paper the author uses research method such as: study of literature, statistical analysis of exchange and interest rates, as well as quantitative evaluation of repayment of loans based on mathematical model of 20- and 30-years mortgage loan repayment in fixed instalments indexed with actual reference rates (CHF LIBOR 3M, PLN WIBOR 3M). The model assumes recalculation of instalments every 3 months altogether with a change of reference rate and exchange repayment amount of Swiss franc loans into PLN with 7% bid-offer spread.

The author puts forward two hypotheses. The first one is that despite abrupt, steep increase value of Swiss currency mortgage the financial condition of Polish borrowers did not deteriorate systematically to fail to repay the loans. The second states that mortgage loans denominated in Swiss franc are more beneficial for borrowers than loans in Polish zloty.

3. The results

3.1. Conditions of Swiss mortgage loans development in Poland

The Swiss franc mortgage loans became the commonly spread out type of loan in Polish banking sector since 2005. The reasons of using such type of financing were as follows:

1. Large disparity of interest rates between foreign currencies and Polish zloty (with significantly lower interest rates of CHF than EUR);
2. Lack of credit ability of some part of borrowers in PLN;
3. Long-term depreciation of foreign currencies against Polish zloty in period 2004-2008;
4. Good perspectives of development of Polish economy after joining EU in May 2004;

5. An easy access to foreign currencies financing on international markets (in majority provided by foreign parent companies of Polish banks);
6. Belief of borrowers in stability of exchange rate of Swiss franc (Swiss franc was considered as safe heaven currency);
7. Expectation of joining eurozone by Poland in the nearest future and hence reduction of foreign exchange risk;
8. Lack of legal barriers of using foreign currencies in crediting of households;
9. Active policies of banks in selling foreign currencies loans instead of Polish zloty loans;
10. Lack of housing policy of the state and thus lack of long-term saving solutions for housing purposes;
11. Active media promotion of low cost loans in foreign currencies;
12. Expectation of long-term bull market of the real estate in Poland.

From 2005 the foreign currencies, primarily Swiss franc, had dominated financing of the real estate purchase. Due to higher interest rate disparity of PLN WIBOR 3M over CHF LIBOR 3M than EURIBOR 3M (Fig. 1) as well as due to similar relative pricing of Swiss and euro currency (Fig. 2) the only real offer of loans in period 2004-2008 was Franc instead of euro.

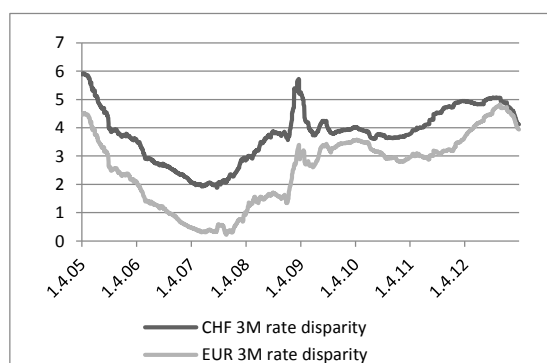


Fig 1. Interest rate disparity CHF and EUR vs. PLN (2005-2012; %).

Source: own elaboration based on interbank market data

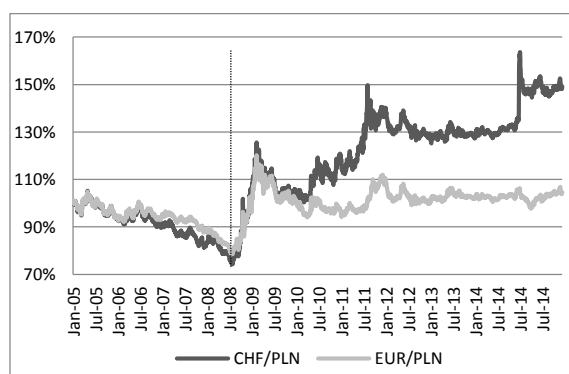


Fig 2. Relative pricing of EUR and CHF in Poland (2005-2014, 01.01.2005 = 100%).

Source: own elaboration of NBP data

As Swiss franc was systematically depreciating versus Polish zloty in period 2005-2008, even faster than euro, what was a result of depreciation of CHF versus EUR on the international market, the borrowers dominantly preferred Helvetic currency. Euro started to be utilized after commencing subprime crisis, when first problems with Swiss franc volatility and availability on the international market emerged (Fig. 2 and 3). Until 2012 the banks structurally limited the mortgage loans in foreign currencies granted to borrowers because of sharp increase of value of Swiss currency versus Polish zloty. In 2014 the foreign currency loans had been banned by the Polish Financial Supervisory Authority and started to be available only for borrowers receiving incomes in foreign currencies. At present foreign currency mortgage loans portfolios are maturing and the share of new loans in foreign currencies is minimal (Fig. 3). Due to lack of new FC mortgage loans the structure of the loans in the banking sector is changing revealing increasing share of Polish zloty loans, which reached more than 50% of the value of total loans in the Polish banking sector (Fig. 4).

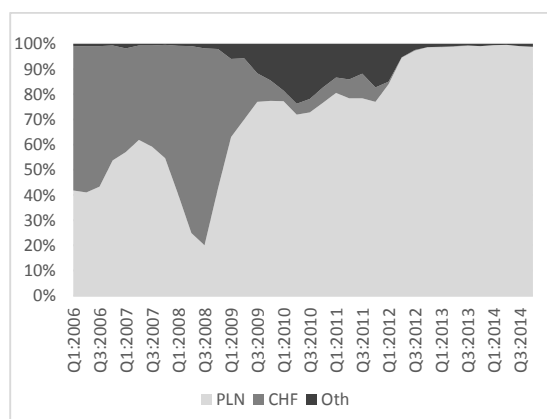


Fig 3. Currency structure of new mortgage loans in Poland (Q1:2006 - Q4:2014)

Source: own elaboration based on Raporty AMRON-SARFIN 2016

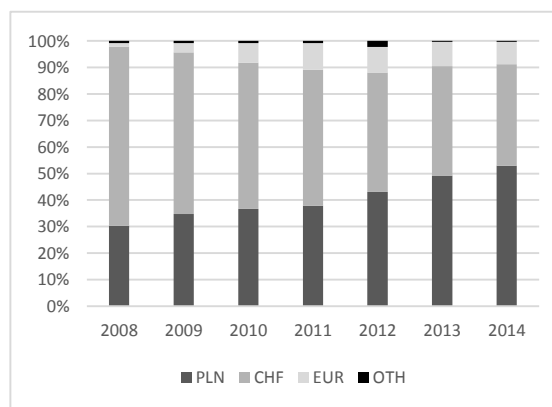


Fig. 4. Structure of mortgage loans in Polish banking sector (2008-2014)

Source: own elaboration based on Raport 2013, Raport 2014, Raport 2015

3.2. Swiss franc mortgage loans development

The most active period for crediting in Swiss currency remained in 2006 and 2008 (Tab. 1.), when the conditions of the economy and the banking sector were very favourable [Ocena 2013].

Table 1. New CHF-denominated mortgage loans development in Poland (2005-2014)

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
New CHF mortgage loans (mld zł)	10,5	23,6	31,4	52,6	5,5	2,9	3,3	0,2	0,1	0,1
Volume of new CHF mortgage loans (thousands)	83,1	115,5	97	162	19,2	8,3	9,7	0,4	0,1	0,1

Source: own elaboration based on PFSA data.

Lower rate of development of Swiss franc denominated loans was observed in 2007, what was mostly a consequence of implementation in July 2006 by Polish Financial Supervisory Authority the regulation called Recommendation S. Such recommendation was a first banking sector legal regulation limiting access to foreign currencies loans by higher requirement of creditworthiness and more detailed investigation of the financial situation of the borrower. One of the regulation of the Recommendation among the others was to investigate creditworthiness of the borrower with assumption that the loan value is increased by 20% and the interest rate is at the level equal to domestic currency (Polish zloty)¹. Until implementation of the Recommendation S Polish borrowers could more easily get Swiss franc loan than denominated in Polish zloty, what was directly a result of lower value of instalments of CHF denominated loans. The peak period for foreign loans crediting falls in 2008, when the appreciation of the Polish currency versus Swiss franc was the strongest. The increase of a value of loans adjusted by the exchange rate CHF/PLN was then even higher. Altogether with the starting of subprime crisis banks started to reduce crediting in Swiss currency and increased credit spread on new CHF denominated loans. Such policy was a consequence of the turmoil on the international interbank market, problems with CHF interbank financing as well as increase of interbank market real costs of capital (reflected e.g. in increase of CDS spreads). The another reason was

¹ The other regulations implemented by PFSA and Parliament related to foreign currency mortgage loans were Recommendation SII (2009), Recommendation SIII (2011) Recommendation T, and also „Anti-spread Act of 2011. The most crucial impact for the process of FCL development had Recommendation S.

increased volatility CHF/PLN and much stronger appreciation of Swiss franc than euro versus PLN (Fig 5 and 6).



Fig. 5. Coefficient of variation for CHF/PLN and EUR/PLN rate (2005-2012)

Source: own elaboration based on NBP data



Fig. 6. Annual rate of change of CHF/PLN and EUR/PLN rate (2005-2012)

Source: own elaboration based on NBP data

Banks in Poland started then to offer euro as a currency of the first choice but from the beginning of 2009 ultimately Polish zloty has been dominating as a meaning of new mortgage loans in Poland. Until 2014 the total value of foreign currencies loans exceeded 50% of total mortgages in the banking sector. The overall evaluation of the foreign exchange mortgage loans versus denominated in PLN is presented in the table 2.

Table 2. Development of mortgage loans in Poland (2005-2014)

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CHF mortgage loans value (mld zł)	NA	NA	NA	NA	132,9	147,4	163,5	144,7	135,7	132,6
CHF mortgage loans volume (thousands)	NA	NA	NA	NA	NA	621,7	596,1	580,5	562,5	542,9
FC mortgage loans volume (thousands)	NA	NA	NA	NA	NA	717,9	712,4	699,7	677,6	654,4
PLN mortgage loans volume (thousands)	NA	NA	NA	NA	NA	798,7	866,1	980,3	1093,6	1207,8
Mortgage loans volume (thousands)	717,2	945,5	1078,1	1207,5	1374,1	1448,8	1630,7	1731,6	1819,8	1860,5
PLN mortgage loans value (mld zł)	18,5	28,2	49,9	59,1	75,6	98,2	115,6	138,7	161,9	183,9
FC mortgage loans value (mld zł)	32,2	50	65,1	136	142,1	169,3	197,8	178,3	166,9	162,9
Mortgage loans value (mld zł)	50,7	78,2	115	195,8	217,8	267,5	318,8	321,8	328,8	346,8
Households loans value (mld zł)	136,4	183,4	254,2	368,6	412,5	475,4	532	533,2	554,6	588,5
FC mortgage loans to total mortgage loans	63,5%	63,9%	56,6%	69,5%	65,2%	63,3%	62,1%	55,4%	50,8%	47,%
FC mortgage loans to total loans to HH	23,6%	27,3%	25,6%	36,9%	34,5%	35,6%	37,2%	33,4%	30,1%	27,7%

Source: own elaboration based on Raport 2011, Raport 2012, Raport 2013, Raport 2014, Raport 2015.

3.3. Risks of borrowings in Swiss franc

The major problem related to mortgage loans denominated in Swiss franc in Poland was servicing of such loans in domestic currency. As such servicing requires exchange of CHF into PLN and then vice versa, the borrowers are dependent on valuation of currencies on international market, bank pricing policies as well as costs of bid-asks spreads. The factor responsible for creating the highest risk of CHF-denominated loans in Poland was the historically low pricing of Helvetic currency toward Polish zloty when most of the loans were

taken (Fig 7). That exposed borrowers directly onto foreign exchange risk, which started to materialize visibly in the late 2008, and then in 2011 and 2015.

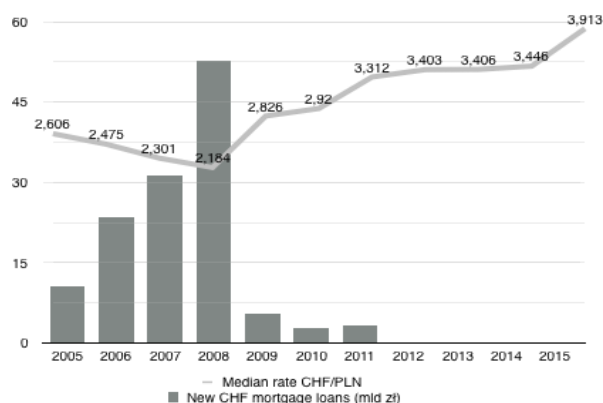


Fig. 7. Development of new Swiss franc mortgage loans versus CHF/PLN rate.
Source: own elaboration based on Ocena 2015 and NBP data

The foreign exchange risk of strong appreciation of CHF/PLN significantly raised the value of instalments of the loans repaid to the banks from CHF-denominated loans. Altogether with appreciation of CHF, the interest rate for Swiss currency was reduced from 3,25% in October 2008 to minimal level and ultimately to the negative value -0,96% in January 2015. Such a change reduced a value of the interest paid by the borrowers on the loans as banks in Poland used an algorithm to calculate interest rate on loans as reference rate (CHF LIBOR 3M) plus credit spread (fixed margin). The foreign currency mortgage loans in Poland included then variable interest rates which, on the one hand passed the interest rate risk onto borrowers, on the other, were automatic stabilizers of the financial condition of the borrowers. Very deep reduction of the interest rate of Swiss currency compensated in a large part the steep appreciation of CHF/PLN rate, keeping the non-performing loans share at a very low level.

Describing the FCL in Poland it is worth to note, that in general Swiss franc financing was granted as a rule to the high income borrowers (Fig 8). That was contrary to PLN-denominated mortgages. Also, the analysis of DtI ratio of borrowers confirms that FCL were used primarily by the persons obtaining relatively high incomes (Fig 9). Despite this rule, some part of the loans granted before implementation of Recommendation S can be in danger due to too low-incomes received by the borrowers. Until July 2006 borrowers of low creditworthiness could obtain just CHF-denominated loans.

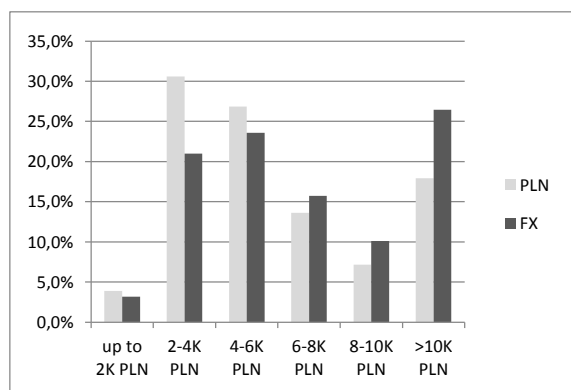


Fig. 8. Structure of mortgage loans according to incomes of borrowers Source: Buszko, Krupa 2015

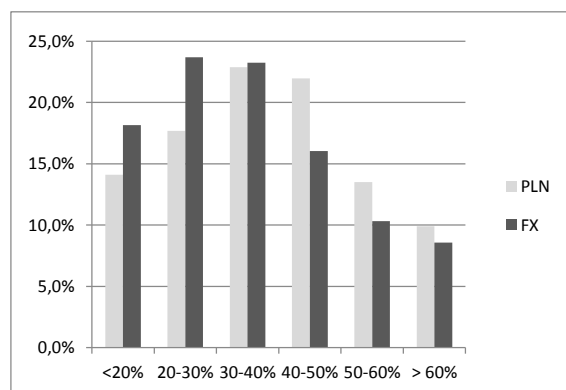


Fig. 9. Structure of mortgage loans according to DtI ratio
Source: Buszko, Krupa 2015

The most significant impact of increase of the CHF/PLN exchange rate on the financial safety and stability as well as a factor of a danger for the Swiss franc borrowers in Poland is the LtV ratio calculated as the current value of debt to the value of the real property. This ratio indicates the burden of debt to the assets and income of the borrower in case of his or her default. For the Swiss franc borrowers about 44% of the value of loans is characterized with LtV >100% (Fig. 10) while for Polish zloty denominated loans such share is about 10%. It is also worth noting that approx. 20% of CHF-denominated mortgage loans represent LtV >140%, what signifies substantial level of bankruptcy risk of borrowers if such loans are not returned on time.

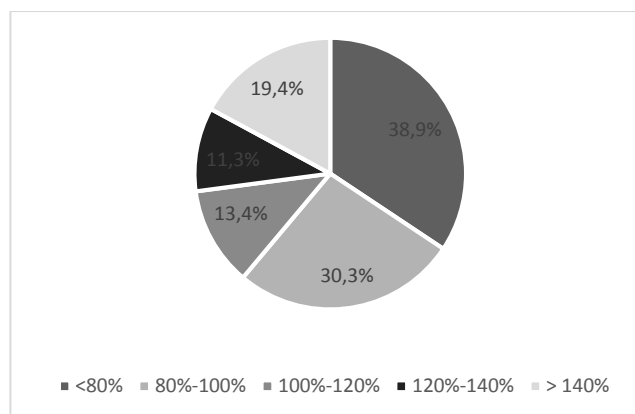


Fig. 10. Structure of LtV of Swiss franc mortgage loans in 2014.
Source: own elaboration based on Raport 2015.

Despite the strictly unfavourable foreign exchange conditions of repaying the CHF-denominated loans, expressed in strong appreciation of Swiss franc versus Polish zloty the quality of the loans remains quite high. In 2014 the NPL ratio was 2,7% (4% with adjustments for loans exchanged into PLN) of the value of all mortgages in Poland and 1,8% (2,7%) of their volume. Such results confirm their highest quality in the whole banking sector loans.

3.4. Instalments value and costs of Swiss franc loans in time

Taking mortgage loans in Swiss francs exposed Polish borrowers onto significant exchange and interest rate risk in a very long period of time. Based on the model of repayment of loans denominated in Francs and Polish zloty in monthly equal instalments, the author found the total value repaid by the borrowers from the moment of taking loan until 31.12.2015, the change of the value of instalments in time, the change of monthly benefits resulting from taking foreign currency loans, the change of monthly benefits of CHF loans in time as well as the value LtV for both types of loans as on 31.12.2015. The author examined model of repayment of a loan of 250.000 zł (approx. 57.000 euro), which is reflecting the average value of CHF-denominated mortgage in Poland. The investigation was conducted for two periods of repayment of loans, i.e. 240 and 360 months. The interest was calculated as CHF LIBOR 3M + fixed credit spread of 2,5% and PLN WIBOR 3M + fixed credit spread 1,5% in whole period of crediting. The Swiss franc loans instalments were exchange at the average exchange rate CHF/PLN from the first six days of each month adjusted with bid-ask spread 7%, what was reflecting real market conditions of foreign currency loans repayment in Poland.

After obtaining results of total value of repayment of CHF and PLN-denominated loans of a value 250.000 zł taken in period 12.2005-12.2011, one could observe the periods in which foreign currency loans were more beneficial for borrowers than mortgages denominated in Polish zloty (Fig. 11). For 20-years financing lower value repaid in total was noted for loans taken in months January-June 2009, June, August, November 2010 and later on until December

2011. For 30-years loans the beneficial periods were: December 2005 – September 2006 and from December 2009. In general, the 30-years loans are more beneficial than 20-years financing and more borrowers in time may take profits due to such loans. The worst period for taking the loan in Swiss franc is July 2008 for both 20 and 30-years loans. Borrowers taking 20-years mortgages in CHF repaid until the end of December 2015 totally 60.507 zł more than borrowers taking PLN-denominated loans, what equals 24,2% value of the real property. The 30-years loans in Swiss franc generated surplus of expenditures of 34.521 zł over PLN loans what amounted to 13,8% of the value of the real estate. On the other hand, the borrowers taking either 20 or 30-years loans denominated in Franc in February 2009 could take profits due to lower repayment amount in comparison to borrowers credited in PLN. For 20-years loans the savings were 16.395 zł (6,6%) and for 30-years 21.860 zł (8,7%). The positive effect of foreign currency loans is noted only in periods of crediting at elevated exchange rate of CHF/PLN. The CHF-denominated loans given for 30 years turned out to be more beneficial and less risky in terms of total amount repaid than 20-years loans. Such statement can be explained by the higher share of interest in the instalment and hence stronger effect of reduction of LIBOR rate in 30-years loans comparing to 20-years financing. The heaviest monthly financial burden of CHF-denominated loans is noted for loans taken in July 2008, what is expressed by the highest median of instalments (2.476 zł for 20-years loans and 1.852 zł for 30-years loans) (Fig. 12).

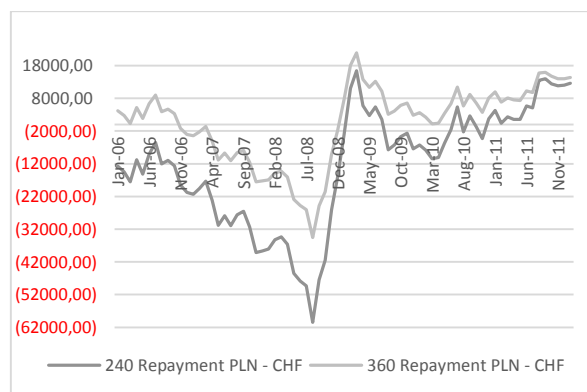


Fig. 11. Disparity in total repayment value of PLN and CHF-denominated loans on 31.12.2015.

Source: own elaboration

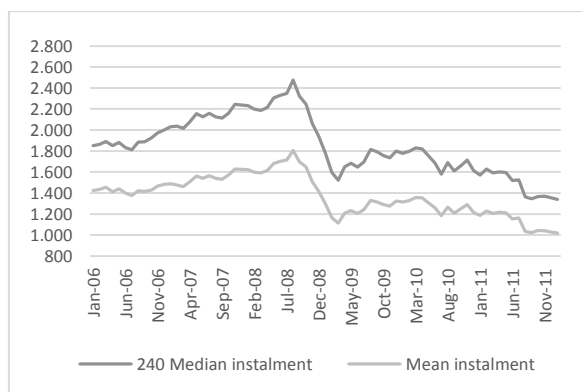


Fig. 12. Median value of instalments of Swiss franc mortgage loans

Source: own elaboration

The lowest instalments are paid by the borrowers taking loans in December 2011 (1.338 zł and 998 zł) what constitutes approx. 54% of the value of instalments from July 2008 loans. The low value of instalments is observed also in case of loans taken in February 2009. In both cases (December 2011 and February 2009) they were granted at elevated pricing of CHF.

According to the survey research [Raport na temat 2013] conducted in the group of borrowers taking loans in francs the most important factor determining decision of taking loans in foreign currency in Poland was the requirement of the lowest value of instalments. Fig. 13 presents initial relative disparity of instalments between PLN and CHF mortgages.

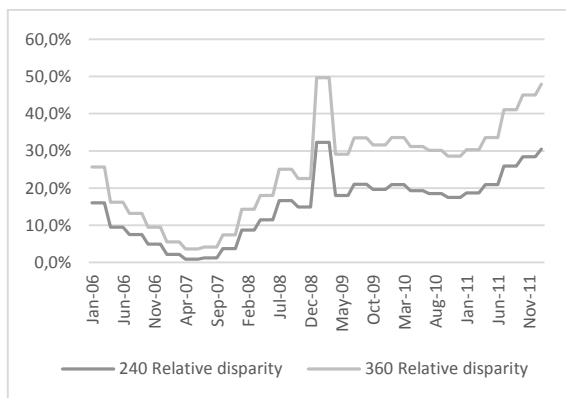


Fig. 13. Relative disparity of CHF and PLN mortgage loans instalments on taking the loan date.

Source: own elaboration

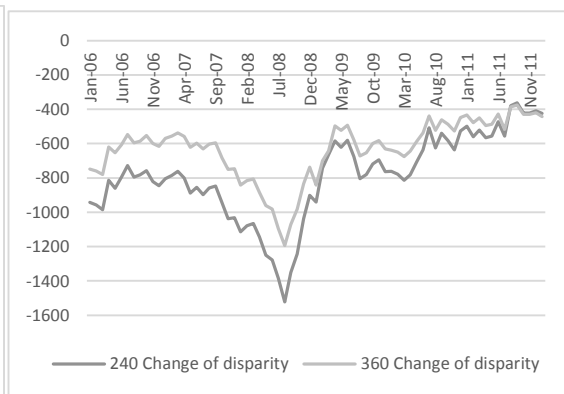


Fig. 14. Change of disparity between PLN and CHF mortgage loans instalments between taking the loan date and 31.12.2015

Source: own elaboration

The level of disparity is diversified and it is the lowest in 2007. Such phenomenon, altogether with Recommendation S, was determining a decrease of new CHF loans taken at that period. In the middle of the mentioned year the borrowers practically did not received benefits due to taking CHF loans. The disparity of at least 10% was noted in periods December 2005 – August 2006 and from December 2007 for 30-years loans and December 2005 – March 2006 and from March 2008. 30-years loans brought higher initial foreign currency crediting benefits than 20-years mortgages.

During the period of loan repayment, the disparity between value of instalments of the PLN-denominated loans and Swiss franc loans has been changing, what determined, and in fact reduced total value of benefits obtained from foreign currency borrowings (Fig. 14).

In case of all of the CHF-denominated loans the change of the disparity was negative, with special regard to loans taken in July 2008, where the loss of the value of disparity was the highest. The absolute change of the disparity of instalments was -1194 zł for 30-years loans and -1523 for 20-years loans. Considering various periods of crediting it is vital to present change of the disparity in time for two critical moments i.e. the July 2008 and February 2009, which are representing the worst and the best time to take CHF-denominated loans (Fig.15, Fig. 16). In case of loans taken in CHF in July 2008 the value of instalment become higher comparing to PLN-denominated loans just in November 2008. The borrowers could then obtain savings just for 3 months. In case of Swiss franc loans taken in February 2009 until October 2014 the instalments were lower comparing to loans in PLN (for 20-years loans) and until December 2014 (for 30-years loans).

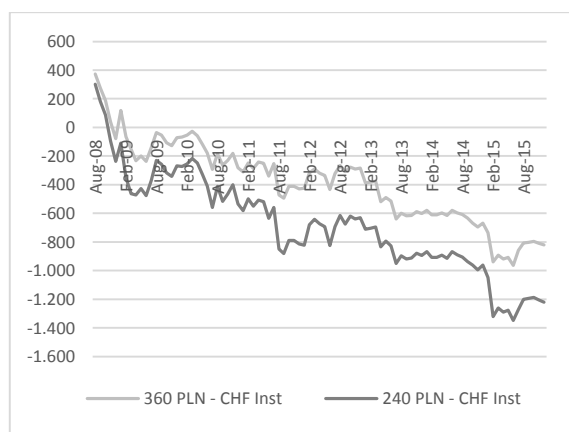


Fig. 15. Instalment value disparity for loans taken in July 2008.

Source: own elaboration

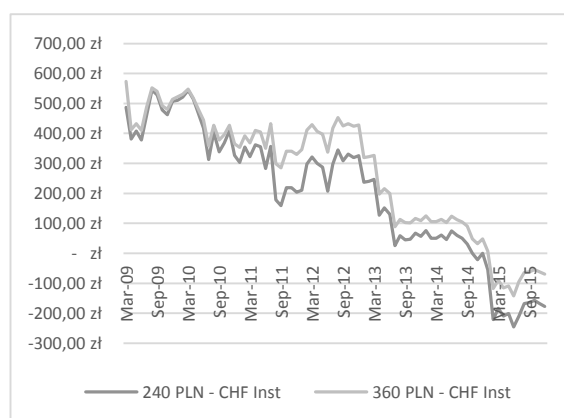


Fig. 16. Instalment value disparity for loans taken in February 2009.

Source: own elaboration

Fig. 17 presents the change of the value of instalments from the moment of taking the loan until 31.12.2015 for the loans taken between December 2005 and December 2011. The instalments value of the borrowers taking the CHF-denominated loan in July 2008 increased by 50% for 20-years loans and by 35,5% for 30-years loans taken in February 2006. Borrowers which took 20-years loans in August 2011 and 30-years loans starting from July 2011 paid at the end of 2015 lower instalments comparing to the period when the loan was taken. If one combines the value of instalments and its change with the increase of the average salaries in the sector of enterprises in Poland, the results indicate that the instalments were relatively cheaper for most borrowers on 31.12.2015 than on the date of taking of the loan (Fig. 18). The relative increase of the value of instalments for borrowers taking loans in the critical moment i.e. July 2008, was 5,2% despite strong appreciation of Franc between that date and 31.12.2015. The results confirm the increase of instalment's purchasing power of borrowers in time with the exception of periods May-July 2008, November 2009, February-March and November 2010 for 20-years loans as well as November 2009 and February 2010 for 30-years loans.



Fig. 17. Change of the value of instalments between taking the loan date and 31.12.2015.

Source: own elaboration

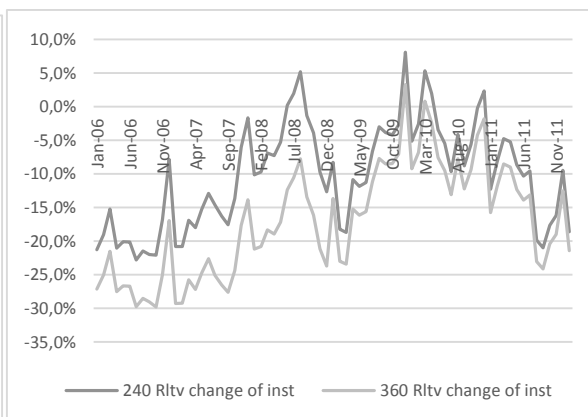


Fig. 18. Relative change of the value of instalments between taking the loan date and 31.12.2015

Source: own elaboration

The analysis of the coefficient of variation of the instalments of the CHF-denominated mortgage loans indicates that 20-years loans are more variable considering the instalments value than 30-years credits (Fig.19). The lowest variability has been noted in case of loans granted in 2011, what is a result of an appreciated but stable valuation of Swiss franc in Poland.

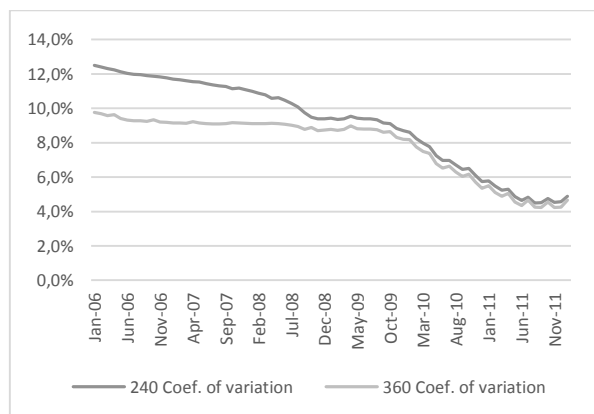


Fig. 19. Coefficient of variation for 20 and 30-years mortgage loans in Swiss franc.

Source: own elaboration

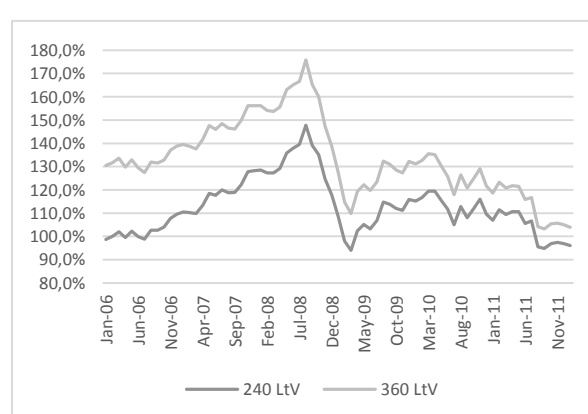


Fig. 20. LtV ratio for 20 and 30-years mortgage loans in Swiss franc.

Source: own elaboration

One of the most important conditions which should be taken into account during the analysis CHF-denominated loans from the perspective of borrowers is the ratio of LtV. Such ratio presents the current value of debt in relation to the value of purchased real property. In the

analysis the author assumed that 100% of the value of real property was financed with the mortgage loan. In opposite to loans in Polish zloty which would never have $LtV > 100\%$ under the condition that debt is not overdue and the initial value of the loan is 100% of the real estate, the CHF-denominated loans in majority are characterized by LtV ratio significantly higher than 100% (Fig. 20).

Just in case of 20-years loans taken in December 2005, March 2006, July 2006, January and February 2009 and from July 2011, the LtV ratio is below 100%. The highest risk is taken by the borrowers taking loans in July 2008, where the LtV is reaching 176% for 30-years crediting and 148% for 20-years loans. In case of failure with the mortgage repayment they would be economically and legally bankrupt as the value of debt significantly exceeds the collateral value, i.e. the value of apartment or house.

Conclusions

The investigation conducted by the author of the paper leads to several conclusions related to development of the Swiss franc loans in Poland. From the point of borrowers, the CHF-denominated loans seemed to be initially very attractive way of financing of the real property as the instalments of the foreign currency loans were significantly lower comparing to domestic financing. The premise to take loans in CHF was the perception of Swiss currency as very safe, stable and resistant for financial crises. Using of such perception for borrowings was incorrect as Swiss franc valuation in Poland was determined by depreciation of PLN and euro on international markets. Increase of CHF rate toward PLN would bring benefits to deponents but not to borrowers. The Swiss franc loans repayment conditions and financial condition of borrowers vary, depending on the date and hence CHF/PLN rate at which the loan was exchanged into PLN and afterwards at which the loans have been repaid. The consequence of such conditions is relatively high volatility of repayment expenditures for loans in CHF taken in various periods in time. The worst terms of the loans repayment and hence the highest LtV are representing loans taken around historical minimum pricing of the Swiss currency (July 2008). Loans taken after February 2009 in general are more beneficial for borrowers than mortgages in domestic currency. Due to variable situation of borrowers using Swiss franc loans, such type of financing should not be treated as a systemic problem and hence there is neither economic nor social reason behind its compulsory exchange onto PLN-denominated loans. When the high valuation of Swiss franc continues, foreign currency loans will be less profitable than Polish zloty mortgages but they should not affect substantially quality of the loans as there was no substantial increase of NPL ratio during long-term high valuation of Swiss currency. Moreover, due to increase of average salaries in Poland altogether with depreciation of PLN, the raise of instalments has been covered by the increased incomes of borrowers. As loans denominated in euro were granted mostly at the beginning of the subprime crisis and within next two years at appreciated value of euro, hence they do not create risk in a similar way like CHF loans. Due to legal requirements of PFSA from 2014 banks cannot grant anymore foreign currency loans to borrowers receiving incomes in Polish zloty, hence portfolio of foreign currency loans will be getting old and might be characterized by NPL ratio increasing in time. The first hypotheses put forward in the paper should be verified positively, the second partially positively due to generally higher costs of 20-years loans in CHF than in PLN but also as a rule more beneficial 30-years franc loans than PLN-denominated.

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**CIET
2016**

Track 2

**Entrepreneurship,
Tourism and Trade**

Primal i dual problema LP-a: analiza osjetljivosti i višestruki optimumi

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Sažetak. U radu su prikazana rješenja niza praktičnih primjera iz područja linearnog programiranja dostupnih u literaturi s pomoću Excelovog alata Solver. Uz rješenja primala razmatrana su i rješenja duala odabranih problema. Izvršena je usporedba dobivenih rezultata. Temeljni cilj rada bio je utvrđivanje međusobne povezanosti podataka koje Solver nudi u svojim izvještajima *Answer Report* i *Sensitivity Report*: cijene u sjeni, odnosno marginalnog troška (*shadow prices*), oportunitetnog troška (*reduced costs*), koeficijenata funkcije cilja (*objective coefficients*) te desnih strana ograničenja (*constraints right hand sides*) za primal i za dual razmatranog problema. Posebno su analizirani problemi višestrukih optimumima (*multiple optima*) i mogućnosti njihove detekcije analizom podataka u izvještajima o osjetljivosti primala, odnosno duala razmatranih problema.

Ključne riječi: *linearno programiranje, primal i dual, Solver, analiza osjetljivosti, višestruki optimumi*

1. Uvod

U uvjetima žestoke konkurencije na tržištu, težnje ka smanjenju troškova i ostvarivanju maksimalne moguće dobiti, a zahvaljujući između ostalog i razvoju računala, modeli i metode operacijskih istraživanja postaju sve veća i sve snažnija potpora menadžerskom odlučivanju.

Linearno je programiranje svakako najpoznatija, najpopularnija i najčešće korištena metoda operacijskih istraživanja [1, 3].

Uz mnogobrojne prednosti, primjena ove metode ima i niz značajnih nedostataka koji se mogu svesti na sljedeće [7]:

- formuliranje linearne funkcije cilja u matematičkom obliku može biti vrlo složena zadaća, a i kada se ta funkcija definira teško je odrediti socijalna, institucijska, financijska i druga ograničenja,
- prikazivanje razmatranog problema baš u obliku linearnih jednadžba i nejednadžba može dovesti do odstupanja od realiteta samog problema (podrazumijevaju se idealni uvjeti i u procesu proizvodnje i na tržištu) koje se ne može zanemariti,
- vrlo je teško odrediti relevantne vrijednosti brojčanih parametara koji se pojavljuju u opisu problema, kako koeficijenata funkcije cilja tako i koeficijenata lijevih i desnih strana pojedinih ograničenja,
- rješenje problema optimuma u slučaju linearnog programiranja dobivaju se metodom pokušaja i pogreške i teško je ustvrditi stvarnu, realnu vrijednost optimuma različitih poslovnih situacija.

Navedeni se nedostaci ublažavaju, između ostalog, detaljnom analizom osjetljivosti rješenja. Ta je analiza, u slučaju linearnog programiranja, vrlo jednostavna i sadržajna, dijelom zahvaljujući i konceptu dualiteta.

Za rješavanje problema linearnog programiranja se koriste različiti programski paketi kao Lindo, Winqsb i slični, a dobro može poslužiti i Excelov alat Solver [6]. Svi oni koriste u rješavanju Simplex algoritam kojega je svijetu predstavio J. Dantzig još 1957. godine.

Korištenje Solvera ograničeno je na probleme do 200 varijabla odlučivanja i 500 ograničenja, a jedan je od ključnih nedostataka u tomu što kod problema s višestrukim optimumima Solver daje samo jedno bazično optimalno rješenje.

Sve navedeno je rezultiralo motivacijom za izradu ovog rada: utvrđivanje međusobne povezanosti podataka koje Solver nudi u svojim izvještajima *Answer Report* i *Sensitivity Report*: cijene u sjeni, odnosno marginalnog troška (*shadow prices*), oportunitetnog troška (*reduced costs*), koeficijenta funkcije cilja (*objective coefficients*) te desnih strana ograničenja (*constraints right hand sides*) za primal i za dual razmatranog problema [5].

Posebno je razmatrana mogućnost detekcije višestrukih optimuma temeljem podataka koje Solver nudi u svojim izvještajima o osjetljivosti rješenja.

2. Matematičke osnove

Svakom problemu linearnog programiranja (primalu), bilo da se radi o traženju maksimuma ili minimuma funkcije cilja, pripada odgovarajući problem traženja minimuma odnosno maksimuma koji se naziva dualom razmatranog problema [5].

Koncept dualiteta može se svrstati u jedno od najznačajnijih otkrića u razvoju teorije linearnog programiranja.

Uzajamni odnosi primala i duala od osobitog su značaja u analizi osjetljivosti problema linearnog programiranja.

2.1 Primal i dual u algebarskom zapisu [3]

Algebarski zapisi primala i duala problema linearnog programiranja, kada je problem primala standardni problem maksimuma, prikazani su u tablici 1.

Tablica 1 Primal standardnog problema maksimuma i njegov dual u algebarskom zapisu

PRIMAL	DUAL
<p>Odredi maksimum funkcije cilja:</p> $F_{CP} = c_1x_1 + c_2x_2 + \dots + c_ix_i + \dots + c_nx_n$ <p>uz ograničenja</p> $a_{11}x_1 + a_{12}x_2 + \dots + a_{1i}x_i + \dots + a_{1n}x_n \leq b_1$ $a_{21}x_1 + a_{22}x_2 + \dots + a_{2i}x_i + \dots + a_{2n}x_n \leq b_2$ <p style="text-align: center;">...</p> $a_{j1}x_1 + a_{j2}x_2 + \dots + a_{ji}x_i + \dots + a_{jn}x_n \leq b_j$ <p style="text-align: center;">...</p> $a_{m1}x_1 + a_{m2}x_2 + \dots + a_{mi}x_i + \dots + a_{mn}x_n \leq b_m$ <p>i nenegativne varijable odlučivanja</p> $x_1 \geq 0, x_2 \geq 0, \dots, x_i \geq 0, \dots, x_n \geq 0.$	<p>Odredi minimum funkcije cilja:</p> $F_{CD} = b_1y_1 + b_2y_2 + \dots + b_jy_j + \dots + b_my_m$ <p>uz ograničenja</p> $a_{11}y_1 + a_{21}y_2 + \dots + a_{j1}y_j + \dots + a_{m1}y_m \geq c_1$ $a_{12}y_1 + a_{22}y_2 + \dots + a_{j2}y_j + \dots + a_{m2}y_m \geq c_2$ <p style="text-align: center;">...</p> $a_{1i}y_1 + a_{2i}y_2 + \dots + a_{ji}y_j + \dots + a_{mi}y_m \geq c_i$ <p style="text-align: center;">...</p> $a_{1n}y_1 + a_{2n}y_2 + \dots + a_{jn}y_j + \dots + a_{mn}y_m \geq c_n$ <p>i nenegativne varijable odlučivanja</p> $y_1 \geq 0, y_2 \geq 0, \dots, y_j \geq 0, \dots, y_m \geq 0.$

Algebarski zapisi primala i duala problema linearnog programiranja, kada je problem primala standardni problem minimuma, prikazani su u tablici 2.

Tablica 2 Primal standardnog problema minimuma i njegov dual u algebarskom zapisu

PRIMAL	DUAL
<p>Odredi minimum funkcije cilja:</p> $F_{CP} = c_1x_1 + c_2x_2 + \dots + c_ix_i + \dots + c_nx_n$ <p>uz ograničenja</p> $a_{11}x_1 + a_{12}x_2 + \dots + a_{1i}x_i + \dots + a_{1n}x_n \geq b_1$ $a_{21}x_1 + a_{22}x_2 + \dots + a_{2i}x_i + \dots + a_{2n}x_n \geq b_2$ <p style="text-align: center;">...</p> $a_{j1}x_1 + a_{j2}x_2 + \dots + a_{ji}x_i + \dots + a_{jn}x_n \geq b_j$ <p style="text-align: center;">...</p> $a_{m1}x_1 + a_{m2}x_2 + \dots + a_{mi}x_i + \dots + a_{mn}x_n \geq b_m$ <p>i nenegativne varijable odlučivanja</p> $x_1 \geq 0, x_2 \geq 0, \dots, x_i \geq 0, \dots, x_n \geq 0.$	<p>Odredi maksimum funkcije cilja:</p> $F_{CD} = b_1y_1 + b_2y_2 + \dots + b_jy_j + \dots + b_my_m$ <p>uz ograničenja</p> $a_{11}y_1 + a_{21}y_2 + \dots + a_{j1}y_j + \dots + a_{m1}y_m \leq c_1$ $a_{12}y_1 + a_{22}y_2 + \dots + a_{j2}y_j + \dots + a_{m2}y_m \leq c_2$ <p style="text-align: center;">...</p> $a_{1i}y_1 + a_{2i}y_2 + \dots + a_{ji}y_j + \dots + a_{mi}y_m \leq c_i$ <p style="text-align: center;">...</p> $a_{1n}y_1 + a_{2n}y_2 + \dots + a_{jn}y_j + \dots + a_{mn}y_m \leq c_n$ <p>i nenegativne varijable odlučivanja</p> $y_1 \geq 0, y_2 \geq 0, \dots, y_j \geq 0, \dots, y_m \geq 0.$

Veličine prikazane u izrazima prikazanim u tablicama 1 i 2 su:

F_{CP} , F_{CD} - funkcija cilja primala, odnosno duala

x_i , $i = 1, 2, \dots, n$ - varijable odlučivanja primala

y_j , $j = 1, 2, \dots, m$ - varijable odlučivanja duala

a_{ij} , $i = 1, 2, \dots, n$; $j = 1, 2, \dots, m$ - koeficijenti lijevih strana ograničenja primala

a_{ji} , $j = 1, 2, \dots, m$; $i = 1, 2, \dots, n$ - koeficijenti lijevih strana ograničenja duala

c_i , $i = 1, 2, \dots, n$ - koeficijenti funkcije cilja primala, odnosno koeficijenti desne strane ograničenja duala

b_j , $j = 1, 2, \dots, m$ - koeficijenti desne strane ograničenja primala, odnosno koeficijenti funkcije cilja duala.

2.2 Primal i dual u matričnom zapisu [3]

Matrični zapisi primala i duala problema linearnog programiranja, kada je problem primala standardni problem maksimuma, prikazani su u tablici 3.

Tablica 3 Primal standardnog problema maksimuma i njegov dual u matričnom zapisu

PRIMAL	DUAL
<p>Odredi maksimum funkcije cilja:</p> $F_{CP} = \mathbf{c}^T \mathbf{x}$ <p>uz ograničenja</p> $\mathbf{A} \cdot \mathbf{x} \leq \mathbf{b}$ <p>i nenegativne varijable odlučivanja</p> $\mathbf{x} \geq \mathbf{0}.$	<p>Odredi minimum funkcije cilja:</p> $F_{CD} = \mathbf{b}^T \mathbf{y}$ <p>uz ograničenja</p> $\mathbf{A}^T \cdot \mathbf{y} \geq \mathbf{c}$ <p>i nenegativne varijable odlučivanja</p> $\mathbf{y} \geq \mathbf{0}.$

Matrični zapisi primala i duala problema linearnog programiranja, kada je problem primala standardni problem minimuma, prikazani su u tablici 4.

Tablica 4 Primal standardnog problema minimuma i njegov dual u matričnom zapisu

PRIMAL	DUAL
<p>Odredi minimum funkcije cilja:</p> $F_{CP} = \mathbf{c}^T \mathbf{x}$ <p>uz ograničenja</p> $\mathbf{A} \cdot \mathbf{x} \geq \mathbf{b}$ <p>i nenegativne varijable odlučivanja</p> $\mathbf{x} \geq \mathbf{0}.$	<p>Odredi maksimum funkcije cilja:</p> $F_{CD} = \mathbf{b}^T \mathbf{y}$ <p>uz ograničenja</p> $\mathbf{A}^T \cdot \mathbf{y} \leq \mathbf{c}$ <p>i nenegativne varijable odlučivanja</p> $\mathbf{y} \geq \mathbf{0}.$

U danim je izrazima:

$$\mathbf{x} = \begin{Bmatrix} x_1 \\ x_2 \\ \dots \\ x_i \\ \dots \\ x_n \end{Bmatrix}; \mathbf{c}^T = \{c_1, c_2, \dots, c_i, \dots, c_n\}, \mathbf{c} = \begin{Bmatrix} c_1 \\ c_2 \\ \dots \\ c_i \\ \dots \\ c_n \end{Bmatrix}; \mathbf{b} = \begin{Bmatrix} b_1 \\ b_2 \\ \dots \\ b_j \\ \dots \\ b_m \end{Bmatrix}, \mathbf{b}^T = \{b_1, b_2, \dots, b_j, \dots, b_m\}; \mathbf{y} = \begin{Bmatrix} y_1 \\ y_2 \\ \dots \\ y_j \\ \dots \\ y_m \end{Bmatrix}$$

gdje je \mathbf{x} – vektor varijabla odlučivanja primala, \mathbf{c}^T – vektor koeficijenata funkcije cilja primala, \mathbf{c} – vektor koeficijenata desne strane ograničenja duala, \mathbf{b} – vektor koeficijenata desne strane ograničenja primala, \mathbf{b}^T – vektor koeficijenata funkcije cilja duala, \mathbf{y} – vektor varijabla odlučivanja duala, dok je \mathbf{A} – matrica koeficijenata lijevih strana ograničenja primala, a \mathbf{A}^T – matrica koeficijenata lijevih strana ograničenja duala:

$$\mathbf{A} = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1i} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2i} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ a_{j1} & a_{j2} & \dots & a_{ji} & \dots & a_{jn} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ a_{m1} & a_{m2} & \dots & a_{mi} & \dots & a_{mn} \end{bmatrix}, \mathbf{A}^T = \begin{bmatrix} a_{11} & a_{21} & \dots & a_{j1} & \dots & a_{m1} \\ a_{12} & a_{22} & \dots & a_{j2} & \dots & a_{m2} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ a_{1i} & a_{2i} & \dots & a_{ji} & \dots & a_{jn} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ a_{1n} & a_{2n} & \dots & a_{jn} & \dots & a_{mn} \end{bmatrix}.$$

2.3 Višestruki optimumi

Donositelju odluke vrlo je važno znati postoji li uz dobiveno optimalno rješenje \mathbf{x}_{10} i neko drugo, alternativno optimalno rješenje \mathbf{x}_{20} , odnosno postoji li neka druga kombinacija vrijednosti varijabla odlučivanja za koju će funkcija cilja imati istu optimalnu vrijednost.

Ako razmatrani problem linearnog programiranja ima dva bazična optimalna rješenja \mathbf{x}_{10} i \mathbf{x}_{20} , tada su sve konveksne kombinacije ta dva optimalna rješenja

$$\mathbf{x}_O^* = \alpha \cdot \mathbf{x}_{10} + (1 - \alpha) \cdot \mathbf{x}_{20}, \quad \alpha \in [0, 1]$$

također optimalna rješenja tog problema.

Zaključuje se da u tom slučaju razmatrani problem ima beskonačno mnogo optimalnih rješenja.

3. Primjeri

Primjeri obrađeni u ovom radu su preuzeti iz udžbenika [2, 3]. Prvi je primjer [3] odabran za usporedbu rezultata rješenja i analize osjetljivosti primala i duala razmatranog problema, dok je u druga dva primjera, koji prema [2] imaju više od jednog optimalnog rješenja, prikazan način detekcije postojanja višestrukih optimuma kao i način određivanja barem još jednog bazičnog optimalnog rješenja s pomoću Excelovog alata Solver i duala razmatranog problema.

3.1 Primjer 1: Proizvodni problem, [3, str. 230]

Poduzeće proizvodi tri vrste proizvoda: P1, P2 i P3. U tablici 5 prikazano je vrijeme (u satima) koje je potrebno utrošiti na strojnu obradu, bojenje i kontrolu kvalitete svakog pojedinog proizvoda, sati kojima poduzeće tjedno raspolaže za izvršavanje tih operacija kao i dobit koja se ostvaruje po komadu svakog od proizvoda.

Tablica 5 Proizvodnja – ulazni podatci

Vrsta proizvoda	Strojna obrada u h	Bojenje u h	Kontrola kvalitete u h	Dobit po komadu u kn
Proizvod P1	0,4	0,3	0,3	150
Proizvod P2	0,7	0,5	0,3	160
Proizvod P3	0,5	0,3	0,4	140
Tjedno raspoloživo vrijeme	72	48	36	

Potrebno je odrediti plan tjedne proizvodnje koja će poduzeću donijeti najveću dobit.

3.1.1 Primal primjera 1

Ako se varijable odlučivanja (nenegativni brojevi) definiraju na sljedeći način: x_1 – broj komada proizvoda P1, x_2 – broj komada proizvoda P2, te x_3 – broj komada proizvoda P3, tada je funkcija cilja (ukupna dobit poduzeća)

$$F_{CP} = 150 \cdot x_1 + 160 \cdot x_2 + 140 \cdot x_3$$

koju treba maksimizirati uz sljedeća ograničenja:

- raspoloživo vrijeme za strojnu obradu
 $0,4 \cdot x_1 + 0,7 \cdot x_2 + 0,5 \cdot x_3 \leq 72 \quad (1)$
- raspoloživo vrijeme za bojenje
 $0,3 \cdot x_1 + 0,5 \cdot x_2 + 0,3 \cdot x_3 \leq 48 \quad (2)$
- raspoloživo vrijeme za kontrolu kvalitete
 $0,3 \cdot x_1 + 0,3 \cdot x_2 + 0,4 \cdot x_3 \leq 36 \quad (3)$

Na slici 1 prikazana je priprema podataka i rješenje primala s pomoću Solvera.

3		Varijable odlučivanja			Funkcija cilja			
4		x1	x2	x3	Dobit			
5		60,0	60,0	0,0	18.600,00 kn			
6	Koeficijenti Fc	150,0	160,0	140,0				
7								
8								
9	Opis ograničenja	Koeficijenti LSO			LSO	Operator	DSO	Br.
10	strojna obrada	0,4	0,7	0,5	66,0	<=	72,0	1
11	bojenje	0,3	0,5	0,3	48,0	<=	48,0	2
12	kontrola kval.	0,3	0,3	0,4	36,0	<=	36,0	3

Slika 1 Primjer 1: rješenje primala

Maksimalnu tjednu dobit od 18.600,00 kuna poduzeće će ostvariti proizvodnjom 60 komada proizvoda P1 i P2, pri čemu se proizvod P3 neće proizvoditi.

3.1.2 Dual primjera 1

Funkcija cilja duala (prema izrazima danim u tablici 1), minimalni trošak (vrijednost) raspoloživih resursa za zadanu razinu dobiti, glasi

$$F_{CD} = 72 \cdot y_1 + 48 \cdot y_2 + 36 \cdot y_3$$

i treba je minimizirati uz sljedeća ograničenja:

$$0,4 \cdot y_1 + 0,3 \cdot y_2 + 0,3 \cdot y_3 \geq 150 \quad (1)$$

$$0,7 \cdot y_1 + 0,5 \cdot y_2 + 0,3 \cdot y_3 \geq 160 \quad (2)$$

$$0,5 \cdot y_1 + 0,3 \cdot y_2 + 0,4 \cdot y_3 \geq 140 \quad (3).$$

Varijable odlučivanja su jedinični interni (marginalni) troškovi resursa s kojima poduzeće raspolaže: y_1 – jedinična interna vrijednost strojne obrade (po satu), y_2 – jedinična interna vrijednost bojenja, te y_3 – jedinična interna vrijednost kontrole kvalitete.

Prvo ograničenje duala znači vrijednost pripisanu proizvodnji jedne jedinice proizvoda P1 (0,4 h strojne obrade, 0,3 h bojenja i 0,3 sati kontrole kvalitete) koja ne može biti manja od dobiti po jedinici tog proizvoda (150 kuna). Na isti se način mogu opisati ograničenja (2) i (3) duala.

Na slici 2 prikazana je priprema podataka i rješenje duala s pomoću Solvera.

3		Varijable odlučivanja			Funkcija cilja			
4		y1	y2	y3	Trošak			
5		0,0	50,0	450,0	18.600,00 kn			
6	Koeficijenti Fc	72,0	48,0	36,0				
7								
8								
9	Opis ograničenja	Koeficijenti LSO			LSO	Operator	DSO	Br.
10	jed. vrijednost proizvodnje P1	0,4	0,3	0,3	150,0	>=	150,0	1
11	jed. vrijednost proizvodnje P2	0,7	0,5	0,3	160,0	>=	160,0	2
12	jed. vrijednost proizvodnje P3	0,5	0,3	0,4	195,0	>=	140,0	3

Slika 2 Primjer 1: rješenje duala

Minimalni trošak resursa koji će poduzeće ostvariti je 18.600,00 kuna uz interne vrijednosti od 50 kuna po satu bojenja i 450 kuna po satu kontrole kvalitete.

3.1.3 Usporedba podataka analize osjetljivosti primala i duala primjera 1.

Podaci o analizi osjetljivosti primjera 1. dobiveni s pomoću Solvera dani su na slici 3.

Iz prikazanih podataka slijedi da je (sukladno brojevima označenim na slici 3):

- **1:** optimalne vrijednosti varijabla odlučivanja primala jednake su cijenama u sjeni (marginalnim troškovima) duala,
- **2:** optimalne vrijednosti varijabla odlučivanja duala jednake su cijenama u sjeni (marginalnim troškovima) primala
- **3:** koeficijenti funkcije cilja primala kao i raspon njihove moguće promjene (najveće moguće povećanje odnosno smanjenje) jednaki su desnim stranama odgovarajućih ograničenja duala kao i rasponima mogućih promjena tih desnih strana,
- **4:** koeficijenti funkcije cilja duala kao i raspon njihove moguće promjene (najveće moguće povećanje odnosno smanjenje) jednaki su desnim stranama odgovarajućih ograničenja primala kao i rasponima mogućih promjena tih desnih strana,
- **5:** oportunitetni trošak (reducirani trošak), tj. smanjenje funkcije cilja primala za svaki proizvedeni komad P3 (kojega nema u optimalnom planu proizvodnje) jednak je razlici desne strane odgovarajućeg ograničenja duala i konačne vrijednosti lijeve

strane tog ograničenja duala, odnosno negativnoj vrijednosti dopuštenog povećanja desne strane tog ograničenja,

- 6: oportunitetni trošak (reducirani trošak), tj. povećanje funkcije cilja za svaki dodani sat resursa strojne obrade (čija je interna vrijednost jednaka nuli) jednak je razlici desne strane odgovarajućeg ograničenja primala i konačne vrijednosti lijeve strane tog ograničenja primala, odnosno vrijednosti dopuštenog smanjenja desne strane tog ograničenja.

6	Variable Cells						a)
7			Final	Reduced	Objective	Allowable	
8	Cell	Name	Value	Cost	Coefficient	Increase	Decrease
9	\$B\$5	x1	60	0	150	10	30
10	\$C\$5	x2	60	0	160	90	10
11	\$D\$5	x3	0	-55	140	55	1E+30
12			1	5			3
13	Constraints						
14			Final	Shadow	Constraint	Allowable	Allowable
15	Cell	Name	Value	Price	R.H. Side	Increase	Decrease
16	\$E\$10	strojna obrada LSO	66	0	72	1E+30	6
17	\$E\$11	bojenje LSO	48	50	48	4	12
18	\$E\$12	kontrola kval. LSO	36	450	36	12	7,2
12			2				6
6	Variable Cells						b)
7			Final	Reduced	Objective	Allowable	Allowable
8	Cell	Name	Value	Cost	Coefficient	Increase	Decrease
9	\$B\$5	y1	0	6	72	1E+30	6
10	\$C\$5	y2	50	0	48	4	12
11	\$D\$5	y3	450	0	36	12	7,2
12			2				4
13	Constraints						
14			Final	Shadow	Constraint	Allowable	Allowable
15	Cell	Name	Value	Price	R.H. Side	Increase	Decrease
16	\$E\$10	jed. vrijednost proizvodnje P1 LSO	150	60	150	10	30
17	\$E\$11	jed. vrijednost proizvodnje P2 LSO	160	60	160	90	10
18	\$E\$12	jed. vrijednost proizvodnje P3 LSO	195	0	140	55	1E+30
12			1				3
							5

Slika 3 Podatci o analizi osjetljivost: a) primala, b) duala, i njihova povezanost

Iz podataka o analizi osjetljivosti rješenja primala razmatranog primjera (sl. 3.a) može se zaključiti sljedeće:

- bazično rješenje problema osjetljivo je na promjenu razine dobiti po pojedinom proizvodu: dopušteno povećanje dobiti po proizvodu P1 je 10 kuna (6,7%), a dopušteno smanjenje 30 kuna (20%), dok je dopušteno smanjenje dobiti po proizvodu P2 10 kuna (6,3%),
- raspoloživi sati za bojenje i za kontrolu kvalitete uska su grla proizvodnje; povećanje raspoloživog vremena za kontrolu kvalitete za 1 sat povećalo bi optimalnu funkciju cilja (maksimalnu dobit) za 450 kuna,
- ako se poduzeće ipak odluči proizvesti određenu količinu proizvoda P3 maksimalna dobit će se smanjiti za 55 kuna po svakom tom proizvodu.

3.2 Primjer 2: Raspodjela radnog vremena – Hitna pomoć, [2, str. 186]

U stanici hitne pomoći raspored radnog vremena (dežurstava) zahtijeva brojno stanje medicinskog osoblja koje je prikazano u tablici 6.

Stupanje medicinskog osoblja na posao je svakoga dana u 0, 4, 8, 12, 16 i 20 sati, a radi se 8 sati neprekidno.

Kako izgleda raspored dežurstava koji će značiti najmanje troškove za ustanovu?

Tablica 6 Hitna pomoć – ulazni podatci

Vremenski interval	0-4	4-8	8-12	12-16	16-20	20-24
Potreban broj medicinskog osoblja	10	6	20	18	12	16
troškovi dežurstva po osobi i satu u kn	495	396	330	330	330	396

3.2.1 Primal primjera 2

Ako se s x_i označi broj osoba koje dolaze na posao na početku i -tog intervala vremena (a takvih intervala ima 6) i ako te osobe ostaju na poslu sljedećih 8 sati, bit će varijable odlučivanja: x_1 - broj osoba koje dolaze u 0:00 sati i rade do 8:00, x_2 - broj osoba koje dolaze u 4:00 sati i rade do 12:00, x_3 - broj osoba koje dolaze u 8:00 sati i rade do 16:00, x_4 - broj osoba koje dolaze u 12:00 sati i rade do 20:00, x_5 - broj osoba koje dolaze u 16:00 sati i rade do 24:00, te x_6 - broj osoba koje dolaze u 20:00 sati i rade do 4:00 idućeg dana.

Troškovi dežurstava su sljedeći: osoba koja dolazi u 0:00 sati (njih x_1) radi 4 sata uz cijenu sata 495 kuna i 4 sata uz cijenu sata od 396 kuna pa je trošak dežurstva te osobe $4 \cdot 495 + 4 \cdot 396 = 3564$ kune; osoba koja dolazi u 4:00 sati (njih x_2) radi uz ukupni trošak dežurstva $4 \cdot 396 + 4 \cdot 330 = 2904$ kuna; osoba koja dolazi u 8:00 sati (njih x_3) kao i osoba koja dolazi u 12:00 sati (njih x_4) radi svih 8 sati uz cijenu sata 330 kuna pa je ukupni trošak dežurstva te osobe $8 \cdot 330 = 2640$ kuna; osoba koje dolazi u 16:00 sati (njih x_5) radi 4 sata uz cijenu sata 330 kuna, te 4 sata uz cijenu sata od 396 kuna pa je cijena dežurstva te osobe 2904 kune; te konačno, osoba koja dolazi u 20:00 sati (njih x_6) radi 4 sata uz cijenu sata 396 kuna, a 4 sata uz cijenu sata od 495 kuna pa je cijena dežurstva te osobe 3564 kune.

Prema tome, funkcija cilja primala (ukupni troškovi dežurstava) je

$$F_{CP} = 3564 \cdot x_1 + 2904 \cdot x_2 + 2640 \cdot x_3 + 2640 \cdot x_4 + 2904 \cdot x_5 + 3564 \cdot x_6$$

a ograničenja koja slijede iz potrebnog brojnog stanja osoblja u pojedinim intervalima su

$$x_1 + x_2 \geq 6 \quad (1), \quad x_2 + x_3 \geq 20 \quad (2), \quad x_3 + x_4 \geq 18 \quad (3)$$

$$x_4 + x_5 \geq 12 \quad (4), \quad x_5 + x_6 \geq 16 \quad (5), \quad x_6 + x_1 \geq 10 \quad (6).$$

Na slici 4 prikazana je priprema podataka i rješenje s pomoću Solvera.

3		Varijable odlučivanja						Funkcija cilja			
4		x1	x2	x3	x4	x5	x6	Trošak dežurstva			
5		6	0	20	0	12	4	123.288,00 kn			
6	Koeficijenti Fc	3564	2904	2640	2640	2904	3564				
7											
8											
9	Opis ograničenja	Koeficijenti LSO						LSO	Operator	DSO	Br.
10	osoblje 0-4	1	1					6	>=	6	1
11	osoblje 4-8		1	1				20	>=	20	2
12	osoblje 8-12			1	1			20	>=	18	3
13	osoblje 12-16				1	1		12	>=	12	4
14	osoblje 16-20					1	1	16	>=	16	5
15	osoblje 20-24	1					1	10	>=	10	6

Slika 4 Primjer 2: rješenje primala

6	Variable Cells						
7			Final	Reduced	Objective	Allowable	Allowable
8	Cell	Name	Value	Cost	Coefficient	Increase	Decrease
9	\$B\$5	x1	6	0	3564	0	2640
10	\$C\$5	x2	0	0	2904	2640	0
11	\$D\$5	x3	20	0	2640	0	2640
12	\$E\$5	x4	0	0	2640	1E+30	0
13	\$F\$5	x5	12	0	2904	0	2640
14	\$G\$5	x6	4	0	3564	2640	0

Slika 5 Primjer 2: podatci o analizi osjetljivosti koeficijenata funkcije cilja primala

Dakle, najmanji trošak dežurstava u iznosu od 123.288,00 kuna Hitna će pomoć imati uz varijable odlučivanja $x_1^o = 6$, $x_2^o = 0$, $x_3^o = 20$, $x_4^o = 0$, $x_5^o = 12$, te $x_6^o = 4$.

Međutim, iz podataka o analizi osjetljivosti koeficijenata funkcije cilja primala (slika 5) može se vidjeti da je oportunitetni trošak uz varijable x_2 i x_4 , čija je vrijednost u optimalnom rješenju jednaka nuli, također jednaka nuli. Proizlazi da se funkcija cilja neće promijeniti niti ako te varijable poprimu neku vrijednost različitu od nule. Budući da se u tom slučaju moraju promijeniti vrijednosti i nekih drugih varijabla odlučivanja to upućuje na postojanje barem još jednog optimalnog rješenja.

Kod korištenja Solvera može se pokazati da cijene u sjeni (marginalni troškovi) duala razmatranog problema jesu varijable odlučivanja drugog bazičnog optimalnog rješenja. Ovo se može objasniti algoritmom koji se koristi u Simpleks metodi i „putanjom“ kojom se dolazi do optimuma u slučaju traženja maksimuma funkcije cilja primala, odnosno minimuma funkcije cilja duala.

3.2.2 Dual primjera 2

Funkcija cilja duala prema tablici 1 glasi

$$F_{CD} = 6 \cdot y_1 + 20 \cdot y_2 + 18 \cdot y_3 + 12 \cdot y_4 + 16 \cdot y_5 + 10 \cdot y_6$$

i treba je maksimizirati uz sljedeća ograničenja:

$$y_1 + y_2 \leq 3564 \quad (1), \quad y_1 + y_2 \leq 2904 \quad (2), \quad y_2 + y_3 \leq 2640 \quad (3)$$

$$y_3 + y_4 \leq 2640 \quad (4), \quad y_4 + y_5 \leq 2904 \quad (5), \quad y_5 + y_6 \leq 3564 \quad (6).$$

Na slici 2 prikazana je priprema podataka i rješenje duala s pomoću Solvera.

3		Varijable odlučivanja						Funkcija cilja			
4		y1	y2	y3	y4	y5	y6	Dobit ili Trošak ili			
5		264	2640	0	2640	264	3300	123.288,00 kn			
6	Koeficijenti Fc	6	20	18	12	16	10				
7											
8											
9	Opis ograničenja	Koeficijenti LSO						LSO	Operator	DSO	Br.
10	trošak smjene (0:00)	1					1	3564	<=	3564	1
11	trošak smjene (4:00)	1	1					2904	<=	2904	2
12	trošak smjene (8:00)		1	1				2640	<=	2640	3
13	trošak smjene (12:00)			1	1			2640	<=	2640	4
14	trošak smjene (16:00)				1	1		2904	<=	2904	5
15	trošak smjene (20:00)					1	1	3564	<=	3564	6

Slika 6 Primjer 2: rješenje duala

Drugo bazično optimalno rješenje primala razmatranog primjera je ono za koje varijable odlučivanja primala poprimaju vrijednost odgovarajućih marginalnih troškova (cijena u sjeni, *shadow price*) njegovoga duala, dakle: $x_1^{o2} = 0$, $x_2^{o2} = 6$, $x_3^{o2} = 16$, $x_4^{o2} = x_5^{o2} = 6$, te $x_6^{o2} = 10$, što se može vidjeti iz podataka o analizi osjetljivosti ograničenja duala (sl. 7).

16	Constraints						
17			Final	Shadow	Constraint	Allowable	Allowable
18	Cell	Name	Value	Price	R.H. Side	Increase	Decrease
19	\$H\$10	trošak smjene (0:00) LSO	3564	0	3564	1E+30	0
20	\$H\$11	trošak smjene (4:00) LSO	2904	6	2904	0	264
21	\$H\$12	trošak smjene (8:00) LSO	2640	14	2640	264	0
22	\$H\$13	trošak smjene (12:00) LSO	2640	6	2640	0	2640
23	\$H\$14	trošak smjene (16:00) LSO	2904	6	2904	3300	0
24	\$H\$15	trošak smjene (20:00) LSO	3564	10	3564	0	3300

Slika 7 Primjer 2: podatci o analizi osjetljivosti ograničenja duala

Rješenje se poklapa s odgovarajućim drugim optimalnim rješenjem dobivenim s pomoću programa Winqsb [2, str. 188].

3.3 Primjer 3: Proizvodnja viskija, [2, str. 208]

Proizvođač viskija uvozi 3 vrste sirovina (A, B i C) različitih gradacija i miješa ih zavisno o receptima koji specificiraju maksimalni i minimalni postotak tih sirovina u svakoj od vrsta viskija koje proizvodi (Blue Dot, Highland Fling i Old Frenzy). Receptura i cijene viskija po litri dana je u tablici 7.

Tablica 7 Proizvodnja viskija – specifikacija i cijene

Vrsta viskija	Specifikacija	Cijena po litri u €
Blue Dot	ne manje od 60% sirovine A ne više od 20% sirovine C	6,80
Highland Fling	ne manje od 15% sirovine A ne više od 20% sirovine C	5,70
Old Frenzy	ne više od 50% sirovine C	6,00

Raspoložive dnevne količine sirovina A, B i C, kao i njihove nabavne cijene prikazane su u tablici 8.

Tablica 8 Proizvodnja viskija – sirovine

Sirovina	Dnevna količina u l	Cijena po litri u €
A	2000	7
B	2500	5
C	1200	4

Zbog ugovorne klauzule proizvođač mora dnevno proizvesti najmanje 1000 litara Highland Flinga. Odrediti plan proizvodnje koji će maksimizirati dnevno ostvarenu dobit.

3.3.1 Primal primjera 3

Ako se s x_1 označi dnevno proizvedena količina Blue Dote, s x_2 - dnevno proizvedena količina Highland Flinga, a s x_3 - dnevno proizvedena količina Old Frenzyja, tada se mogu uvesti sljedeće varijable odlučivanja: x_{1A} - količina sirovine A upotrijebljene za piće x_1 , x_{2A} - količina sirovine A upotrijebljene za piće x_2 , x_{3A} - količina sirovine A upotrijebljene za piće x_3 , x_{1B} - količina sirovine B upotrijebljene za piće x_1 , x_{2B} - količina sirovine B upotrijebljene za piće x_2 , x_{3B} - količina sirovine B upotrijebljene za piće x_3 , x_{1C} - količina sirovine C upotrijebljene za piće x_1 , x_{2C} - količina sirovine C upotrijebljene za piće x_2 , te x_{3C} - količina sirovine C upotrijebljene za piće x_3 .

Ukupna količina dnevno proizvedenog viskija Blue Dot jednaka je zbroju količina sirovina A, B i C umiješanih u taj viski

$$x_1 = x_{1A} + x_{1B} + x_{1C}$$

pa je dnevni prihod od prodaje viskija Blue Dot

$$TR_1 = 6,8 \cdot x_1 = 6,8 \cdot (x_{1A} + x_{1B} + x_{1C})$$

Analogno vrijedi i za ostale dvije vrste viskija:

$$x_2 = x_{2A} + x_{2B} + x_{2C}, \quad TR_2 = 5,7 \cdot x_2 = 5,7 \cdot (x_{2A} + x_{2B} + x_{2C})$$

$$x_3 = x_{3A} + x_{3B} + x_{3C}, \quad TR_3 = 6 \cdot x_3 = 6 \cdot (x_{3A} + x_{3B} + x_{3C}).$$

Ukupni dnevni prihod je

$$TR = TR_1 + TR_2 + TR_3 = 6,8 \cdot (x_{1A} + x_{1B} + x_{1C}) + 5,7 \cdot (x_{2A} + x_{2B} + x_{2C}) + 6 \cdot (x_{3A} + x_{3B} + x_{3C})$$

Dnevno se potroši $(x_{1A} + x_{2A} + x_{3A})$ litara sirovine A po jediničnoj cijeni od 7 kuna, $(x_{1B} + x_{2B} + x_{3B})$ litara sirovine B po jediničnoj cijeni od 5 kuna, te $(x_{1C} + x_{2C} + x_{3C})$ litara sirovine C po jediničnoj cijeni od 4 kune. Slijede ukupni troškovi upotrijebljenih sirovina:

$$TC = 7 \cdot (x_{1A} + x_{2A} + x_{3A}) + 5 \cdot (x_{1B} + x_{2B} + x_{3B}) + 4 \cdot (x_{1C} + x_{2C} + x_{3C}).$$

Oduzimanjem ukupnih troškova od ukupnog prihoda i sređivanjem se dobije funkcija cilja primala (dnevna dobit proizvođača viskija) koju treba maksimizirati:

$$\pi = -0,2 \cdot x_{1A} + 1,8 \cdot x_{1B} + 2,8 \cdot x_{1C} - 1,3 \cdot x_{2A} + 0,7 \cdot x_{2B} + 1,7 \cdot x_{2C} - x_{3A} + x_{3B} + 2 \cdot x_{3C}.$$

Ograničenja slijede iz raspoložive količine sirovina, recepture te ugovorne obveze vezane uz količinu viskija Highland Fling [2, str. 211] su (uz sve nejednakosti oblika \leq):

$$x_{1A} + x_{2A} + x_{3A} \leq 2000 \quad (1)$$

$$x_{1B} + x_{2B} + x_{3B} \leq 2500 \quad (2)$$

$$x_{1C} + x_{2C} + x_{3C} \leq 1200 \quad (3)$$

$$-0,4 \cdot x_{1A} + 0,6 \cdot x_{1B} + 0,6 \cdot x_{1C} \leq 0 \quad (4)$$

$$-0,2 \cdot x_{1A} - 0,2 \cdot x_{1B} + 0,8 \cdot x_{1C} \leq 0 \quad (5)$$

$$-0,6 \cdot x_{2A} - 0,6 \cdot x_{2B} + 0,4 \cdot x_{2C} \leq 0 \quad (6)$$

$$-0,85 \cdot x_{2A} + 0,15 \cdot x_{2B} + 0,15 \cdot x_{2C} \leq 0 \quad (7)$$

$$-0,5 \cdot x_{3A} - 0,5 \cdot x_{3B} + 0,5 \cdot x_{3C} \leq 0 \quad (8)$$

$$-x_{2A} - x_{2B} - x_{2C} \leq -1000. \quad (9)$$

Podrazumijeva se da su varijable odlučivanja nenegativne.

Na slici 8 prikazana je priprema podataka i rješenje s pomoću Solvera odakle slijedi da će najveću dnevnu dobit u iznosu od 5.066,67 € proizvođač viskija ostvariti za vrijednosti varijabla odlučivanja $x_{1A}^o = 1850$, $x_{2A}^o = 616,7$, $x_{3A}^o = 616,7$, $x_{1B}^o = 150$, $x_{2B}^o = 266,7$, $x_{3B}^o = 583,3$, $x_{1C}^o = 0$, $x_{2C}^o = 1616,7$, te $x_{3C}^o = 0$. Ovo nadalje znači da će se dnevno proizvesti $1850 + 616,7 + 616,7 = 3083,3$ litara viskija vrste Blue Dot, $150 + 266,7 + 583,4 = 1000$ litara viskija Highland Fling i $0 + 1616,7 + 0 = 1616,7$ litara viskija Old Frenzy.

Međutim, iz podataka o analizi osjetljivosti (slika 9) može se vidjeti da je oportunitetni trošak (*reduced cost*) uz varijablu x_{3C} , čije je vrijednost u optimalnom rješenju jednaka nuli, također jednaka nuli.

3		Varijable odlučivanja									Funkcija cilja			
4		x1A	x2A	x3A	x1B	x2B	x3B	x1C	x2C	x3C	dnevna dobit			
5		1850,0	616,7	616,7	150,0	266,7	583,3	0,0	1616,7	0,0	5.066,67 €			
6	Koeficijenti Fc	-0,2	1,8	2,8	-1,3	0,7	1,7	-1,0	1,0	2,0				
7														
8														
9	Opis ograničenja	Koeficijenti LSO									LSO	Operator	DSO	Br.
10	količina sirovine A	1,00			1,00			1,00			2000,0	<=	2000,0	1
11	količina sirovine A		1,00			1,00			1,00		2500,0	<=	2500,0	2
12	količina sirovine A			1,00			1,00			1,00	1200,0	<=	1200,0	3
13	recepture 1	-0,40	0,60	0,60							0,0	<=	0,0	4
14	recepture 2	-0,20	-0,20	0,80							0,0	<=	0,0	5
15	recepture 3				-0,60	-0,60	0,40				-16,7	<=	0,0	6
16	recepture 4				-0,85	0,15	0,15				0,0	<=	0,0	7
17	recepture 5							-0,50	-0,50	0,50	-808,3	<=	0,0	8
18	ugovorna obveza				-1,00	-1,00	-1,00				-1000,0	<=	-1000,0	9

Slika 8 Primjer 3: rješenje primala

6	Variable Cells							
7								
8	Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease	
9	\$B\$5	x1A	1850	0	-0,2	1E+30	0,33333333	
10	\$C\$5	x2A	616,6666667	0	1,8	2,2204E-16	1	
11	\$D\$5	x3A	616,6666667	0	2,8	1E+30	2,2204E-16	
12	\$E\$5	x1B	150	0	-1,3	1,33333333	1E+30	
13	\$F\$5	x2B	266,6666667	0	0,7	0	2,2204E-16	
14	\$G\$5	x3B	583,3333333	0	1,7	2,2204E-16	0	
15	\$H\$5	x1C	0	-1,33333333	-1	1,33333333	1E+30	
16	\$I\$5	x2C	1616,666667	0	1	0,5	0	
17	\$J\$5	x3C	0	0	2	0	1E+30	

Slika 9 Primjer 3: podatci o analizi osjetljivosti koeficijenata funkcije cilja primala

Proizlazi da se funkcija cilja neće promijeniti niti ako ta varijabla poprimi neku vrijednost različitu od nule. Budući da se u tom slučaju moraju promijeniti vrijednosti i nekih drugih varijabla odlučivanja to upućuje na postojanje barem još jednog optimalnog rješenja.

Prema [3] postoje ukupno 3 bazična optimalna rješenja, a jedno od njih će se ovdje odrediti analizom podataka o analizi osjetljivosti duala opisanog primjera.

3.3.2 Dual primjera 3

Funkcija cilja duala prema tablici 1 glasi

$$F_{CD} = 2000 \cdot y_1 + 2500 \cdot y_2 + 1200 \cdot y_3 - 1000 \cdot y_9$$

i treba je maksimizirati uz sljedeća ograničenja:

$$y_1 - 0,4 \cdot y_4 - 0,2 \cdot y_5 \geq -0,2 \quad (1)$$

$$y_2 + 0,6 \cdot y_4 - 0,2 \cdot y_5 \geq 1,8 \quad (2)$$

$$y_3 + 0,6 \cdot y_4 + 0,8 \cdot y_5 \geq 2,8 \quad (3)$$

$$y_1 - 0,6 \cdot y_6 - 0,85 \cdot y_7 - y_9 \geq -1,3 \quad (4)$$

$$y_2 - 0,6 \cdot y_6 + 0,15 \cdot y_7 - y_9 \geq 0,7 \quad (5)$$

$$y_3 + 0,4 \cdot y_6 + 0,15 \cdot y_7 - y_9 \geq 1,7 \quad (6)$$

$$y_1 - 0,5 \cdot y_8 \geq -1,0 \quad (7)$$

$$y_2 - 0,5 \cdot y_8 \geq 1,0 \quad (8)$$

$$y_3 + 0,5 \cdot y_8 \geq 2,0 \quad (9)$$

Na slici 10 prikazana je priprema podataka i rješenje duala s pomoću Solvera.

3		Variable odlučivanja									Funkcija cilja			
4		y1	y2	y3	y4	y5	y6	y7	y8	y9	Trošak			
5		0,3	1,0	2,0	1,3	0,0	0,0	1,3	0,0	0,5	5.066,67 €			
6	Koeficijenti Fc	2000	2500	1200	0	0	0	0	0	-1000				
7														
8														
9	Opis ograničenja	Koeficijenti LSO									LSO	Operator	DSO	Br.
10	resurs 1	1,00			-0,40	-0,20					-0,2	>=	-0,2	1
11	resurs 2		1,00		0,60	-0,20					1,8	>=	1,8	2
12	resurs 3			1,00	0,60	0,80					2,8	>=	2,8	3
13	resurs 4	1,00					-0,60	-0,85		-1,00	-1,3	>=	-1,3	4
14	resurs 5		1,00				-0,60	0,15		-1,00	0,7	>=	0,7	5
15	resurs 6			1,00			0,40	0,15		-1,00	1,7	>=	1,7	6
16	resurs 7	1,00							-0,50		0,3	>=	-1,0	7
17	resurs 8		1,00						-0,50		1,0	>=	1,0	8
18	resurs 9			1,00					0,50		2,0	>=	2,0	9

Slika 10 Primjer 3: rješenje duala

Jedno od preostalih bazičnih optimalnih rješenje primala razmatranog primjera je ono za koje varijable odlučivanja primala poprimaju vrijednost odgovarajućih marginalnih troškova (cijena u sjeni, *shadow price*) njegovoga duala, dakle: $x_{1A}^{o2} = 1850$, $x_{2A}^{o2} = 1233,3$, $x_{3A}^{o2} = 0$, $x_{1B}^{o2} = 150$, $x_{2B}^{o2} = 458,3$, $x_{3B}^{o2} = 391,7$, $x_{1C}^{o2} = 0$, $x_{2C}^{o2} = 808,3$, te $x_{3C}^{o2} = 808,3$, što se može vidjeti iz podataka o analizi osjetljivosti ograničenja duala (slika 11).

19	Constraints						
20							
21	Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
22	\$K\$10	resurs 1 LSO	-0,2	1850	-0,2	1E+30	0,33333333
23	\$K\$11	resurs 2 LSO	1,8	1233,33333	1,8	1E+30	2,2204E-16
24	\$K\$12	resurs 3 LSO	2,8	0	2,8	2,2204E-16	1E+30
25	\$K\$13	resurs 4 LSO	-1,3	150	-1,3	1,33333333	1E+30
26	\$K\$14	resurs 5 LSO	0,7	458,33333	0,7	2,2204E-16	3,3307E-16
27	\$K\$15	resurs 6 LSO	1,7	391,66667	1,7	3,3307E-16	2,2204E-16
28	\$K\$16	resurs 7 LSO	0,33333333	0	-1	1,33333333	1E+30
29	\$K\$17	resurs 8 LSO	1	808,33333	1	3,3307E-16	1,33333333
30	\$K\$18	resurs 9 LSO	2	808,33333	2	1	3,3307E-16

Slika 11 Primjer 3: podatci o analizi osjetljivosti ograničenja duala

- Rješenje se poklapa s odgovarajućim trećim bazičnim optimalnim rješenjem dobivenim s pomoću programa Winqsb [2, str. 214].

Drugi način iznalaženja alternativnih optimalnih rješenja sastoji se u sljedećem:

- razmatranom se problemu dodaje novo ograničenje prema kojem je vrijednost odabrane i -te varijable jednaka njenoj optimalnoj vrijednosti ($x_i = x_i^o$),
- riješi se tako postavljeni problem pa se u izvještaju o analizi osjetljivosti analizira moguća promjena desne strane dodanog ograničenja; ako se desna strana dodanog ograničenja može mijenjati za neki iznos $\Delta x_i \neq 0$ pri čemu je cijena u sjeni tog ograničenja jednaka nuli, to znači da se vrijednost i -te varijable može mijenjati u dobivenim granicama bez promjene optimalne vrijednosti funkcije cilja,
- novo bazično optimalno rješenje tada se dobije rješavanjem razmatranog problema uz dodatno ograničenje $x_i = x_i^o + \Delta x_i$.

4. Zaključak

U radu je, na nekoliko primjera dostupnih u literaturi, prikazana mogućnost primjene Excelovog alata Solver u rješavanju problema linearnog programiranja i analizi osjetljivosti tih rješenja sa svrhom eliminiranja/ublažavanja temeljnih nedostataka linearnog programiranja. Dana je usporedba podataka o mogućim promjenama koeficijenata funkcije cilja i desnih strana ograničenja, marginalnim i oportunitetnim troškovima, koje u izvještajima o analizi osjetljivosti daje Solver za primal i za dual razmatranih problema.

Pojašnjen je način utvrđivanja eventualne egzistencije većeg broja optimalnih rješenja te određivanja drugog bazičnog optimalnog rješenja (ako je riječ o problemu s 2 bazična optimuma), odnosno barem još jednog bazičnog optimalnog rješenja (ako je riječ o problemu s više od dva bazična optimuma) i to s pomoću cijena u sjeni duala razmatranog problema.

Pokazano je da u granicama svojih mogućnosti (do 200 varijabla odlučivanja i do 500 ograničenja) Solver može poslužiti kao jednostavan i učinkovit alat pri rješavanju problema linearnog programiranja i analizi osjetljivosti dobivenih rješenja.

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Primal and dual LP problem: sensitivity analysis and multiple optima

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Abstract. Several linear programming problems available in the literature are solved by using Excel Solver. The solution of both the primal and the dual of the selected examples is considered. The obtained results have been compared. The aim of this paper is to determine the interconnection of data provided in Solver Answer and Sensitivity reports: shadow prices, reduced costs, objective coefficients and constraints right hand sides both for the primal and the dual of the presented problems. In particular, the problems of multiple optima and possibilities of their detection by analyzing data in the sensitivity reports for the primal and dual solutions of the selected problems were considered.

Key words: linear programming, primal and dual, Solver, sensitivity analysis, multiple optima

Potencijali za razvoj novih proizvoda i usluga u turizmu baziranih na novim ICT tehnologijama

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Sažetak. U svijetu ICT-a (Information and Communication Technologies) 2020. godina se smatra prekretnicom jer se očekuje komercijalizacija 5G mobilnih mreža pa će telekomunikacijski operateri (s posebnim naglaskom na mobilne operatere) u narednom periodu žurno morati mijenjati kompletan pristup poslovanju odnosno filozofiju poslovanja i pristupa korisniku. Uz to cijeli niz novih pojmova (5G, SDN, NVF, HetNet ...) odnosno sustava baziranih na ovim novim tehnologijama, postat će stvarnost i sadašnjost te budućnost u svakodnevnom životu. Definiran je i pojam koji to sve objedinjuje – „Vizija 2020“. U turizmu ne postoji precizno definiran pojam „Vizija 2020“, ali postoji određeni broj analiza i stručnih te znanstvenih radova u kojima su analizirana očekivanja do 2020. godine te perioda nakon 2020. godine. U ovom radu biti će analizirani preduvjeti za usklađivanje i prilagođavanje pristupa u turizmu i „Vizije 2020“ u ICT-u te će biti analizirani potencijali i dani prijedlozi za razvoj novih integriranih usluga u turizmu. Bit će analizirani zajednički interesi gospodarskih sektora ICT-a i turizma u cilju provođenja i implementacije „Vizije 2020“ te kreiranje usluga u turističkim objektima i turizmu u Republici Hrvatskoj baziranih na novim tehnologijama. Na kraju će biti dan načelni prijedlog standardizacije i kategorizacije turističkih objekata obzirom na nove predložene usluge bazirane na novim tehnologijama čime bi se u turizmu dodijelila dodatna vrijednost za turističke objekte koji su opremljeni i koji nude usluge bazirane na novim tehnologijama.

Ključne riječi: *ICT, 5G, IoT/IIoT, Vizija 2020, turizam.*

1. Uvod

Današnje poimanje ICT sektora značajno će se promijeniti u narednih par godina. Od 2020. godine (okvirno je ova godina uzeta kao polazna) prelazimo na potpuno drugi način poimanja ICT-a te moramo napraviti „pomak u načinu razmišljanja“. Te promjene koje slijede i koje neki nazivaju i „četvrtom industrijskom revolucijom“ što samo po sebi govori o veličini i značaju promjena koje slijede odrazit će se na sve grane gospodarstva pa samim time i na turizam. U biti, bolje reći turizam će biti jedna od grana gospodarstva na koju će se promjene koje slijede možda i najviše odraziti.

Promjene koje slijede u ICT sektoru bit će analizirane u ovom radu, a sve je sadržano pod zajedničkim nazivom „Vizija 2020“. Neke turističke zajednice, organizacije i države (ili regije pojedinih država) su već objavili svoje smjernice, vizije i strategije razvitka turizma do 2020-e i poslije ove godine (moguće ponukani i pojmom „Vizije 2020“ u ICT sektoru napravili su svoje vizije i strategije u turizmu). U ovom radu, autori će analizirati promjene koje slijede u ICT sektoru i u turizmu u svijetu te kako se to odražava prema pojmu i poimanju turizma u Republici Hrvatskoj.

2. Vizija 2020 u ICT sektoru – što je to

Postoji cijeli niz tvrtki proizvođača ICT opreme, organizacija, telekom operatera i znanstvenih institucija koje se bave problematikom „Vizije 2020“ i svemu vezanom uz nju. Malo je prostora za nabrojati sve njih, ali mogu se navesti samo neki od njih da se shvati kolika je važnost koja se u svijetu pridaje ovom pojmu i razvitku svega što je vezano uz „Viziju 2020“. Najpoznatiji i najvažniji su svakako:

- **Telekom operateri: AT&T, Deutsche Telekom, DoCoMo, Orange, Telefonica, Telenor, Telstra, Verizon Wireless, Vodafone i cijeli niz drugih telekom operatera**
- **Proizvođači opreme: Alcatel-Lucent, Nokia, Ericsson, Qualcomm, Huawei, Intel, Samsung, i cijeli niz drugih poznatih proizvođača opreme**
- **Međunarodne organizacije: 5G PPP, 5G MF, METIS i METIS II, IEEE, GSMA, WWRF i cijeli niz drugih međunarodnih organizacija**

Već samo spomenuti popis koji predstavlja tek manji dio proizvođača ICT opreme, telekom operatera i međunarodnih organizacija ukazuje na to da se ovoj problematici pristupa ozbiljno, da se investira značajan novac, a sasvim sigurno je da oni koji budu izvan ovih tokova i ne budu se posvećivali ovoj problematici će početi zastoјati i može se lako dogoditi da propadnu. U biti, najbolje je reći da svaki telekom operater i proizvođač opreme koji želi opstati na tržištu bavi se ovom problematikom.

Uz to, sve konzultantske tvrtke, međunarodne organizacije za standardizaciju, znanstvene ustanove i svučilišta ako žele nakon 2020. godine predstavljati važnu kariku u budućoj zajednici moraju se baviti ovom problematikom jer će inače biti gurnuti na margine poslovanja, vrijednosti i značaja koju predstavljaju za društvo i vrijednosti i značaja u znanstvenoj zajednici. Prethodno navedene činjenice su općeprihvaćene i predstavljaju osnovu razmišljanja stručnjaka i znanstvenika koji se bave ovom problematikom.

2.1. Osnovne značajke „Vizije 2020“

Pojam „Vizija 2020“ u tehnološkom smislu ima određene definirane postavke kojih se trebaju pridržavati svi sudionici (proizvođači opreme, telekom operateri, međunarodne organizacije, znanstvene institucije ...) koji rade na implementaciji ove vizije. Osnovne ili bolje reći glavne postavke „Vizije 2020“ su:

- podržavanje i do 1000 puta većeg kapaciteta prijenosa u cilju podržavanja povećanih zahtjeva za prijenosom podataka,
- smanjenje kašnjenja u prijenosu do maksimalno 1 ms u cilju podrške razvoju novih budućih aplikacija,
- brzina korisničkog pristupa od 1 Gb/s i više od toga,
- standardizacija: jedinstveni unificirani standard mobilne mreže 5G (za razliku od dosadašnjih iskustava sa standardizacijom mreža 2G – 4G)
- maksimalna automatizacija mreže u cilju jednostavnog upravljanja i održavanja (mreža postaje “svjesna sebe”),
- proučavanje i prilagodba mrežnog iskustva kako bi se omogućilo uvođenje poslovnih modela budućnosti,
- dinamički pristup informacijama od strane uređaja sa svojstvima umjetne inteligencije (AI – artificial intelligence),
- jedinstvena IP mreža (zasnovana na IPv6 adresiranja) sa kombinacijom “bešavnog”

pristupa putem mobilnih mreža, te mreža LAN/WAN/PAN/WLAN i www (uvodi se potpuno novi pojam “wireless world wide web”)

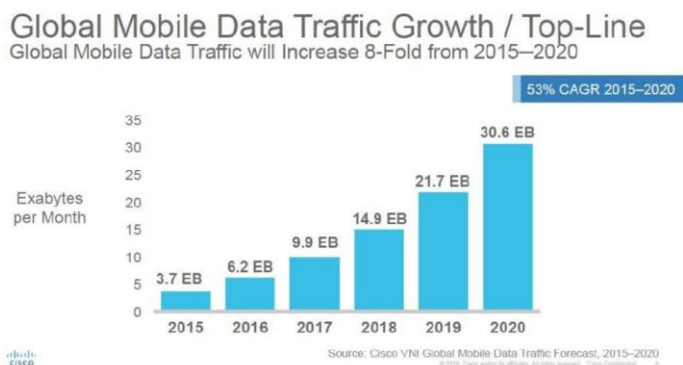
- prilagodba telekom operatera budućnosti za “rješenja u oblaku” kako bi se kreirale “mreže na zahtjev” koje postaju prilagodljive potrebama,
- zadržavanje (ili čak smanjivanje) ukupne potrošnje energije, unatoč ubrzanom rastu prijenosa prometa.

Iz prethodno pobrojanih osnovnih postavki jasno je da se u pojmu „Vizija 2020“ krije potpuno novi pristup telekomunikacijama i informatici (tj. potpuno novi pristup ICT-u). Promjene koje slijede uzrokovat će promjene u svim segmentima ICT-a, ali ono što je posebno značajno i važno, podrazumijeva potpuno novi pristup kreiranju tarifnih paketa i usluga unutar tih tarifnih paketa, tj. potpuno novi pristup u „načinu razmišljanja“ prilikom organizacije mobilnih telekom operatera njihovih unutarnjih procesa u cilju kreiranja potpuno novog korisničkog pristupa. Osim potpuno novog korisničkog pristupa i novog načina kreiranja tarifnih modela, ponude će morati biti i personalizirane za privatne i poslovne segmente uz napomenu i posebne segmentacije i „personalizacije“ za posebne gospodarske grane pa tako i za turizam, tj. za turističke djelatnosti.

2.2. Sastavni dijelovi „Vizije 2020“

Sastavni dijelovi „Vizije 2020“ su prije svega peta generacija mobilnih mreža (5G) te razvoj dijela ICT-a koji podrazumijeva razvoj Internet stvari/uređaja (IoT) i Internet stvari/uređaja u gospodarstvu (IIoT) ili bolje reći novi pristup ovoj problematici – pristup „internet svega“ (IoE). Naravno „Vizija 2020“ je mnogo širi pojam i predstavlja osnovu za poslovni razvoj i usmjeravanje ICT sektora u cilju podrške svim gospodarskim granama, ali temelj počiva na razvoju 5G mreže te pristup razvitku internet uređaja (stvari) ili bolje reći pristup korisničkim mrežama uređaja baziranim na pristupu IoE – internet svega. Razvoj, standardizacija i komercijalizacija pete generacije mobilnih sustava je ključ za što bržu implementaciju „Vizije 2020“. Zašto je 5G mreža ključna za „Viziju 2020“ najbolje se može zaključiti ako se analiziraju podaci koji su prikazani na slici 1.

Sa slike je vidljivo da procjena porasta podatkovnog prometa iznosi blizu deset puta od 2015. godine do 2020. godine (dakle u narednih pet godina) – sa 3,7 EB (eksabajta) na čak 30,6 EB (eksabajta). Ako se podaci sa slike malo dublje analiziraju, onda se vidi da je procjena porasta (u apsolutnom iznosu) najveća upravo u razdoblju 2018. – 2020. godine, tj. u razdoblju kada se očekuje komercijalizacija prvih mobilnih mreža pete generacije. O ovomu će detaljnije biti pisano u narednom dijelu rada.

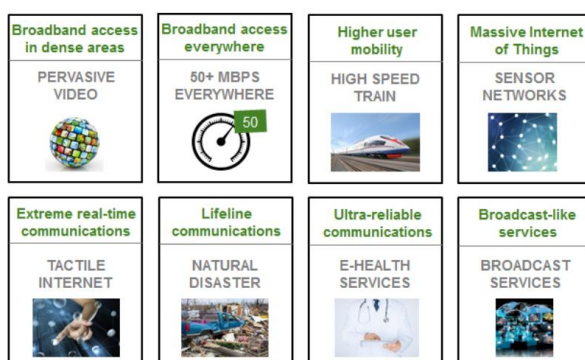


Slika 1 Prikaz procjene porasta mobilnog prometa za period 2015 – 2020. godine
(Preuzeto od Cisco VN Group Mobile data Traffic Forecast 2015 – 2020)

2.3. Poslovni modeli temeljeni na „Viziji 2020“

Za sami početak razdoblja iza 2020. godine, poslovni modeli bazirani na „Viziji 2020“ mogu se podrazumijevati kao poslovni modeli bazirani na petoj generaciji mobilnih mreža i primjeni internet stvari (uređaja).

Gdje se sve ove promjene mogu događati i kakav je potencijal za primjenu u stvarnom svakodnevnom životu? Možda najbolje se sve može vidjeti i iščitati sa sljedeće slike (slika 2) koja je pruzeta iz dokumenta *5G White Paper* izdanog od strane NGMN Alliance u veljači 2015. godine. Ono što sa slike 2 nije izravno vidljivo jeste i primjena novih tehnologija u turizmu koja će donijeti dosta noviteta te mogućnost za razvoj potpuno novih proizvoda i usluga, a koje će turističkim djelatnicima donijeti sasvim novi dodatni (i značajan) prihod. Ili bolje reći, onaj tko ne bude pratio trendove, moći će gotovo sigurno računati s laganim gubljenjem posla i stagnacijom.



Slika 2 Prikaz primjene 5G mreže i IoT-a u „Viziji 2020“

(Preuzeto od 5G White Paper, NGMN 5G Initiative, NGMN Alliance)

3. Peta generacija mobilnih sustava (5G)

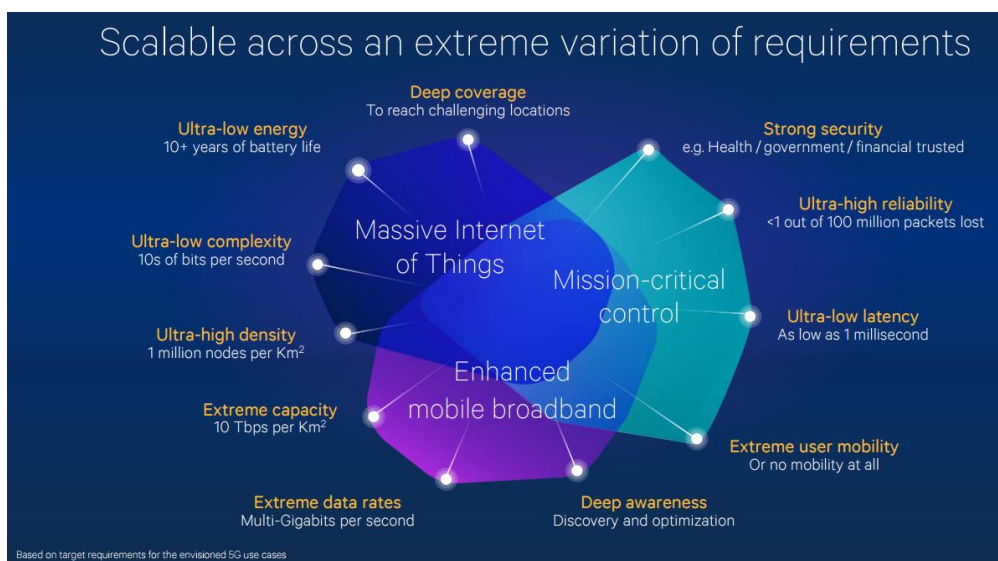
Peta generacija mobilnih sustava (5G) neće samo biti nova generacija mobilnih sustava već i nova vrsta sustava (White Paper, Qualcomm), tj. sustav s potpuno novom filozofijom pristupa tehnologiji i poslovanju koje je na nju naslonjeno. Peta generacija mobilnih sustava bit će svakako podloga za implementaciju „Vizije 2020“ i svih eventualnih kasnijih „vizija“ ili sličnih dokumenata koji će biti razvijani i pisani za razdoblje koje slijedi nakon 2020. godine.

3.1. Osnovne značajke pete generacije (5G) mobilnih sustava

Glavni cilj razvitka i standardizacije pete generacije mobilnih sustava (5G) jeste podrška i omogućavanje razvoja potpuno novih proizvoda i usluga, uvezivanje postojećih i novih gospodarskih grana te osnaživanje i poboljšanje korisničkih iskustava (Qualcomm's 5G Vision, Qualcomm).

Glavne značajke koje 5G sustavi moraju podržati već su navedeni u dijelu rada u kojem su navedene osnovne postavke za „Viziju 2020“ – jer 5G je osnovna podloga za primjenu „Vizije 2020“. Sa slike 3 je dijelom vidljivo ono što je prije bilo navedeno – da 5G sustav nije samo pomak u generaciji mobilnih sustava već je to pomak u potpuno novom pristupu razvoju proizvoda i usluga ili bolje reći „pomak u načinu razmišljanja“.

Naime, ono što se traži od 5G mobilnih sustava kao podloge za implementaciju „Vizije 2020“ jesu i sljedeće stavke: jako dobra i kvalitetna pokrivenost signalom, izuzetno mala potrošnja energije, visoka sigurnost, ekstra velika brzina širokopojasnog prijenosa, izuzetno nisko kašnjenje (kao preduvjet za razvoj potpuno novih proizvoda i usluga u stvarnom vremenu gdje ova komponenta dolazi do punog izražaja).



Slika 3. Osnovne značajke 5G sustava
(Preuzeto iz rada Qualcomm's 5G Vision, Qualcomm)

3.2. Sastavni dijelovi pete generacije (5G) mobilnih sustava

Peta generacija mobilnih sustava još nije standardizirana, ali proces standardizacije je u tijeku. Pretpostavka je da će se ovaj proces završiti tijekom ove i iduće godine, a da bi prvi testni (moguće i komercijalni sustavi) trebali biti pušteni u rad već 2018. godine (očekuju se prve komercijalne 5G mreže u Sočiju, Rusiji tijekom zimskih OI te u Južnoj Koreji).

Prateći literature te brojne dokumente koji se objavljuju, vidljiva je želja i pokušaj nekih mobilnih operatera da već krajem ove godine i početkom iduće kao prvi komercijalno u rad puste (neku vrstu) 5G mobilnih sustava te tako zauzmu vodeće pozicije u novom poretku u telekomunikacijama.

Što je ključ uspjeha koji se očekuje od 5G mobilnih sustava? Prije svega pristup korisnicima neće biti baziran samo na sadašnjem klasičnom pristupu putem baznih stanica (kao što je to slučaj sa sadašnjim 2G/3G/4G mobilnim sustavima) već se pretpostavlja (standardizacija 5G sustava je još u tijeku!) da će kroz standardizaciju 5G mobilnih sustava biti omogućena kombinacija korištenja standardnih baznih stanica (jasno s novim modelima kodiranja i korištenjem novog frekvencijskog spektra čime će se omogućiti veća brzina pristupa putem klasičnih baznih stanica) i korištenja wi-fi baznih stanica.

Jasno, prekapčanje ili preuzimanje između klasičnih baznih stanica i wi-fi korisničkog pristupa mora biti "bešavno", a korisnik ne smije osjetiti prijelaz između različitih tehnologija pristupa prilikom korištenja određene usluge.

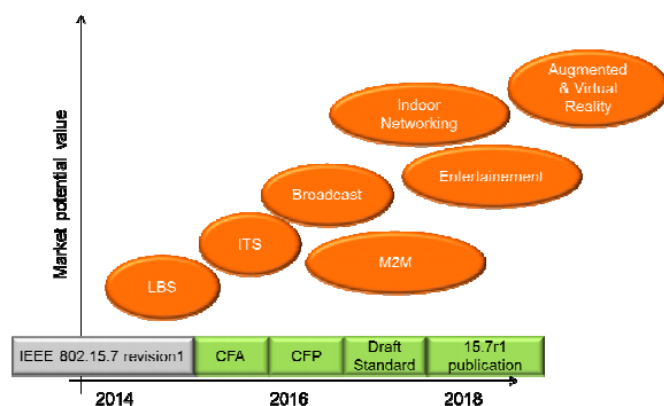
3.3. Li-fi (Light Fidelity) tehnologija

Pojam „Optičke bežične komunikacije“ (*Optical Wireless Communications* - OWC) ili *Light Fidelity* (Li-Fi) odnosi se na komunikaciju zasnovanu na propagaciji elektromagnetnih valova na frekvencijama iznad 30 THz.

Osnovne karakteristike ovih sustava (udaljenost, pokrivenost ...) je takva da je dostupnost pokrivenosti zasnovana na zatvorenom prostoru sa značajno većom propusnošću i brzinom prijenosa. Dakle, ograničena je pokrivenost s jednim Li-Fi konektorom, ali omogućava značajno veće brzine prijenosa i propusnost nego sadašnje komercijalne tehnologije.

Ova tehnologija je tek u fazi razvoja i standardizacije, ali nije nemoguće da bude sastavni dio 5G ili nekih budućih 5G+ ili čak 6G mobilnih sustava. Naime, kako se očekuje da će do 2020. godine na internet biti spojeno preko 50 milijardi uređaja, a prema nekim procjenama (kao što je to procjena WWRF-a) taj broj bi mogao biti i značajno veći. Na slici 4. je prikazan planirani vremenski tijek razvoja ove tehnologije do komercijalizacije.

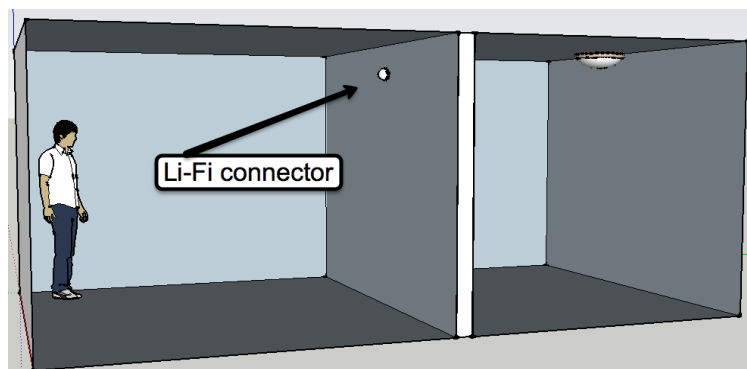
Prema analizama Ericssona i Cisco-a slobodni spektar koji će biti dostupan za primjenu ove tehnologije je preko 700.000 GHz što predstavlja ogroman frekvencijski spektar za sve buduće aplikacije te uređaje koji će biti spojeni na internet i svakako će podržati sve veće zahtjeve za prijenosom podataka, a što je prikazano već ranije u ovom radu na slici 1. Da velike tvrtke vjeruju u ovakvo što najbolje pokazuje primjer da su Cisco i Ericsson napravili zajednički tim koji će raditi na razvitku ove tehnologij, a već se i mnogi telekom operateri u svojim istraživačkim laboratorijima bave ovom problematikom i istražuju potencijale koje ova tehnologija može pružiti (npr. Mobilni operater Orange iz Francuske).



Slika 4. Li-Fi roadmap

(Preuzeto iz rada Light Fidelity – The New wireless communication system, ICWMC 2015, The eleventh International Conference of Wireless and Mobile Communications)

Ono što je posebno dobro jeste činjenica da svjetlosni signal ne prodire kroz zidove prostorije (soba, ureda i slično) te ne postoji mogućnost za interferenciju i ometanje signala koji će biti u različitim prostorijama, a bazirani na Li-Fi tehnologiji (slika 5.). Ova karakteritika (nekada je smatrana nedostatkom s obzirom na ograničenost pokrivanja signalom unutar samo jedne prostorije) je u biti velika prednost jer omogućava pokrivanje pojedinih prostora bežičnim signalom velike brzine i propusnosti, a s druge strane ne postoji mogućnost ometanja signala u drugim prostorijama.

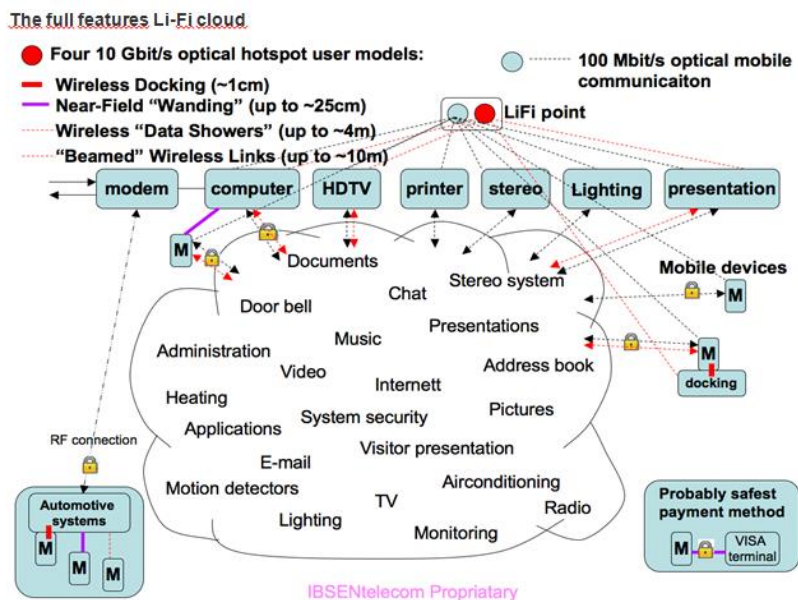


Slika 5. Princip rada Li-Fi tehnologije

(Preuzeto sa <http://www.lificonsortium.org/tech6.html>)

Što ovakva tehnologija omogućava u budućnosti. Kažu da “slika govori više od tisuću riječi” pa je najbolje to prikazati i pojasniti slikom (slika 6.).

U svakom slučaju Li-Fi tehnologija se razvija i standardizira paralelno s 5G mobilnim sustavima i nije nemoguće da jednog dana ovakva tehnologija bude sastavni dio pete generacije ili neke kasnije i novije generacije mobilnih sustava – ali svakako granice brzine prijenosa, propusnost i kapaciteti sustava se pomiču prema neslućenim karakteristikama.



Slika 6. Mogućnosti primjene Li-Fi tehnologije

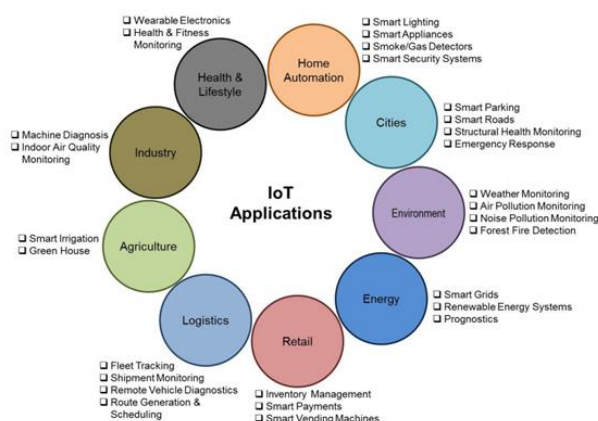
(Preuzeto sa <http://www.lificonsortium.org/tech6.html>)

4. Internet stvari, Internet stvari u gospodarstvu (IIoT) i Internet svega (IoT/IoE)

Postoji nekoliko definicija za pojmove Internet stvari/uređaja (IoT), Internet stvari/uređaja u gospodarstvu (IIoT) i Internet svega (IoE). Sve su slične i podrazumijevaju isti opis pojmova, a možda najbolje definicije, tj. one koje najbolje opisuju ove nove pojmove, su sljedeće:

- **Internet of Things, IoT (Internet uređaja/stvari)** je mreža fizičkih objekata (uređaja) spojenih preko interneta. Ovi objekti (uređaji) sadržavaju ugrađenu tehnologiju za međusobno djelovanje s unutarnjim stanjima i vanjskim okruženjem. (Ahmed Banafa: „What is next for IoT and IIoT”, Enterprise Mobility Summit, Australia 2015)
- **Gospodarski (industrijski) Internet uređaja (stvari)** je mreža fizičkih objekata sustava, platformi i aplikacija koje sadržavaju ugrađenu tehnologiju za međusobnu komunikaciju i dijeljenje inteligencije jednih uređaja s drugima, s vanjskim okruženjem i s ljudima. (Ahmed Banafa: „What is next for IoT and IIoT”, Enterprise Mobility Summit, Australia 2015)
- **Internet svega (Internet of Everything, IoE)** donosi zajedno ljude, procese, podatke i uređaje (stvari) što čini umrežene veze (spojeve) važnijim i vrijednijim nego ikada prije – pretvarajući informaciju u akcije što stvara nove mogućnosti, bogatije iskustvo i stvara jedinstvene (i potpuno nove) ekonomske mogućnosti za gospodarstvo, pojedince i države. (Definicija prema tvrtki CISCO; <http://www.slideshare.net/CiscoIBSG/internet-of-everything>)

Na ovim pojmovima odnosno na primjeni Interneta stvari u privatnom okruženju i u gospodarstvu ili bolje rečeno na primjeni koncepta Interneta svega, temeljit će se budućnost novih aplikacija koje će u „Viziji 2020“ ljudima olakšati svakodnevni život, a mobilnim operaterima, proizvođačima opreme i tvrtkama koje se bave određenim djelatnostima (npr. u turizmu) donijeti dodatne prihode i olakšati i pojednostaviti svakodnevno poslovanje. Ovo možemo nazvati i „win-win-win-win“ situacijom gdje svi dobivaju. U biti, ako „Viziju 2020“ usporedimo sa željeznicom onda je najbolje za usporedbu reći da 5G mobilnih sustava predstavlja tračnice za buduće usluge, a IoT/IoE je lokomotiva vlaka koji prometuje po tim tračnicama. Koje su sve moguće primjene IoT/IoE koncepta u budućnosti najbolje je prikazano na slici 7.

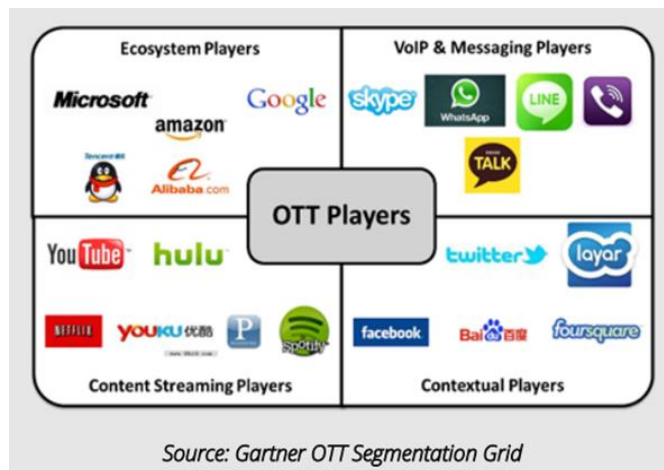


Slika 7. Mogućnosti primjene IoT/IoE tehnologije

(Preuzeto od Ahmed Banafa: „What is next for IoT and IIoT“, Enterprise Mobility Summit, Australia 2015)

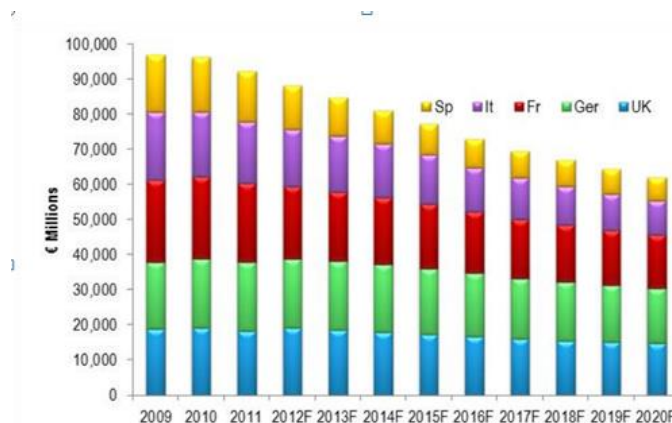
5. Over the Top usluge (OTT)

OTT aplikacije popularno nazivaju i „ubojicama modernih mobilnih telekom operatera“. Aplikacije kao što su Viber, Skype, WhatsApp ... danas su prisutne skoro na svakom „pametnom telefonu“ jer korisnici sve više postaju svjesni mogućnosti primjene ovakvih usluga i smanjenja svojih korisničkih troškova. Pored toga i Netflix se sve više probija i na naše tržište i postaje prijetnja modernim mobilnim telekom operaterima. Podjela OTT aplikacija (prema Gartneru) prikazana je na slici 7.



Slika 8. Segmetacija OTT aplikacije prema Gartneru

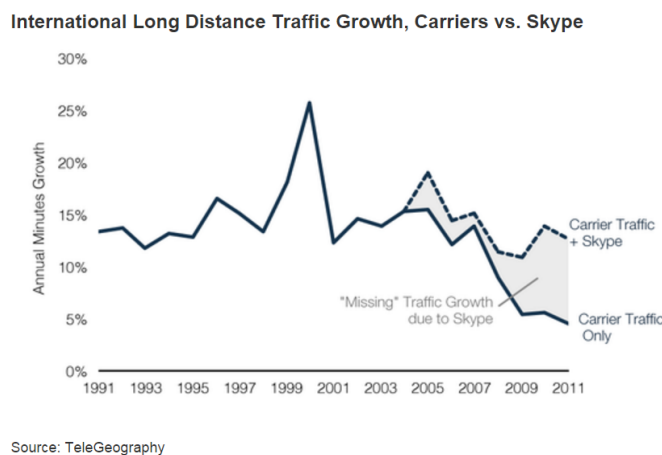
OTT aplikacije predstavljaju ozbiljnu prijetnju za sve moderne mobilne telekom operatere. Ta prijetnja nije izražena samo u operaterima u državama u razvoju već je izražena i u razvijenim državama – čak je u tim državama i izraženija. Prateći ponašanje telekom tržišta u razvijenim državama i u državama u razvoju može se zaključiti da ono što se događa u razvijenim državama može uskoro biti značajnije izraženo i u državama u razvoju – u taj trend se praktički već možemo uvjeriti prateći situaciju u BiH i Hrvatskoj.



Slika 9. Procjena pada prihoda uslijed korištenja OTT aplikacija u razvijenim državama

(Preuzeto sa: <https://www.cgi.com/files/white-papers/CSPs-Communication-Service-providers-Next-Decade-e.pdf>)

Skype je bila prva i još je vjerojatno najpoznatija OTT aplikacija. Koliki je utjecaj Skype-a bio na smanjenje međunarodnog prometa početkom i sredinom prošlog desetljeća, vidljivo je sa slike 9.

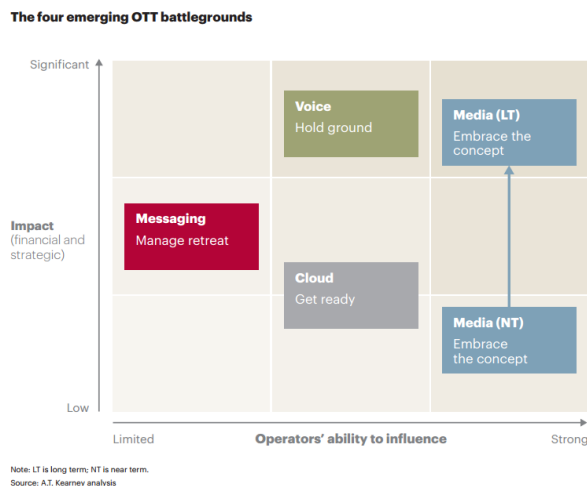


Slika 10. Utjecaj Skype-a na pad međunarodnog prometa

(Preuzeto sa: <https://www.telegeography.com/press/press-releases/2012/01/09/international-call-traffic-growth-slows-as-skypes-volumes-soar/index.html>)

Prema „Viziji 2020“ imat ćemo još brži mobilni pristup internetu što otvara mnogo mogućnosti za primjene i usavršavanje postojećih, ali i kreiranje novih aplikacije. Ako se kod mobilnih operatera ne promjeni strateški pristup tj. ako ne dođe do „promjene načina razmišljanja“ lako je moguće da prihod kod mobilnih i fiksnih telekom operatera nastavi kontinuirano padati. A to u konačnici može dovesti do smanjenja broja mobilnih operatera tj. udruživanja postojećih ili jednostavno gašenje pojedinih operatera.

Prema analizi konzultantske kuće AT Kerney postojat će četiri osnovna polja na kojem će mobilni telekom operatori moći i morati se suprotstaviti OTT aplikacijama. U pojedinim poljima će mobilni operatori moći imati veću mogućnost „obrane” od OTT aplikacija, a na nekim poljima će imati veći utjecaj i mogućnost obrane prihoda. Pojašnjenje je vidljivo na slici 10.



Slika 11. Područja “sukoba” OTT aplikacija i modernih mobilnih operatera

(Preuzeto sa:

https://www.atkearney.de/documents/856314/1214712/BIP_Winning_the_OTT_War_Strategies_for_Sustainable_Growth.pdf/44d5842d-a806-479d-aa9f-4b9555f5b3a9)

6. Potencijalne usluge u turizmu bazirane na „Viziji 2020“

U današnje vrijeme sve je više znanstvenih i stručnih (profesionalnih) radova pa i čitavih simpozija ili seminara koji se bave problematikom i pitanjima vezanima uz ICT i primjenu novih tehnologija u turizmu. Tako je npr. u Dublinu u Irskoj u siječnju 2014. godine održan *Information and Communications Technologies in Tourism 2015*, eProceedings of the ENTER 2014, PhD workshop. Na tom “worskopu” objavljeno je 18 znanstvenih i stručnih radova sa tematikom primjene ICT i novih tehnologija u turizmu.

Radovi koje su predstavili stručnjaci i znanstvenici bili su iz cijelog svijeta - iz Australije, Novog Zelanda, Kine, Hong Konga, SAD-a, Južnoafričke Republike, Malezije, Indije, Velike Britanije, Irske, Portugala i Austrije. Već sam popis država iz kojih dolaze znanstvenici i stručnjaci iz poslovnog svijeta koji se bave ovom problematikom jasno ukazuje na činjenicu koliko je ova tema prisutna u svijetu i koliki broj znanstvenika i stručnjaka se njome danas bave.

U ovom radu se nećemo posebno baviti pojedinim uslugama koje se mogu primjenjivati kroz primjenu novih ICT aplikacija i usluga u turizmu. Za takvo što nema prostora, a nije ni cilj ovdje predlagati konkretne usluge ili proizvode koji bi se mogli primjeniti u turizmu, a bazirane su na ICT tehnologijama.

Ono što je bitno navesti jest sljedeća činjenica – ICT u „Viziji 2020“ donosi praktično neograničene mogućnosti pružanja novih usluga kroz različite aplikacije. Modernom turistu je moguće ponuditi kroz pristup internetu gotovo neograničen spektar usluga – od toga da besplatno komunicira putem telefona pa do toga da u svojoj sobi u nekom hotelu u Hrvatskoj gleda serije ili filmove ili bilo koje druge emisije koje gleda i u svom domu bez obzira iz kojeg dijela svijeta dolazio. A zadovoljan i sretan turist potrošit će i više novca, a moguće i dulje ostati na nekom mjestu i u nekom hotelu nego da nema takve usluge. Sve što mu treba jest ultra brzi pristup mobilnom internetu bilo gdje i bilo kada.

Svjetska turistička organizacija (WTO; www.world-tourism.org) sa sjedištem u Madridu u Španjolskoj objavila je i „Viziju 2020“ za turizam i to po područjima – Europa, Istočna Azija i Pacific i drugo. Sličan dokument postoji i u Australiji gdje je razrađena „Vizija 2020“ za turizam za područje sjevernog teritorija u Australiji (a vjerojatno ima i mnogo drugih sličnih dokumenata u različitim državama i regijama na svijetu).

U dokumentu „Vizija 2020“ za Europu, WTO predviđa da će deset država na Balkanu u 2020. godini posjetiti oko 79 milijuna međunarodnih turista (u ovu brojku se ne računaju domicilni turisti). Prema toj istoj analizi pet vodećih turističkih destinacija – Grčka, Turska, Bugarska, Rumunjska i Hrvatska će zadržati primat u turističkim posjetama – procjena je da će preko 92% od ovog broja posjetiti i boraviti u ovih pet vodećih turističkih destinacija. A 92% od 79 milijuna jest preko 72,5 milijuna turista. Za ovu brojku se vrijedi boriti, a nije svejedno hoće li u Hrvatskoj završiti pet, deset, petnaest ili i značajno više milijuna turista. Za ove brojke se vrijedi pripremiti i boriti i aktivnom implementacijom novih usluga baziranih na ICT tehnologijama. A te usluge mogu imati neograničen spektar – **bitno je samo imati infrastrukturu kao podlogu i kreativnost u razvoju novih turističkih proizvoda i usluga baziranih na ICT tehnologijama.**

7. Prijedlog za poticanje implementacije novih usluga u turizmu u Republici Hrvatskoj

U „Viziji 2020“ koja je osnova razvoja novih usluga u ICT sektoru postoji puno pretpostavki i zahtjeva koji se standardiziraju i rješavaju. Standardizacija je u tijeku i očekuje se da će (kako je već u radu i navedeno) do 2017. godine biti dovršena, a da će se prvi sustavi 5G mobilnih mreža u komercijalni rad pustiti 2018. godine dok se veća ekspanzija očekuje 2020. godine.

Ali u podlozi svega stoji podloga – super brzi mobilni internet. Super ili bolje reći ultra brzi mobilni internet na prijenosnoj razini, ali i super brzi internet po pitanju korsničkog pristupa. Brzine korisničkog pristupa od 100 Mb/s pa čak i do 1 Gb/s postaju veoma skoro stvarnost.

Međutim, za takvo što je neophodna kvalitetna prijenosna infrastruktura. Prije svega svjetlovodna (optička) prijenosna infrastruktura. U tu svrhu u radu je rađena analiza o broju hotela na području Makarske rivijere (Republika Hrvatska) i turističkog primorja u Crnoj Gori - koliko hotela ima spojenu optičku prijenosnu infrastrukturu te koliko ih ima razvedenu optičku infrastrukturu unutar hotela (do soba, restorana, kafića ...). Rezultati će biti prezentirani u sljedećem poglavlju.

Prije prikaza samih rezultata, bit će navedena preporuka za kreiranje nove oznake za hotele koji su se spremili za implementacije novih usluga baziranih na ICT tehnologijama.

Ono što će u narednom razdoblju biti neophodno jest brzi internet svugdje i u svakom treunutku. U tu svrhu, autori nakon detaljnih analiza turističkog i ICT sektora predlažu uvođenje turističke oznake “Hrvatska 2020+” (*Croatia 2020+*). Za zadovoljiti uvjete za dobivanje ovakve oznake, hoteli, apartmanska naselja i svi drugi turistički objekti trebaju zadovoljiti sljedeće minimalne preduvjete:

- Povezanost objekta svjetlovodnom infrastrukturom (svjetlovodni kabel).
- Razvedenost svjetlovodne (optičke) infrastrukture unutar objekta do svih soba, restorana, kafića, teretane ... i svih drugih dijelova u i oko objekta gdje gosti borave ili mogu boraviti.
- Pokrivenost baznim stanicama za wi-fi signal (do tih lokacija treba biti proveden svjetlovodni kabel) na način da na svakom mjestu u hotelu i oko hotela ili apartmanskog naselja, tj. gdje god borave turisti, signal treba biti minimalne razine jakosti od – 75 dBm na korisničkoj strani.

Turistički objekti koji ovo zadovoljavaju dobili bi oznaku “Hrvatska 2020+” odnosno *Croatia 2020+* koja bi trebala biti promovirana kao dodatna vrijednost za turiste koji borave u tom hotelu ili turističkom naselju.

Zašto bi vlasnici hotela investirali u svjetlovodnu infrastrukturu? Tu na scenu treba stupiti država na način da hotelima ili turističkim naseljima koji ispunjavaju ovaj minimum preduvjeta za dobivanje oznake “Hrvatska 2020+” omogući određene beneficije: od toga da se takvim hotelima ili turističkim naseljima umanji porez do toga da ih se (besplatno) promovira na različitim turističkim sajmovima u inozemstvu gdje Republika Hrvatska, tj. Hrvatska turistička zajednica ili Ministarstvo turizma RH ima svoje standove i gdje budu imali nastupe. Kroz ove, ali i druge mjere, vlasnici hotela i turističkih ili apartmantskih naselja imat će i razlog uložiti u infrastrukturu koja bi u budućnosti (ali veoma bliskoj budućnosti) i njima i državi, ali i telekom operaterima donijela dodatne vrijednosti i zaradu (naravno bilo bi veoma poželjno da se u cijelu priču uključe i telekom operateri).

8. Rezultati istraživanja o potencijalima primjene usluga u turizmu baziranih na novim tehnologijama

U okviru rada provedeno je malo istraživanje vezano uz hotele i hotelska naselja u Makarskoj i na Makarskoj rivijeri (Baška Voda, Brela, Igrane, Podgora i Živogošće) te u turističkim središtima u Crnoj Gori (Bar, Budva, Herceg Novi, Kotor, Ulcinj). Ili bolje reći istraživanje je pokušano biti provedeno, ali odaziv na anketu je bio jako loš. A možda je istraživanje ipak uspjelo jer i takav odaziv ili bolje reći neodaziv govori za sebe i za osvješćenost turističkih djelatnika po pitanju mogućnosti uvođenja novih proizvoda i usluga u turizmu baziranih na novim tehnologijama iz „Vizije 2020“.

Upitnik je bio veoma kratak (5 pitanja s odgovorima DA ili NE) i veoma jednostavan za popuniti (slika 12.). Tako da ne može biti razlog slabog odaziva to što je upitnik složen ili dugačak za odgovaranje ili da bi onima koji ga popunjavaju to moglo oduzeti mnogo vremena.

Upiti (anketni upitnici) su poslani putem e-adresa hotelima (uzeti su u obzir hoteli i hoteli/apartmani u privatnom smještaju – svi oni koji na svojim web stranicama ili na stranicama turističke zajednice imaju kontakt e-adrese) u navedenim naseljima, a nakon 7 - 9 dana poslani su podsjetnici (tj. ponovljeni upiti). Broj poslanih upita prema hotelima u određenim gradovima i naseljima su navedeni kako sljedeći (6 turističkih naselja u Hrvatskoj i 5 turističkih naselja u Crnoj Gori):

Hrvatska:

- Baška Voda: 15
- Brela: 25
- Igrane: 16
- Makarska: 16
- Podgora: 25
- Živogošće: 28

Crna Gora:

- Bar: 45
- Budva i pripadajuća rivijera: 88
- Herceg Novi: 29
- Kotor: 21
- Ulcinj: 24

UPITNIK

Općeniti podaci

1. Naziv hotela:.....

2. Mjesto/lokacija:.....

3. Broj soba/apartmana:.....

Tehnički podaci

1. Postoji li fiksni Internet priključak u sobama hotela (bez obzira na tehnologiju pristupa Internetu):	DA	NE
2. Postoji li bežična Internet veza unutar hotela (bilo gdje):	DA	NE
3. Postoje li bežične Internet veze u sobama hotela:	DA	NE
4. Postoji li optički telekomunikacijski kabel spojen do hotela:	DA	NE
5. Postoji li potpuno razvedena optička telekomunikacijska infrastruktura unutar hotela (do soba, restorana, kafića, konferencijskih sala,...):	DA	NE

Podatke popunio/la:.....

Funkcija osobe koja je popunila formular:.....

Slika 12. Izgled anketnog upitnika s pitanjima

Broj odgovora koji je dobiven (bez obzira je li poslan popunjen upitnik natrag ili samo informacija da se radi o privatnoj kući s apartmanima – dakle pretpostavlja se da im ne trebaju nove tehnologije):

Hrvatska:

- Baška Voda: 3 (od 15)
- Brela: 2 (od 25)
- Igrane: 0 (od 16)
- Makarska: 0 (od 16)
- Podgora: 0 (od 25)
- Živogošće: 1 (od 28)

Crna Gora:

- Bar: 2 (od 45)
- Budva i pripadajuća rivijera: 3 (od 88)
- Herceg Novi: 1 (od 29)
- Kotor: 1 (od 21)
- Ulcinj: 0 (od 24)

Jasno je da nema smisla raditi neku posebnu analizu jer broj pristiglih odgovora je zanemariv. Međutim, predstavnici hotela koji su odgovorili i poslali autorima popunjen anketni upitnik uglavnom imaju dovedenu svjetlovodnu (optičku) infrastrukturu do hotela kao i razvedenu svjetlovodnu (optičku) infrastrukturu do soba, restorana, kafića, hotelskog predvorja i konferencijskih sala u hotelu. Konkretno od sedam odgovora primljenih od hotela iz Crne Gore, šest hotela ima spojen svjetlovodni (optički) kabel do hotela, a četiri ih imaju potpuno

razvedenu svjetlovodnu optičku infrastrukturu unutar hotela (jedan hotel ima djelomično razvedenu infrastrukturu do soba, ali ne i do restorana, kafića i drugih prostora unutar hotela). Iz Hrvatske (Makarske i Makarske rivijere) stiglo je samo šest odgovora. Četiri su odgovora osoba koji imaju apartmane ili kuću s apartmanima tako da nisu odgovorili na anketni upitnik, a pretpostavlja se da nemaju niti svjetlovodni kabel doveden do kuće niti razveden do apartmana. Bez obzira radilo se o pet ili šest apartmana bilo bi dobro da razmisle o ovoj opciji jer će turist u budućnosti tražiti ovakve pogodnosti bez obzira bili smješteni u hotelima visoke kategorije ili u privatnim apartmanima. Od dvaju odgovora predstavnika hotela iz Makarske i s Makarske rivijere, jedan hotel ima spojenu svjetlovodnu infrastrukturu do telekom operatera i razvedenu svjetlovodnu infrastrukturu po hotelu dok drugi to nema. Malo za napraviti kvalitetnu analizu.

Znači li to da predstavnici hotela koji nisu odgovorili na upitnik u hotelima koje predstavljaju nemaju instaliranu svjetlovodnu infrastrukturu ili je u pitanju samo lijenost i određena doza neodgovornosti? To se ne može sa sigurnošću tvrditi, ali barem je za nadati se da je potaknuto razmišljanje vodećih ljudi tih hotela o potrebi uvođenja svjetlovodne (optičke) infrastrukture unutar objekta (ili objekata) kao i povezivanje tih objekata s telekomunikacijskom infrastrukturom telekomunikacijskih operatera. U interesu i hotela i telekom operatera i države, a u konačnici u interesu i građana Republike Hrvatske jer turizam predstavlja jednu od ključnih gospodarskih grana za razvitak Republike Hrvatske.

9. Zaključak

Zaključak ovog rada je veoma kratak. Potencijal koji se kroz implementacije novih potencijalnih usluga baziranih na novim tehnologijama koje se planiraju uvesti i koje su osnova „Vizije 2020“ je doista velik. Međutim, isto tako, velika šteta može nastati ako se naredno razdoblje i razdoblje koji slijedi iza 2020. godine dočeka nespreman u turizmu. Jer „četvrta industrijska revolucija“ donosi mnogo potencijala za nove usluge i nove prihode, ali isto tako ako turistički djelatnici i turističke zajednice u drugim državama ovo prepoznaju, a u Hrvatskoj se o ovome ne bude vodilo računa šteta može biti ogromna tim prije jer udio turističkog prihoda u ukupnom BDP-u Republike Hrvatske je viši nego u ostalih država koje imaju izrazitu turističku orijentaciju.

Na potezu su turistički djelatnici koji moraju imati više osjećaja za vrijeme koje dolazi, turističke zajednice na općinskim, županijskim razinama i na razini Republike Hrvatske te svakako Vlada Republike Hrvatske koje mora pokrenuti i poticati razmišljanja o implementaciji novih tehnologija kroz koje će se moći razvijati novi proizvodi i usluge u svim gospodarskim granama, a posebice u turizmu.

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New products and services in tourism based on new technologies

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Summary: In the world of ICT (Information and Communication Technologies) 2020 is considered a milestone because it is expected commercialization 5G mobile networks and the telecommunications operators in the coming period urgent need to change the entire approach to business and business philosophy and user access. In addition, a number of new concepts and systems based on these new technologies, will become a reality and the present and the future in our daily lives. It is defined and the notion that it all together - Vision 2020. In tourism there is no precisely defined concept of "Vision 2020" but there are a number of analysis and professional and scientific papers in which they analyzed the expectations to 2020 and the period after 2020. This paper will analyze the requirements for harmonizing and adapting the approach to tourism and Vision 2020 in ICT and will be analyzed potentials and give suggestions for the development of new integrated services in tourism. It will be analyzed common interests of economic sectors of ICT, construction and tourism course in order to carry out the implementation of the "Vision 2020" and the creation of services in tourist facilities and tourism in the Republic of Croatia based on new technologies. It will be given to the proposal in principle of standardization and categorization of tourist facilities due to the proposed new services based on new technologies which would be awarded in tourism added value for tourism facilities that are equipped and offering services based on new technologies.

Keywords: *ICT, 5G, IoT/IoE, Vision 2020, tourism.*

Schengenski sporazum

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Sažetak. Europska unija garantira svojim građanima slobodu kretanja. To je jedno od osnovne četiri slobode koje osigurava Europska unija, pored slobode kretanja dobara, usluga i kapitala. Upravo je Schengenski sporazum taj koji osigurava jednu od tih sloboda – slobodu kretanja ljudi. 1985. g. šest je europskih država potpisalo Schengenski sporazum. Pet godina nakon toga Schengenskom je konvencijom utvrđen način na koji će biti provedeno ukidanje provjere na unutarnjim granicama. Utvrđeno je i niz mjera za pojačavanje kontrole na vanjskim granicama, definirani su postupci za izdavanje jedinstvenih viza te uveden Schengenski informacijski sustav, koji je naknadno 2013. godine zamijenjen novom generacijom sustava SIS II. Potpisnici Schengenskog sporazuma izbrisali su međusobne granice na kopnu, moru i u zračnim lukama zbog čega je i postao sinonim otvorenih granica unutar Europske unije. Protokolom uz Ugovor iz Amsterdama, Schengenski sporazum i ostali elementi schengenske pravne stečevine, uvršteni su u institucionalni i pravni okvir Europske unije i dio su njezinog pravnog poretka. Ukidanje granične kontrole u praksi započinje 1995. Usvajanje schengenske pravne stečevine do pristupanja u Europsku uniju je obaveza za svaku državu kandidatkinju za članstvo u Uniji. Hrvatska, kao punopravna članica Europske unije od 01. srpnja. 2013. godine ima mogućnost aplicirati za pristup schengenskom prostoru. Cilj ovog rada je definirati elementarne odrednice schengenskog prostora, prikazati način na koji je organiziran, te navesti uvjete koji moraju biti ostvareni da bi neka država ostvarila pravo schengenskog prostora.

Ključne riječi: schengenski prostor, EU, vanjske granice, unutarnje granice

1. Uvod

Europska unija gospodarsko je i političko partnerstvo 28 europskih država. Osnovana je nakon Drugog svjetskog rata zbog poticanja gospodarske suradnje, ali i sa namjerom da zemlje koje međusobno trguju postanu ekonomski ovisne jedna o drugoj te se na taj način izbjegnu i budući sukobi. Od tada se stvara ogromno tržište koje teži dostizanju svojega punog potencijala.

Europska unija garantira svojim građanima slobodu kretanja osoba. To je jedno od osnovne četiri slobode koje osigurava Europska unija. Tu spadaju i pravo kretanja dobara, usluga i kapitala. Upravo je Schengenski sporazum taj koji osigurava jednu od tih sloboda – slobodu kretanja ljudi.

Temeljni pravni akti koji uređuju schengensku pravnu stečevinu su Konvencija o provedbi schengenskog sporazuma, Odluka Vijeća 2007/533/PUP o uspostavi, djelovanju i korištenju druge generacije Schengenskog informacijskog sustava SIS II, te Uredba br. 1987/2006 Europskog parlamenta i Vijeća o uspostavi, djelovanju i korištenju druge generacije Schengenskog informacijskog sustava SIS II (Pravo i publikacije EU-a, 2015).

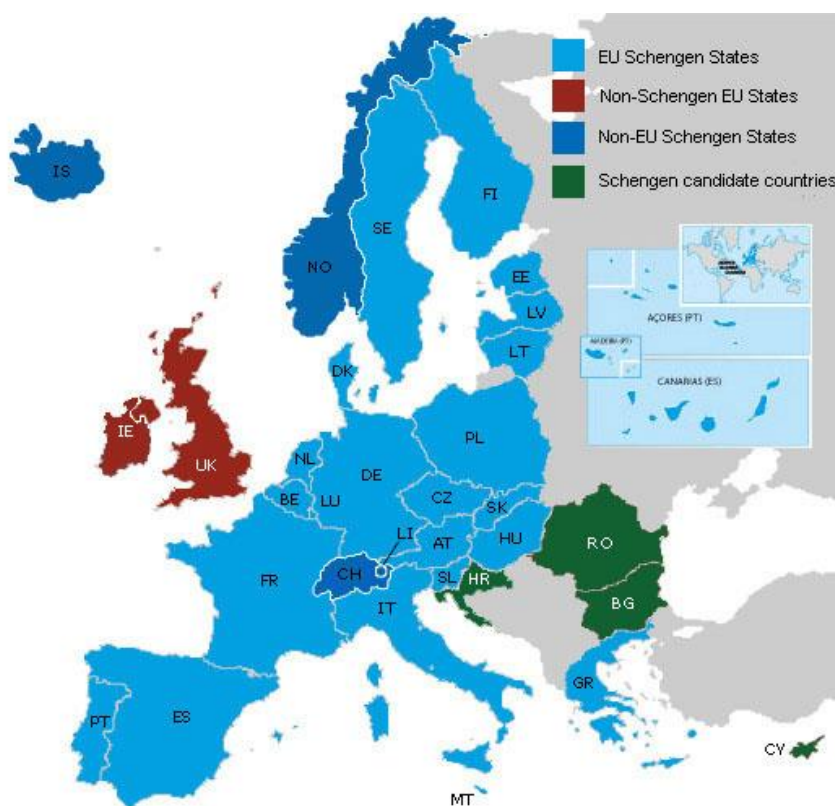
Idejni koncept Europske unije ujedinjuje u sebi tri elementa: slobodu, sigurnost i pravičnost. Da bi se ostvarili ti ideali te osigurala sloboda kretanja ljudi, Schengenski sporazum treba osigurati (Šegvić, 2011):

- ukidanje unutarnjih granica između država članica,
- uvođenje jedinstvene vizne politike za državljane trećih država čime im se omogućava maksimalno tromjesečni boravak na području država članica,
- borbu protiv ilegalnih emigranata,
- uvođenje zajedničke vanjske granice,
- uvođenje mjera koje će nadoknaditi pravnu prazninu nastalu ukidanjem unutarnjih granica država članica.

S obzirom da su u posljednje vrijeme izbili teroristički napadi (op. Pariz), Europska unija priprema niz mjera za borbu protiv terorizma, što uključuje pojačani nadzor nad vanjskim granicama i za građane Europske unije, što do sada nije bio slučaj. RH se po tom pitanju nalazi u dosta nepovoljnom položaju. RH ima najdužu vanjsku granicu Europske unije. To može imati za posljedicu produljenje roka koji će Europska komisija odrediti Hrvatskoj za pristupanje Schengenskom prostoru.

2. Schengenski prostor

Osnova za uspostavljanje unutarnjeg tržišta sa slobodnim kretanjem osoba bilo je zaključivanje dvaju schengenskih sporazuma: Prvi se odnosi na mjerodavni Schengenski sporazum od 14. lipnja 1985., a drugi je Konvencija o provedbi Schengenskog sporazuma, koji je potpisan 19. lipnja 1990., a stavljen u upotrebu 26. ožujka 1995. (Europski parlament, 2015).



Slika 1: Schengenski prostor

Na početku se Konvencijom o provedbi Schengenskog sporazuma (koju su potpisali samo Belgija, Francuska, Njemačka, Luksemburg i Nizozemska) uređivala suradnja među državama potpisnicama, području pravosuđa i unutarnjih poslova. Protokolom priloženim Ugovoru iz Amsterdama utvrđen je prijenos schengenske pravne stečevine u Ugovore. Danas schengenska pravna stečevina, zajedno sa Ugovorom iz Lisabona¹ podliježe parlamentarnom i sudskom nadzoru. Budući da je većina schengenskih propisa sada dio pravne stečevine EU-a, od proširenja EU-a 1. svibnja 2004. države pristupnice sukladno članku 8. Schengenskog protokola više nemaju mogućnost propusta primjene određenih odredbi (Službeni list Europske Unije, 2013).

Zemlje članice schengenskog prostora su: Švedska, Finska, Estonija, Letonija, Litva, Danska, Poljska, Slovačka, Mađarska, Češka, Njemačka, Austrija, Slovenija, Lichtenstein, Luxemburg, Nizozemska, Belgija, Francuska, Italija, Malta, Španjolska, Portugal i Grčka.

Zemlje članice Europske unije koje nisu u schengenskom prostoru: Ujedinjeno Kraljevstvo i Irska. Zemlje članice schengenskog prostora koje nisu članice Europske unije: Island, Norveška i Švicarska. Zemlje kandidatkinje za ulazak u schengenski prostor: Hrvatska, Rumunjska, Bugarska i Cipar (Vaša Europa, 2016).

2.1 Povijest Schengenskog sporazuma

Cijeli proces počinje nezadovoljstvom cestovnih prijevoznika 1984. g. zbog dugog čekanja uslijed graničnih formalnosti. Iste je godine potpisan i francusko-njemački sporazum o postupnom ukidanju kontrole osoba i pojednostavljenoj graničnoj kontroli državljana Europske zajednice (Rošić, 2008).

Godine 1985. kao posljedice suradnje vlada zemalja osnivačica došlo je do potpisivanja sporazuma o ukidanju provjera na zajedničkim granicama. Potpisivanje sporazuma dogodilo se u mjestu Schengen koje se nalazi u neposrednoj blizini tromeđe Francuske, Luxemburga i Njemačke. Sporazum je zapravo potpisan na brodu MS Princesse Marie – Astrid na rijeci Moselle koja onuda protiče.

Od 1995. g. sedam je zemalja članica: Španjolska, Portugal, Njemačka, Francuska, Nizozemska, Belgija i Luksemburg. Zatim se 1997. godine pridružuju Italija i Grčka te nakon toga Austrija. Godine 2001. Schengenu pristupaju Danska, Island, Norveška, Finska i Švedska. U prosincu 2007. Schengenskoj zoni pristupaju Latvija, Litva, Estonija, Slovačka, Slovenija, Mađarska, Češka Republika, Poljska i Malta. 2008. priključuje se i Švicarska.

U periodu kada se schengenski režim počeo primjenjivati bilo je razdoblje velikih promjena: došlo je do ujedinjenja Njemačke, povećao se broj tražitelja azila, povećao se broj ilegalnih useljenika iz Afrike i Azije, pojačane su terorističke aktivnosti u Europi. U takvim uvjetima pojavio se problem mogućeg pretvaranja schengenske granice u utvrdu, odnosno mogućnosti da schengenski prostor postane područje zatvoreno za strance.

Međutim, s druge strane jedan dio analitičara tvrdio je da su vanjske granice EU vrlo slabo nadzirane. U posljednjem desetljeću poteškoće za Schengenski sustav predstavljaju i susjedne države u Europskoj uniji jer ih strogi nadzor vanjskih granica EU odvaja od toga „elitnog

¹ Op. Lisabonski ugovor, punim nazivom Ugovor iz Lisabona o izmjenama i dopunama Ugovora o Europskoj uniji i Ugovora o osnivanju Europske zajednice, međunarodni je ugovor koji je potpisan u Lisabonu 13. prosinca 2007. godine s ciljem rješavanja pitanja daljnjeg institucionalnog funkcioniranja Europske unije. Dopunjuje postojeće ugovore o Europskoj uniji i Europskoj zajednici, ne zamjenjujući ih. Ugovor je stupio na snagu 01. prosinca 2009., nakon što je prošao proces ratifikacije u svim tadašnjim državama članicama EU.

kluba“. Nama blizak primjer je odnos Slovenije i Hrvatske prije ulaska u Europsku uniju (Šegvić, 2011).

2.2 Integriranje u pravni poredak EU-a

Godine 1997., kada je dogovoren Ugovor iz Amsterdama², odlučeno je kako bi bilo poželjno integrirati mjere u okviru schengenskog sporazuma u pravni poredak EU-a. To je učinjeno pomoću Protokola u prilogu Ugovora, što je omogućilo Vijeću detaljno usvajanje mjera. Mjere koje je Vijeće usvojilo su Odluke koje definiraju schengensku pravnu stečevinu, i Odluke koje raspodjeljuju schengensku pravnu stečevinu na ‘pravne baze’ (tj. ovlasti za djelovanje Europske zajednice ili Europske unije), iznesene u Ugovoru (Peers, 2013.).

Od tog trenutka, Odluke o pristupanju schengenske pravne stečevine su usvojene od strane Vijeća, s jednoglasnom odlukom postojećih schengenskih država i država koje žele sudjelovati u schengenskim pravilima. Nadalje, udruživanje zemalja nečlanica sa schengenskom pravnom stečevinom iziskivalo je nekakav oblik ugovora između EZ/EU i trećih zainteresiranih država. Stoga je Vijeće odlučilo proširiti schengenski prostor na Grčku, 1999. godine, te na Švedsku, Dansku i Finsku 2001. godine (Ivanda, 2001.). Istovremeno, na snagu stupa i ugovor između EZ/EU i Norveške i Islanda, proširujući tako schengensku pravnu stečevinu na zemlje nečlanice.

Međutim, za države koje su EU pristupile od 1999. (među kojima je i Republika Hrvatska), utvrđen je proces dvofaznog ulaska u schengenski sustav.

Prvo, ugovori koji reguliraju ulazak novih država u EU odredili su određene preduvjete, odnosno odredbe schengenske pravne stečevine (pravila na vanjskim granicama, zajedničke liste viza, kao i aspekte policijske i pravosudne suradnje) koji se počinju primjenjivati na dan pristupanja tih država Uniji.

Drugo, primjena osnovnih pravila Schengena (ukidanje unutarnjih graničnih kontrola, sloboda putovanja, jedinstvena politika viza, te uporaba Schengenskog informacijskog sustava SIS o kojem će se govoriti nešto kasnije), odgođeno je za nekoliko godina, dok postojeće schengenske članice jednoglasno odluču da zainteresirane zemlje mogu početi primjenjivati pravila Schengena (iako im je pristup SIS-u omogućen i ranije) (Peers, 2013.).

2.3 Područja primjene schengenskog sustava

Područja primjene schengenskog sustava odnose se na (Europski parlament-Vama na usluzi, 2015):

- Ukidanje graničnih kontrola na unutarnjim granicama za sve osobe.
- Osnaživanje i usklađivanje granične kontrole na vanjskim granicama - svi građani Europske unije imaju pravo ulaska u schengenski prostor u bilo kojem trenutku samo uz predodjenje osobnih dokumenata - osobne iskaznice ili putovnice.
- Državljanima zemalja nečlanica koje se nalaze na zajedničkom popisu država nečlanica čijim je državljanima potrebna viza za ulazak u Schengenski prostor, imaju pravo na jedinstvenu vizu koja vrijedi na cijelom schengenskom prostoru.

² Op. Amsterdamski ugovor iz 1999. godine unio je proširenje nadležnosti Europskog suda u području drugog i trećeg stupa. Donijet je na temelju konferencije vlada u Torinu, Italija, u kojem su sudjelovali i zastupnici Komisije i Europskog parlamenta. Ugovorom iz Amsterdama uvedene su promjene u Maastrichtski UEU kao i u osnivačke ugovore triju zajednice. Ugovor iz Amsterdama predviđa pažljive reforme u području zajedničke vanjske i sigurnosne politike. Politika viza, azila i useljavanja kao i druge politike vezane uz slobodu kretanja osoba iz trećih država premještene su iz područja policijske i pravosudne suradnje u kaznenim stvarima u drugi stup.

- Suradnju policije država članica na otkrivanju i sprečavanju kaznenih djela, također imaju pravo na kazneni progon počinitelja kaznenih djela na državnom području susjedne schengenske države; konstruiran je sustav brzog izručenja i uzajamno priznavanje kaznenih presuda.
- Uspostavu i razvoj SIS-a (Schengenski informacijski sustav).
- Slobodu kretanja građana Europske unije i članova njihovih obitelji (uređeno Direktivom 2004/38/EZ).

Svaka novoprimljena država članica dužna je implementirati pravila Schengenskog sporazuma, koji je Amsterdamskim ugovorom postao dio pravne stečevine EU-a.

Pristupanje Schengenu nije samo politička odluka. Zemlje koje pristupaju imaju listu preduvjeta koje moraju ispuniti, a koji obuhvaćaju (Ivanda, 2001.):

- preuzimanje odgovornosti za kontrolu vanjskih granica i traženje standardnih Schengenskih viza a da pri tome ne štete ostalim zemljama članicama
- odgovarajuće propise o vatrenom oružju
- rad nadležnih tijela koja primjenjuju schengensku pravnu stečevinu,
- efikasnu suradnju sa sigurnosnim agencijama u drugim zemljama Schengena u cilju održavanja visokog nivoa sigurnosti
- primjenu uobičajenih schengenskih pravila kao što su kontrola na zemlji, moru i aerodromima, traženje viza, suradnja policije i zaštita osobnih podataka
- spajanje i korištenje sa SIS-om.

Zemlje koje potencijalno pristupaju schengenskom prostoru prije toga moraju proći schengensku evaluaciju. Nakon pristupanja zemlje prolaze mehanizme kontrole u kojima se periodično kontrolira da li dovoljno efikasno primjenjuju schengenska pravila. Terenskim provjerama prethodi analiza rizika Europske agencije za upravljanje operativnom suradnjom na vanjskim granicama EU (Frontex), Europske agencije za temeljna ljudska prava te po potrebi nekih drugih tijela i agencija npr. Europol.

Prilikom sastavljanja izvješća članovi evaluacijskog tima (predstavnici zemalja članica i Europske komisije) sastavljaju preporuke za korektivne mjere kojima bi se uklonili eventualni nedostaci utvrđeni tijekom evaluacije. U tri mjeseca od donošenja takve preporuke evaluirana zemlja mora Europskoj komisiji i Vijeću europske unije predložiti akcijski plan za uklanjanje tih nedostataka (Službeni list Europske Unije, 2013.).

3. Sloboda kretanja osoba

Sloboda kretanja osoba dijeli se na slobodu kretanja radnika i slobodu poslovnog nastana za poduzetnike. Opća sloboda kretanja građana Unije je neovisna od gospodarske djelatnosti (Večernji list, Specijal: EU učionica, 2012.).

Sloboda kretanja radnika znači slobodnu alokaciju čimbenika proizvodnje rada. Njome se jamči mobilnost, no osim ekonomske ova sloboda ima i socijalnu i društveno-političku važnost (npr. pitanje socijalne sigurnosti, politike zapošljavanja, ostanka u toj državi i sl.).

Europska unija osigurava slobodno kretanje radnika što podrazumijeva zabranu svake diskriminacije na temelju nacionalnosti između radnika država članica u odnosu na zapošljavanje, plaću i druge uvjete rada i zaposlenja (EUR-Lex, 2015.). Ta sloboda može se ograničiti samo radi zaštite javne politike, javne sigurnosti ili javnog zdravlja, a obuhvaća pravo prihvatiti stvarnu ponudu za zaposlenje, kretati se slobodno unutar područja država članica za te svrhe, ostati u državi članici u svrhu zaposlenja u skladu s odredbama zakona, uredbi ili upravnih akta koje se odnose na zapošljavanje državljana te države, ostati na području države

članice nakon zapošljavanja u toj državi, prema uvjetima koje određuje u svojim uredbama Komisija.

Ugovor o funkcioniranju Europske unije (UFEU) ne sadrži pojam radnika pa je sudska praksa taj pojam definirala široko. U svakom slučaju, radnik se u smislu prava Unije, definira kao osoba koja obavlja nesamostalnu djelatnost te za svoj rad prima plaću. U odnosu na obitelj radnika Unija je priznala prava obitelji radnika na zajednički život, pravo na školovanje i pravo na zaposlenje. Propisi prava Unije o slobodi kretanja ne zabranjuju obrnuto diskriminiranje, tj. diskriminiranje vlastitih državljana u potpuno unutarnjim situacijama. Naime, postojeće zabrane diskriminacije u okviru tržišnih sloboda pretpostavljaju prekogranični element.

Sloboda kretanja osoba je pravo zagarantirano ne samo za više od pola milijarde europskih građana nego i državljanima trećih zemalja koji se zakonito nalaze na schengenskom području. Slobodno kretanje podrazumijeva: bez čekanja u zračnim lukama, na morskim ili kopnenim granicama, bez unutarnjih graničnih kontrola. Kontrolna infrastruktura npr. kućice za graničnu policiju i ostale fizičke barijere su uklonjene. Države članice imaju pravo provjere osoba te carinske provjere unutar svog državnog područja kao dio uobičajene policijske, carinske i imigracijske kontrole (Međunarodna trgovina i carina, 2015).

Bogata sudska praksa koja se odnosi na slobodno kretanje osoba obuhvaćena je Direktivom 2004/38/EZ Europskog parlamenta i Vijeća o pravu građana Unije i članova njihovih obitelji na slobodu kretanja i boravište na području neke države članice. Direktiva je uspostavljena s ciljem poticanja građana na ostvarivanje svojih prava slobode kretanja i boravka u članicama, smanjenja administracije, kao i preciznog definiranja statusa članova obitelji (Europski parlament, 2015.). Pa se tako prema Direktivi 2004/38/EZ kao članovi obitelji navode: bračni partner; registrirani partner, ako je po zakonodavstvu države članice domaćina registrirana zajednica izjednačena s bračnom zajednicom; izravni potomci koji nisu navršili 21. godinu ili su uzdržavanici, kao i oni bračnog druga ili registriranog partnera te izravni srodnici u uzlaznoj liniji koji su uzdržavanici, kao i oni bračnoga druga ili registriranog partnera (EUR-Lex - 32004L0038 - EN, 2015.).

3.1 Vanjske granice

Vanjska granica schengenskog područja duga je preko 50 000 km (oko 80 % more i 20 % kopno) te uključuje stotine zračnih i morskih luka, kao i granične prijelaze na kopnenim granicama (Poslovni dnevnik, 2015.).

Svaka schengenska država odgovorna je za kontrolu svojih vanjskih granica. Standardi i razina kontrole jednaki su na svim graničnim prijelazima na vanjskim granicama u schengenskom području bez obzira na njihovu lokaciju. Zajednička pravila utvrđena su u „Zakoniku o schengenskim granicama” (Sintić Toić, 2012.).

Granična policija jedne države može biti premještena u drugu državu kako bi sudjelovala u zajedničkim operacijama i pružila potporu državama članicama koje proživljavaju osobite pritiske. U skladu s pravilima EU-a o lokalnom graničnom prometu na vanjskim granicama mnoge schengenske države sklopile su bilateralne aranžmane sa susjednim trećim zemljama, uključujući dozvolu za lokalni granični promet, kako bi omogućile lokalni granični promet, trgovinu, socijalnu i kulturnu razmjenu i regionalnu suradnju.

3.1.1 Europska agencija za upravljanje operativnom suradnjom na vanjskim granicama (Frontex)

Europska agencija za upravljanje operativnom suradnjom na vanjskim granicama (FRONTEX) nastala je i počela s radom 2005. godine.

Prije svega, svrha Frontexa olakšati je i učiniti učinkovitijim primjenu mjera EU-a u pogledu upravljanja vanjskim granicama, priznajući pri tom državama članicama pravo zadržavanja primarne odgovornost za stvarnu kontrolu i nadzor nad granicama. Frontex mora obavljati svoje zadatke „u potpunom skladu“ s pravom EU-a, uključujući Povelje o temeljnim pravima, Ženevske konvencije o statusu izbjeglica i „obveze koje se odnose na međunarodnu zaštitu, a osobito načelo zabrane protjerivanja“, odnosno da se osobu ne vrati natrag u zemlju stalnog boravišta (Peers, 2013.).

Frontex ima niz zadataka (Peers, 2013.):

- koordinaciju operativne suradnje između država članica u području upravljanja vanjskim granicama
- pomoć državama članicama u obuci nacionalnih graničara, uključujući osnutak zajedničkih standarda obuke
- sudjelovanje u razvoju istraživanja relevantnih za kontrolu i nadzor vanjskih granica
- pomoć državama članicama u okolnostima koje zahtijevaju povećanu tehničku i operativnu pomoć na vanjskim granicama; raspoređivanje europskih graničnih postrojbi (timova) tijekom zajedničke operacije, pilot projekata i brzih intervencija
- pruža državama članicama potrebnu potporu, uključujući i koordinaciju ili organizaciju, zajedničkih operacija povratka i dr.

Države članice i dalje mogu sudjelovati u operativnoj suradnji s drugim državama članicama ili trećim zemljama na vanjskim granicama, ako takva suradnja upotpunjuje aktivnosti Frontexa i ako je Frontex o njima pravovremeno obaviješten (FRONTEX, FRONTEX financial regulation, 2015.). Države članice se također moraju suzdržati od poduzimanja aktivnosti koje mogu dovesti u pitanje, odnosno ugroziti ciljeve Frontexa.

Frontex Uredba također navodi da „nitko ne smije biti protjeran, ili na drugi način predan vlastima, zemlje u suprotnosti s načelom zabrane protjerivanja, ili iz koje postoji opasnost od povratka u drugu zemlju, protivno tom načelu“. Također, posebne potrebe djece, žrtava trgovanja ljudima, osoba kojima je potrebna medicinska pomoć, osoba kojima je potrebna međunarodna zaštita i drugih ranjivih osoba će se rješavati u skladu s EU i međunarodnim zakonima. U tu svrhu, Frontex mora povući Kodeks ponašanja kako bi se osiguralo da Frontex operacije poštuju načela vladavine prava i temeljnih prava, s posebnim naglaskom na maloljetnike bez pratnje i ugrožene osobe, kao i osobe koje traže međunarodnu zaštitu (FRONTEX, FRONTEX financial regulation, 2015.).

3.1.2 Nadzor vanjskih granica

Da bi osigurala provođenje Schengenskog sporazuma svaka država članica schengenskog sustava mora uskladiti niz propisa s pravom Europske unije. Na primjer, Zakon o nadzoru državne granice, Zakon o strancima, Zakon o azilu, Zakon o policiji, Zakon o zaštiti tajnosti osobnih podataka. Posljedica Schengenskog sporazuma je i zaključivanje brojnih bilateralnih sporazuma i dogovora. Kako sa državama potpisnicama Schengenskog sporazuma tako i sa susjednim državama koje su izvan schengenskog prostora.

Funkcija schengenske vanjske granice trebala bi spriječiti ulaz osobama koje ne ispunjavaju propisane uvjete. Također bi na svim graničnim prijelazima trebali biti precizno regulirani te ujednačeni uvjeti za prijelaz preko njih.

Da bi državljaniin treće zemlje prešao granicu Europske unije potrebni su mu (Rošić, 2008.):

- važeća putna isprava

- važeća viza (ukoliko se radi o državljanima trećih država s kojima postoji vizni režim)³
- isprave koje dokazuju razlog ulaska i dovoljna novčana sredstva te sve to ako pojedincu nije zabranjen ulazak te ako ne predstavlja opasnost za javni red, nacionalnu sigurnost ili međunarodne odnose država članica.

Granični nadzor obuhvaća nadzor zelene (kopnene) granice i plave (morske) granice te uključuje pregled osoba, ukradenih vozila, dokumenata, isprava, ukradenog oružja te provjeru ispunjavanja uvjeta za ulaz u schengenski prostor. Kako Schengenski sporazum teži ukidanju unutarnjih granica i uspostavu zajedničkih vanjskih granica to podrazumijeva snažniji nadzor vanjskih granica jer ukidanje unutarnjih granica ne smije smanjiti sigurnost državljana Europske unije već im treba zajamčiti viši stupanj sigurnosti.

4. Republika Hrvatska i schengenski prostor

Hrvatska je postala članica Europske unije 01. 07. 2013. g., međutim, nije članica schengenskog prostora. Hrvatska vlada najavila je da će Hrvatska 01. srpnja 2015. formalno aplicirati za članstvo u schengenskoj zoni te time omogućiti hrvatskim građanima da se unutar nje kreću slobodno i gotovo bez ikakvog nadzora. Od tog trenutka Hrvatska će biti izravno podvrgnuta evaluaciji odnosno provjeri EU-a da li je za to spremna ili ne. Da bi je Odbor za koordinaciju i nadzor schengenskih instrumenata procijenio spremnom treba ispuniti niz ozbiljnih tehničkih kriterija. Očekivanja su da će odluka o ocjeni spremnosti Hrvatske biti donijeta u roku pola godine od apliciranja (Poslovni, 2013.).

Za pristupanje Hrvatske potrebna je jednoglasna odluka Vijeća Europske unije o uklanjanju kontrola na unutarnjim granicama (nakon konzultacija sa Europskim parlamentom). Provjera spremnosti Republike Hrvatske uključuje primjenu schengenske pravne stečevine u područjima: vanjskih granica, policijske suradnje, vizne politike, sudjelovanje u SIS-u te zaštiti osobnih podataka. Također uključuje i pravosudnu suradnju u građanskim i kaznenim postupcima.

U državama članicama do sada je trebalo između tri i osam godina nakon pristupanja Uniji da pristupe schengenskom području. EU je Republici Hrvatskoj stavila na raspolaganje 120 milijuna eura iz privremenog Schengenskog instrumenta i to isplaćujući 40 milijuna eura u 2013. i 80 milijuna eura u 2014. koje Hrvatska mora iskoristiti za poboljšanje nadzora i kontrole buduće vanjske granice EU (financiranje izgradnje i opremanje graničnih prijelaza, infrastrukture za potrebe policije, nabavka tehničke opreme za nadzor granice, ulaganje u informatičke sustave itd).

Primjeri Rumunjske i Bugarske pokazuju da ulazak u schengensko područje nije samo tehničko već i političko pitanje, naročito u ocjeni borbe protiv korupcije i organiziranog kriminala te efikasnosti pravosuđa, što povećava značaj EU antikorupcijskog izvješća.

S „novim mehanizmima“ nadzora učinkovitosti pravosuđa i borbe protiv korupcije koje uvodi EU, Republika Hrvatska će i nakon pristupanja imati obvezu određenog vida izvješćivanja o stanju pravosuđa i borbi protiv korupcije i organiziranog kriminala, ali pod istim uvjetima kao i ostale države članice. Prvo Izvješće o suzbijanju korupcije (engl. *EU Anti-Corruption Report*) objavljeno je početkom prosinca 2015. i uključuje svih 28 država članica, a sadrži također i preporuke, na razini EU i za svaku državu članicu te su utvrđena područja na kojima će biti potrebno osigurati buduća djelovanja s razine EU. Kao i ostale države članice i Hrvatska će biti

³ Op. Amsterdamski ugovor razvrstava države nečlanice u tri skupine: države negativne liste (čiji državljani moraju imati vizu za ulaz u sve države Schengenskog sporazuma), države sive liste (prema kojima svaka od članica mora uvesti vizni režim) i države pozitivne liste (čiji državljani ne trebaju posjedovati vizu za ulaz u schengenski prostor)

obuhvaćena pravosudnom rang listom - *Justice Scoreboard* - mehanizmom evaluacije pravosudnih sustava država članica kao alatom za promicanje učinkovitog pravosuđa (Pristupanje RH Schengenskom sustavu, 2015).

5. Zaključak

Schengenski ugovor dio je pravne stečevine EU-a koji uklanja unutarnje granice u EU-u te jača kontrolu vanjskih granica EU-a. Danas, preko 400 milijuna ljudi živi u schengenskoj zoni, koja se sastoji od 22 države članice i 3 države koje nisu članice Europske unije: Island, Norveška i Švicarska. Irska i Velika Britanija nisu dio područja Schengena jer su odlučile zadržati kontrolu na svojim granicama, iako redovito surađuju u rješavanju pitanja iz područja sudstva i policije. Cipar, Bugarska i Rumunjska još nisu uvršteni u schengensku zonu, iako su članice Europske unije već dugi niz godina, s obzirom na to da ne ispunjavaju potrebne uvjete i nisu uspjeli dosegnuti propisane standarde.

Uvjet za pristup je provedba schengenskih standarda u četiri područja: kontrola zračnih, kopnenih i pomorskih granica, vizni režim, policijska suradnja i zaštita osobnih podataka. Za Hrvatsku to znači nadzor 2.374,9 km kopnene granice i 948 km morske granice, obuku postojećih i zapošljavanje novih policijskih snaga, nabavu opreme za nadzor granice, kao i implementaciju nacionalnog informacijskog sustava na graničnim prijelazima buduće vanjske granice EU-a koji ima tehničke pretpostavke za priključenje SIS-u (Schengenskom Informacijskom Sustavu). Pristupanje Schengenu znači učinkovitu koordinaciju policije, carine i pravosuđa na nacionalnoj razini, odnosno suradnju tih službi na razini EU-a.

Primjena Schengenskog sporazuma za članice EU-a ima veliki značaj na više područja: sloboda kretanja osoba, roba i kapitala, jačanje ideje građanstva i temeljnih ljudskih prava, jačanje europskog zakona i pravde, kontinuiran i koordiniran rad na razvoju mehanizama koji služe održavanju unutarnje i vanjske sigurnosti. Schengenski prostor također predstavlja područje odgovornosti, solidarnosti i partnerstva članica u pitanjima azilanata i emigranata. Sve to stavlja pred države članice nove izazove u kojima će svakako svoj prostor i mjesto naći i Hrvatska.

Ulazak u Schengen Hrvatskoj donosi niz pogodnosti kao što su: povećanje potražnje za inozemnim dobrima, ali i još bolja mogućnost plasiranja vlastitih proizvoda i usluga na inozemno tržište, zatim podizanje svijesti o jeftinijim proizvođačima u inozemstvu, smanjenje rizika vezanih za kupnju i prodaju izvan zemlje, jačanje turizma i mnoge druge.

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The Schengen agreement

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Abstract. In the town called Schengen, in the south Luxembourg, in 1985, six European countries signed the Schengen Agreement. Five years after the Schengen Convention the abolition of checks at internal borders was determined. A series of measures to increase control at external borders were established. Procedures for issuing uniform visas were introduced including the Schengen Information System, which was replaced by a new generation of SIS II in 2013. The signatories of the Schengen Agreement erased their boundaries on land, sea and airports, and opened borders within the European Union. The Protocol to the Treaty of Amsterdam, the Schengen Agreement and other elements of Schengen acquis, are included in the institutional and legal framework of the European Union and are a part of its legal system. The abolition of border controls started in 1995. In the following years, the Schengen area slowly expands and soon, with accession of Bulgaria and Romania, it will cover 28 European countries. The abolition of internal borders between Member States serves to ensure free movement of goods, people, services and capital. In addition to the economic importance, the abolition of internal borders has freedom of movement within the European Union, which contributes to greater homogeneity and cohesion of European countries; the basic idea of the European Union. An adoption of the Schengen acquis by accession to the European Union is an obligation for each candidate country for EU membership. Croatia, as a full member of the European Union from July 1 2013 will soon have the option to apply for access the Schengen area.

Keywords: *the Schengen area, EU external borders, internal borders, visas*

Stjecanje dobara između država članica Europske unije

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Sažetak. Europska unija je jedinstveno gospodarsko i političko partnerstvo 28 europskih država. Jedinstveno ili „unutarnje“ tržište omogućilo je slobodno kretanje roba, usluga i osoba te postalo glavni gospodarski pokretač EU-a. Uspostavom jedinstvenog tržišta uklonjena je većina trgovinskih barijera. S obzirom na to da između država članica Europske unije nema graničnih crta niti carinske kontrole, više ne možemo govoriti o uvozu i izvozu dobara kad se radi o razmjeni i kretanju dobara na području Europske unije, već se izraz „uvoz“ zamjenjuje izrazom „stjecanje“, a izraz „izvoz“ izrazom „isporuka dobara u drugu državu članicu“. Ti izrazi se koriste kako bi mogli razlikovati te transakcije od „uvoza i izvoza“ koji se i dalje primjenjuju prilikom razmjene dobara sa državama koje nisu članice Europske unije, tj. prema trećima. Nakon ulaska u EU i Republika Hrvatska je prihvatila sve elemente trgovinske politike EU. Jedinstveno unutarnje tržište donijelo je razne pogodnosti kako za proizvođače/dobavljače tako i za krajnje potrošače. Zajedničko tržište je najveće postignuće EU-a. Da bi se ostvarilo jamstvo slobodnog kretanja roba, usluga, ljudi i kapitala, zakonodavci su morali donijeti stotine direktiva koje su potrebne za uklanjanje tehničkih, kulturnih, pravnih i regulatornih poteškoća unutar same Unije koje je morala prihvatiti i Hrvatska.

Ključne riječi: Europska unija, trgovina, stjecanje dobara

1. Uvod

Sa svojim udjelom od 16.5 % u ukupnom svjetskom uvozu i izvozu, EU se smatra najvećim svjetskim trgovcem. Slobodna trgovina je jedno od temeljnih načela EU-a, koja je omogućila europskim potrošačima i proizvođačima jednostavniji pristup i lakšu razmjenu dobara, usluga i protok novca (EU, 2015.).

Cjelokupni proces europskog ujedinjenja započeo je nakon Drugog svjetskog rata kada je potpisivanjem Pariških i Rimskih ugovora nastala „prva“ integracija. Od pedesetih godina pa sve do danas dogodile su se brojne promjene na europskom području. EU je tijekom svog djelovanja doživjela nekoliko „valova proširenja“ i danas broji 28 zemalja članica. U samoj jezgri procesa ujedinjenja europskih država nalazi se trgovinska politika jer je jedan od prvih ciljeva bio povezan sa postupnim ukidanjem carina i ostalih ograničenja koji su utjecali na međusobnu trgovinu (Kersan-Škabić, 2012.).

Temelj Europske unije, koji je ujedno i ugrađen i u ugovor o Europskoj uniji, sačinjavaju tzv. „četiri slobode“, slobodno kretanje: robe, ljudi, kapitala i usluga. Ono u praktičnom dijelu znači za potrošače širi izbor proizvoda po konkurentnijoj cijeni te veću zaštitu, dok proizvođačima pojednostavljuje proces globalnog natjecanja i prekograničnog poslovanja. To jedinstveno tržište i postoji radi 500 milijuna potrošača koji imaju pravo kupovati proizvode i usluge po istim kriterijima i ugovornim obvezama, dok je svakom proizvođaču u Europskoj uniji omogućen pristup svakom od tih potrošača.

Jedna od najvećih prednosti jedinstvenog tržišta za proizvođače je ekonomija razmjera i konkurentnost, dok je malim tvrtkama i proizvođačima omogućen lakši pristup novim tržištima.

2. Trgovinska politika Europske unije

Cjelokupna trgovinska politika Europske unije uređena je člankom 207 Ugovora o funkcioniranju Europske unije (Lisabonski ugovor) te je samim time u njezinoj isključivoj nadležnosti.

EU tržište je ključnu ulogu imalo i u osnivanju Svjetske trgovinske organizacije (WTO). EU je 2012. bila glavni trgovinski partner s više od 100 zemalja, a čak 10 % stanovništva EU-a ovisilo je o vanjskoj trgovini što govori o značaju vanjske trgovine za njeno stanovništvo. Također trgovina je značajno pridonijela i povećanju BDP-a i životnog standarda kako u Uniji tako i drugdje (Europa, EU, 2015.).

Međutim, svjetska trgovina se u posljednje vrijeme bitno promijenila. Razvojem tehnologije kao i dolaskom na tržište nekih novih gospodarskih supersila (op. zemlje BRIC-a, Brazil, Rusija, Indija i Kina), svjetska trgovina je u velikoj mjeri doživjela promjene te se počelo trgovati robom i uslugama kojima se do sada nije moglo trgovati. Svojim ujedinjenjem države članice su sva važnija pitanja vezana za međunarodnu trgovinu prepustila Europskoj komisiji koja zastupa Europsku uniju u pregovorima o međunarodnim trgovinskim sporazumima i pitanjima vezanim za trgovinu (Europski parlament, 2015.).

Ciljevi trgovinske politike Europske unije su (Kersan-Škabić, 2012.):

- smanjenje carinskih barijera
- harmonizirani razvoj svjetske trgovine
- progresivno ukidanje ograničenja u međunarodnoj trgovini.

Ključnu ulogu u stvaranju integriranog unutarnjeg tržišta i zajedničke gospodarske politike imaju trgovinska i carinska politika koje su temelj Europske unije. Zajednička trgovinska politika temelji se na jedinstvenim načelima, osobito u pogledu primjene carinskih stopa i kvota, inozemnih izravnih ulaganja, zaključivanja bilateralnih i multilateralnih carinskih i trgovinskih sporazuma koji se odnose na trgovinu robom i uslugama, postizanje ujednačenosti mjera liberalizacije te izvozne politike i zaštitnih mjera.

Trgovinska politika Europske unije regulira trgovinske odnose sa zemljama nečlanicama i u potpunoj je nadležnosti Europske unije, što znači da države članice ne mogu samostalno sklapati trgovinske sporazume ili donositi nove propise. Za vođenje pregovora sa trgovinskim partnerima zadužena je Europska komisija, dok Vijeće Europske unije i Europski parlament imaju zakonodavne ovlasti.

Europska unija je jedno od najvećih carinskih područja na svijetu sa 28 carinskih uprava koje primjenjuju zajedničke carinske standarde. Zajednička carinska tarifa, kao jedna od glavnih značajki carinske politike Europske unije, propisuje carinske pristojbe koje se naplaćuju na uvoz robe u Europsku uniju i idu u proračun Europske unije, a ne zemljama članicama (carine obuhvaćaju oko 13 % proračunskih prihoda Europske unije). Neke od zemalja europskog gospodarskog prostora poput Norveške, Islanda, Švicarske, kao i zemlje u razvoju, najčešće imaju povlaštene carinske stope ili slobodan uvoz robe bez ograničenja po pitanju carine, osim carinske kontrole. Puna primjena Zajedničke carinske tarife očituje se, primjerice, u trgovini s državama poput Kanade, SAD-a i Japana.

Europska unija uz zajedničku trgovinsku politiku također provodi trgovinsku i carinsku politiku kroz niz mehanizama za zaštitu trgovine i to mjerama zaštite od subvencioniranog izvoza iz zemalja izvan Unije, provedbu bilateralnih i multilateralnih sporazuma, mjere anti-dampinga te dijaloga s relevantnim dionicama iz javnog i privatnog sektora.

3. Carinska politika EU

S obzirom na to da temelj Europske unije čine zajedničko tržište i carinska unija, jako je bitno naglasiti značajke svake posebno. Zajedničko tržište obilježavaju zajednička trgovinska i poljoprivredna politika te slobodno kretanje roba, a carinsku uniju obilježavaju bescarinska trgovina između zemalja članica i zajednički carinski propisi koji se primjenjuju prema trećim zemljama (Ministarstvo financija RH, Carinska uprava, 2015.).

Carinska unija je jedno od najvećih postignuća Europske unije i ključni je čimbenik u globalnom okruženju 21. stoljeća. Europska unija je po svom određenju carinska unija koja primjenjuje brojna pravila na uvoz i izvoz robe sa trećima, no u potpunosti su uklonjene sve kontrole između zemalja članica. Carinska unija okružuje unutarnje tržište Europske unije i omogućuje slobodno kretanje roba unutar tog područja te nadzire uvoz i izvoz proizvoda iz trećih zemalja. Carinskom unijom upravlja 28 nacionalnih carinskih službi zemalja članica koje djeluju zajednički. Oni nadziru kretanje proizvoda na vanjskim granicama Europske unije koje uključuju granične prijelaze u zračnim lukama, trajektnim lukama i na kopnenim graničnim prijelazima kao i unutarnje područje Europske unije.

Europska unija je isključivo odgovorna za funkcioniranje carinske unije, međutim da bi se to provelo ona se mora zasnivati na partnerstvu sa zemljama članicama i između njih. Ključnu ulogu u svemu ima Europska komisija koja predlaže carinske zakone i prati primjenu istih. Ona također nastoji osigurati da carinska unija ima moderne, učinkovite i međusobno povezane carinske ustanove koje se mogu nositi sa postojećim i budućim izazovima (Politike Europske Unije, 2015.).

Carinski propisi koji se primjenjuju su (Ministarstvo financija, Carinska uprava RH, 2015.):

- Carinski zakonik Zajednice (CZZ)-Uredba Vijeća (EZZ) br. 2913/92 od 12. listopada 1992., kojom se donosi CZZ sa svim izmjenama i dopunama.
- Zakon o provedbi carinskih propisa Europske unije.
- Uredba za provedbu Carinskog zakonika Zajednice (UPCZZ) – Uredba Komisije (EZZ) br. 2454/93 od 2. srpnja 1993., o odredbama za provedbu Uredbe Vijeća kojom se donosi CZZ, sa svim izmjenama i dopunama.
- Razni provedbeni propisi (pravilnici) kojima se detaljnije reguliraju carinska postupanja čije je donošenje u nadležnosti pojedinih zemalja članica.

Za provedbu carinskih postupaka za određenu robu prvenstveno je potrebno utvrditi carinski status robe. Sukladno odredbama koje propisuje CZZ moguća su dva carinska statusa robe: prvi se odnosi na status robe Zajednice, a drugi na robu koja nema status Zajednice.

„Roba Zajednice“ je roba koja je (Carinska uprava RH, 2015.):

- U cijelosti dobivena na carinskom području Zajednice prema uvjetima iz članka 23. CZZ-a i koja ne sadrži robu uvezenu sa teritorija koji nije dio carinskog područja Zajednice.
- Dobivenu ili proizvedenu u carinskom području Zajednice – bilo od robe koja je u cijelosti dobivena na carinskom području Zajednice, bilo od robe prethodno uvezene i puštene u slobodan promet.
- Uvezene iz trećih zemalja koje nisu dio carinskog područja Zajednice i puštene u slobodan promet.

„Roba koja nema status Zajednice“ je (Carinska uprava RH, 2015):

- Roba unesena u carinsko područje Zajednice u skladu sa člankom 37. CZZ-a.
- Roba privremeno smještena ili u slobodnoj zoni kontrolnog tipa 1. ili u slobodnom skladištu.

- Roba stavljena u postupak s odgodom ili u slobodnu zonu kontrolnog tipa 2.

Zajednička carinska tarifa je carinska tarifa koja se na vanjskim granicama Unije primjenjuje na uvoz robe iz trećih zemalja u Uniju, a čija je visina i klasifikacija zajednička svim državama članicama i jedna je od najvažnijih propisa Europske unije. Zakonska osnova sadržana je u članku 20. Uredbe Vijeća (EEZ) 2913/92 o uspostavi Carinskog zakonika Zajednice.

Prema navedenom članku sastoji se od (Zajednička carinska tarifa EU, 2015) :

- kombinirane nomenklature
- bilo koje druge nomenklature koja se u potpunosti ili djelomično bazira na kombiniranoj nomenklaturi ili uvodi daljnju podjelu kombinirane nomenklature zbog potrebe provedbe tarifnih mjera Zajednice u specifičnim područjima u trgovini robom
- stopa carine i drugih elementa davanja koje se primjenjuje na robu obuhvaćenu kombiniranim nomenklaturom
- preferencijalnih tarifnih mjera sadržanih u ugovorima koje je Zajednica sklopila s pojedinim zemljama ili grupama zemalja, temeljem kojih se osigurava preferencijalni tarifni tretman
- preferencijalnih tarifnih mjera uvedenih jednostrano od Zajednice u odnosu na određene zemlje, grupe zemalja ili teritorije
- autonomnih suspenzija kojima se snižavaju ili ukidaju carine za određenu robu
- drugih tarifnih mjera koje se temelje na zakonodavstvu Zajednice (na primjer, antidampinške i kompenzacijske carine, zaštitne carine, dodatne carine).

Svi mehanizmi koji se primjenjuju u Europskoj uniji, posebice carinski propisi i zakoni temelje se prvenstveno na zaštiti i poticaju domaće proizvodnje te regulaciji tržišta.

3.1. Kombinirana nomenklatura

Kombinirana nomenklatura bazirana je na Međunarodnoj konvenciji o Harmoniziranom sustavu nazivlja i brojčanog označavanja te uključuje daljnje podjele zbog trgovinskih, statističkih i carinskih potreba Europske unije. Sam naziv „kombinirana nomenklatura“ je nastao kombinacijom bivše carinske (engl. *Common customs tariff*) i statističke trgovinske (Nimex) nomenklature Europske unije.

U primjeni je na području Europske unije od 1988. godine. Ona je sastavni dio Zajedničke carinske tarife, čija zakonska osnova je sadržana u članku 20. Uredbe Vijeća (EEZ) 2913/92 (Ministarstvo financija RH, Carinska uprava, 2015.).

Utvrđeno je da će se tako uspostavljena nomenklatura sastojati od (Ministarstvo financija RH, Carinska uprava, 2015.):

- nomenklature Harmoniziranog sustava (HS)
- daljnje podjele nomenklature HS-a za potrebe Zajednice, koju se naziva KN podbrojevi
- uvodnih odredbi, dodatnih napomena uz odsjeke i poglavlje vezanih uz KN podbrojeve.

Klasifikacija (nomenklatura) robe definirana je člankom 3. Uredbe. Podbrojevi Kombinirane nomenklature imaju osmeroznamenkastu tarifnu oznaku, od kojih (Ministarstvo financija RH, Carinska uprava, 2015.):

- prvih šest znamenki predstavljaju tarifne brojeve i podbrojeve iz Harmoniziranog sustava
- sedma i osma znamenka identificiraju podbrojeve Kombinirane nomenklature.

Ako tarifni broj ili podbroj Harmoniziranog sustava nije dalje podijeljen za potrebe Zajednice, na mjestu sedme i osme znamenke bit će oznaka „00“. Zbog specifičnih mjera koje se provede pri uvozu (npr. ugovori o povlaštenim trgovinskim režimima, zajedničke trgovinske i druge politike itd.), podbrojevi Kombinirane nomenklature mogu biti dalje podijeljeni na TARIC podbrojeve. Oni zajedno s osmeroznamenkastom KN oznakom čine TARIC oznaku. U slučaju da ne postoji daljnja TARIC podjela, deveta i deseta znamenka biti će „00“ (Carinska uprava RH, 2015).

3.2. TARIC sustav

S obzirom na svakodnevne promjene u Zajedničkoj carinskoj tarifi istom nije moguće upravljati u papirnatom obliku, stoga je tiskano izdanje carinske tarife prestalo postojati. Kao zamjena za nju kreiran je TARIC sustav (akronim od francuskog naziva za „integriranu tarifu Zajednice“ - *Tarif Intégrée Communautaire*) (Carinska uprava RH, Taric, 2015.).

Člankom 2. Uredbe 2658/87 o tarifnoj i statističkoj nomenklaturi i zajedničkoj carinskoj tarifi, TARIC sustav predstavlja bazu podataka u kojoj se nalaze sve mjere zajedničke trgovinske politike Europske unije. Zajedničke mjere primjenjuju se u trgovini s trećim zemljama te pokrivaju vanjskotrgovinske, statističke, trgovinske i druge politike.

Za funkcioniranje TARIC sustava zadužena je Europska komisija te je time osigurana jedinstvena primjena mjera od svih država članica. Također TARIC sustav omogućuje svim gospodarskim subjektima pravovremen prikaz svih transparentnih mjera kako u uvozu tako i u izvozu (Carinska uprava RH, Taric, 2015.).

TARIC predstavlja informatičku verziju Zajedničke carinske tarife (elektroničku bazu podataka) koja sadrži sve dnevno aktualne EU mjere koje treba primijeniti u trgovini s trećim zemljama, odnosno svojevrsni mozak carinskog informacijskog sustava i alat bez čije bi uporabe bilo gotovo nemoguće ocariniti robu.

Sastoji se od (Carinska uprava RH, Taric, 2015.):

- nomenklature robe
- stopa carine
- preferencijalne stope
- antidampinške mjere
- ostale propisane mjere u Europskoj uniji.

Iz toga proizlazi da TARIC predstavlja skup svih mjera Zajednice (tarifnih i netarifnih) koji se primjenjuju u trgovini s trećim zemljama, sadržanih u brojnim pojedinačnim propisima Europske unije.

Održava ga Opća uprava za poreze i carinsku uniju (DG TAXUD) Europske komisije. Trenutno je dostupan samo na engleskom jeziku i nije produkcijski, što znači da ne mora nužno odgovarati dnevnim podacima koji su objavljeni na web stranicama Europske komisije.

4. Republika Hrvatska i trgovinska politika EU

Ulaskom u EU, Hrvatska je prihvatila sve elemente trgovinske politike EU, kao i sve trgovinske sporazume koje je EU potpisala sa zemljama nečlanicama. Time su svi sporazumi o slobodnoj trgovini koje je Hrvatska samostalno potpisala prestali važiti. Ulaskom u Europsku uniju, vezano za tarifne propise i carinska davanja, van snage su stavljeni (Zajednička carinska tarifa EU, 2015.):

- Zakon o carinskoj tarifi i Uredba o carinskoj tarifi, uključujući nacionalnu podjelu i sva njome utvrđena uvozna i izvozna davanja, kao i Odluke o odobrenju preferencijalnog uvoza u okviru kvota, dodijeljene temeljem Uredbe o carinskoj tarifi za 2013.

- Protokol o pristupanju Republike Hrvatske Marakeškom ugovoru o osnivanju Svjetske trgovinske organizacije (WTO), uključujući obvezujući raspored na kojem se temelje osnovne stope carine i WTO carinske kvote.
- Svi sporazumi o slobodnoj trgovini koje je RH zaključila s drugim zemljama, uključujući sve njima utvrđene preferencijalne stope carine i preferencijalne carinske kvote.

Kao članici, Hrvatskoj je olakšan izvoz proizvoda na tržište EU jer postaje dijelom zajedničkog unutarnjeg tržišta (Kersan-Škabić, 2012.). Nakon ulaska RH u EU, vanjska granica EU postaje granica Hrvatske s Bosnom i Hercegovinom, Srbijom i Crnom Gorom te se na tim granicama provodi i pojačani carinski nadzor. Kao nova članica EU, Hrvatska je uskladila svoje zakonodavstvo i carinsku praksu sa praksom EU, te je od samog ulaska i primjenjuje. U tu svrhu donesen je i Zakon o provedbi carinskih propisa EU koji predstavlja nacionalni carinski zakon (Zakon o provedbi carinskih propisa Europske unije NN 54/13, 2015.).

Nakon ulaska također su se promijenili i uvjeti za obavljanje trgovine između gospodarskih subjekata u RH sa zemljama članicama EU-a, dok se trgovina sa nečlanicama provodi sukladno europskim i nacionalnim carinskim propisima. S obzirom da više nema graničnih crta niti carinske kontrole između država članica EU-a, više ne možemo govoriti o uvozu i izvozu dobara na području Europske unije pa se izraz „uvoz“ zamjenjuje izrazom „stjecanje“, a izraz „izvoz“ izrazom „isporuka dobara“. Ti izrazi su stavljeni na korištenje kako bi se mogli razlikovati od izraza „uvoz i izvoz“ s obzirom da se ti izrazi još uvijek koriste u trgovini sa državama nečlanicama EU-a.

S time u skladu, predmetom oporezivanja PDV-om na području Europske unije smatra se (Cipek, 2013.) :

- isporuka dobara uz naknadu na području neke države članice
- stjecanje dobara uz naknadu unutar Europske unije na području neke države članice
- obavljanje usluga uz naknadu na području neke države članice
- uvoz dobara na područje neke države članice, odnosno Europske unije.

Stjecanje dobara kao predmetom oporezivanja propisano je člankom 4. stavkom 1. točkom 2. Zakona o PDV-u. Stjecanje dobara kao predmet oporezivanja propisano je i člancima 2., 3., 27., 28., 29., 30. i 31. Pravilnika o PDV-u. S obzirom da stjecanje dobara unutar Europske unije nije više u nadležnosti Carinske uprave nego Porezne uprave, ona će uz pomoć poslovne dokumentacije izvršavati provjere vezane za stjecanje dobara iz drugih država članica (Cipek, 2013.).

Prema članku 9. stavak 1. Zakona o PDV-u „Stjecanje dobara unutar EU“ je stjecanje prava raspolaganja pokretnim materijalnim dobrima u svojstvu vlasnika, koja je iz jedne države članice u drugu državu članicu otpremio ili prevezao prodavatelj ili netko u njegovo ime ili osoba koja dobra stječe (Jerković, 2015.).

Sve dok je kupac porezni obveznik koji ima pravo na odbitak pretporeza, stjecanje je unutar EU-a neutralno (to je jedno od osnovnih načela PDV-a). Kako bi mogli obavljati stjecanje dobara unutar Europske unije, hrvatskim poreznim obveznicima je potreban PDV identifikacijski broj kako bi mogli imati oporezivo stjecanje. U slučaju da ne posjeduju PDV identifikacijski broj isporučitelj dobara iz druge države članice obračunat će PDV u skladu sa propisima svoje države članice (Jerković, 2015.).

Ulaskom Hrvatske u EU svako kretanje robe zemalja članica unutar EU-a predstavlja trgovinu između članica stoga ona ne podliježe obvezi provođenja carinskih postupanja. Međutim, kako trgovina između članica i dalje predstavlja robnu razmjenu ona se mora na neki način mjeriti radi planiranja, sastavljanja nacionalnih računa i platnih bilanci. S obzirom da se mjerenje ne može više provoditi temeljem carinskih deklaracija jer roba nije predmet carinskog postupanja

za trgovinu između zemalja članica uspostavljen je INTRASTAT - poseban sustav u okviru kojeg se prikupljaju podaci o razmjeni između zemalja članica.

5. Zaključak

Zajedničko tržište EU-a s definiranim carinskim sustavom država članica EU-a prema trećim zemljama zahtijevalo je i zajedničku vanjskotrgovinsku politiku prema trećima. Europska ekonomska zajednica koja je nastala 1957. godine potpisivanjem Rimskog ugovora, stvorena je kao carinska unija sa zajedničkom carinskom tarifom država članica prema trećima te željom za uklanjanjem svih prepreka u razmjeni dobara između samih članica. Istim tim ugovorom (op. Rimski ugovor) predviđeno je i stvaranje zajedničkog tržišta, što je podrazumijevalo usklađivanje ekonomskih politika zemalja članica te razvoj zajedničkih ekonomskih odnosa, odnosno u ovom slučaju trgovinskih odnosa s trećima.

S obzirom na to da je Europska unija najveća i najsloženija ekonomska integracija u svijetu, tijekom vremena jedna od važnijih odrednica Europske unije postao je razvoj i unapređenje zajedničke trgovinske politike zemalja članica prema trećima. Europska unija danas predstavlja gospodarstvo koje je prvenstveno najviše usmjereno prema trgovini s trećim zemljama te kontinuirano unaprjeđuje vlastite gospodarsko-političke odnose prema istima.

Rimskim ugovorom o osnivanju EEZ-a predviđene su tzv. „četiri slobode” koje predstavljaju ključne smjernice unutrašnje trgovinske politike. Sloboda kretanja roba je jedna od četiri temeljne slobode unutarnjeg tržišta Europske unije te je promicanje i zaštita slobode kretanja roba iznimno važno za funkcioniranje unutarnjeg tržišta Europske unije.

Ulaskom u Europsku uniju, Republika Hrvatska je preuzela zajedničku trgovinsku politiku EU-a, a samim time i jedinstvene politike zaštitnih mjera u odnosu prema trećim zemljama. Sukladno tome, glavni cilj hrvatske trgovinske politike postaje oporavak gospodarstva stvaranjem povoljnijih uvjeta za trgovinu i buduća ulaganja kako prema ostalim članicama EU-a, tako i prema trećima.

Poduzetnicima koji posluju na hrvatskom tržištu, plasman roba na tržišta država članica EU-a znatno je olakšan. Ravnopravan tretman hrvatskih proizvoda u odnosu na proizvode iz drugih država članica EU-a proširio je mogućnosti poslovanja i trgovine na tržištima drugih država članica EU-a. Korist carinske unije za zemlje članice ogleda se u ukidanju međusobne granične kontrole što podrazumijeva izravnu uštedu i vremena i troškova administrativne procedure špedicije i carinjenja te ubrzava i pojeftinjuje protok roba.

Ukidanjem fiskalnih granica prema državama članicama EU-a isporuka dobara u druge države članice više se ne smatra izvozom nego isporukom dobara unutar EU-a, dok se uvoz dobara iz drugih država članica EU-a smatra stjecanjem dobara unutar EU-a.

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Acquisition of goods between members of the European Union

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Abstract. The European Union is a unique economic and political partnership of 28 European countries. Single or „internal” market allowed the free movement of goods, services and people and become the main economic engine of the EU. The establishment of a single market removed most trade barriers. Given the fact that between the member states of European Union there are no boundary lines or customs control, we cannot talk about the import and export of goods when it comes to trade and the movement of goods in the EU. The term „import”, therefore, replaces the term „acquisition” and the term „export” the term „supply of goods to another member state”. These terms are used in order to distinguish those transactions from the „import and export” which are still utilized in the exchange of goods with non-member countries of the European Union, i.e. third parties. After joining the EU, Croatia accepted all of the elements of EU trade policy. The internal single market has brought many benefits for both manufacturers / suppliers and end consumers. The common market is the greatest achievement of the EU. In order to obtain a guarantee of free movement of goods, services, people and capital, lawmakers had to make hundreds of directives needed to remove technical, cultural, legal and regulatory difficulties within the EU that Croatia had to accept.

Keywords: European Union, trade, acquisition of goods

Developing small rural communities through cultural heritage tourism: A Spanish case

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Abstract. Inland rural areas in Spain have gradually become deprived territories since the migration towards cities that began in the XX century searching for a better life. Agriculture was not the pillar of rural economies anymore on the one hand, owing to periods of bad crops; and on the other, because of the very low prices but high costs involved in harvesting. As a result, young people decided to leave their homeland, looking for a job in the developing industry of big cities. Consequently, small rural areas were left with elderly people, which led to the total abandonment of some villages as old people died. Fortunately, the last years have seen an awakening in promoting rural environments as healthy and homely and therefore, as providers of a better quality of life. For some areas this was feasible thanks to privileged natural environments. However, other inland areas needed to reinvent themselves and benefit from their own valuable assets, i.e. their cultural heritage. The present analysis will introduce a case where a very small village on the Spanish plain has doubled its population in the last 10 years by resorting to their Celtiberian roots. This increase has also meant a significant development in the local community, as small businesses were started up in the wake of the rising number of incoming tourists. Consequently, this also meant jobs and so, young people returned to the rural environment, settling down there and, by starting their own families, increasing the population.

Key words: *rural areas, heritage tourism, population thrust*

1. Introduction

“The tourism industry is more interested in the business of tourism. It is up to communities to take hold of their futures in constructive ways while improving the community.”

McNulty & Koff, 2014, p. 14

This quotation sums up best the message that this paper aims to put forward, i.e. small rural communities have traditionally suffered an ongoing and slow deterioration because of economic reasons. And although there will still be villages that may even disappear because of this, those small communities that have the privilege to be the guarantors of heritage sites can survive thanks to their cultural past by showing this to others, that is, by attracting tourists to their destination.

The 2015 UNWTO/UNESCO Conference on Tourism and Culture finally highlighted the need to create a framework for collaboration between tourism and culture. Emphasis was also placed on the need to include an active participation of the host communities, apart from tourists and the private and public sectors. This was in line with previous work carried out by the UNWTO, such as the Global Code of Ethics for Tourism that was developed in 1999 with the objective to maximise benefits from tourism as well as minimising its potentially negative

impact on environment, cultural heritage, and communities, and later on adopted as a resolution by the General Assembly of the UNO in December 2001. Among the 10 principles outlined, two of them are worth mentioning here: on the one hand, principle 4 establishes tourism as a user of the cultural heritage of mankind and a contributor to its enhancement, thus respecting archaeological and cultural heritage so that future generations can still enjoy it, and also, traditional cultural products, crafts and folklore; on the other hand, principle 5 describes tourism as a beneficial activity for host countries and communities in the sense that it can contribute to employment. Likewise, the UNESCO World Heritage and Sustainable Tourism Programme has created an international framework for cooperation across sectors in order to safeguard heritage and achieve sustainable tourism and economic development. Its Action Plan 2013-2015 outlined major activities such as focusing on the empowerment of local communities and taking into consideration the local context and needs. And although no information is available on how the second phase (2016-2018) is developing, there is a hope that the collaboration of all the stakeholders involved and the estimated budget for the programme (US\$ 3,720,000) will make it succeed.

But firstly, a definition of *cultural heritage tourism* must be provided, since there are as many interpretations as possible definitions that can be found throughout the literature on the subject. However, only those that match the purpose of this paper will be introduced subsequently. According to McNulty & Koff (2014), it relates to visiting those places that are significant to the cultural identity of a particular community and consequently, that makes these people different from others. Similarly, the National Trust for Historic Preservation (Gibson, 2015) describes cultural heritage tourism as experiencing places, crafts, and activities that represent the past and present of particular people. Throsby (1999) uses the concept *Cultural Capital* meaning the group of tangibles and intangibles which reflect the history and identity of a group of people and which is to be understood as an asset through the flow of goods and services derived from it. However, this asset can depreciate if it isn't adequately preserved or build up if it is improved and money is invested. In other words, it is an economic phenomenon. Finally, Caves (2000) coins the term *Creative Capital* to refer to all those material and immaterial values in a society that encourage individuals and institutions to become innovative and dynamic. Obviously, both the degree of knowledge and the resources for acquiring and developing it are very important, but what really matters is to understand it as an attitude, an entrepreneurial spirit, where imagination and opportunity blend.

Spain is a good example of a cultural heritage tourism provider, as the potential visitor can enjoy 44 UNESCO World Heritage Sites. Well-known examples are La Alhambra (Granada) or The Mosque in Cordoba, if travelling down South; the Romanesque Way, which crosses the country from South to North, going through towns of great historical and heritage values; the Silk Exchange Building (Valencia), located on the Eastern coast. And surely, a representative example of cultural heritage in Spain is the Santiago de Compostela Way which was visited by 262,515 pilgrims in 2015, an increase of 10.3% compared to 2014 (Pilgrim Office, 2016). 53.38% of those visitors were foreign and came from 178 countries worldwide (39 more than the previous year). This is a good example of best practice on how the tourism regional and national stakeholders carried out a number of strategies in order to overcome the economic recession that stroke the country seriously from 2009. They realized that Spain had a lot to offer apart from sun and beach destinations and therefore, they decided to go back to their roots, i.e. to enhance and promote all the cultural values that the potential tourist could enjoy. The strategy was to develop quality cultural routes in order to attract quality tourism in areas such as, spa & wellness, sports, gastronomy, wine experience, and spiritual routes. In all these areas, the focus was placed on culture and routes/packages were offered so that customers could enjoy an attractive historical description of what they were

experiencing (Aznar, 2015). The outcome has been outstanding: Spain hit a record of tourist arrivals in 2015 with a total number of over 68 million, 4.9% more than the previous year (Spanish Institute of Tourism Research, 2016), and an increase of 8.5% in total expenditure (Spanish Statistical Office, 2016). Therefore, it is evident that the link between tourism and cultural heritage is key to success when the focus is placed on quality and sustainability.

However, these sites are located in major towns. Therefore, the main problem is how to enhance and promote all those heritage sites that can be found in rural Spain and that have nothing to envy to those landmarks mentioned above. It is a universal fact that rural areas are threatened by a number of factors: an aging population which leads to human desertification; a migration of inhabitants to bigger towns, as many of those who are born in these regions are not willing to stay and which consequently, results in depopulation, and sometimes even in the disappearance of communities; an increase in isolation that causes a degradation of economic activities and as a result, an increase in unemployment. And although the situation is worrying, there is a way out if rural communities regulate themselves both economically and socially through tourism (Hall & Brown, 2000). Even the UNWTO are well aware of this fact and this is why the First World Conference on Tourism for Development will be organized in Beijing in May, 2016, together with China; the focus will be on tourism for poverty reduction as well as tourism for peace. In fact, the Chinese authorities have launched a new Five-Year-Plan whereby by 2020 two million of China's rural population are expected to overcome poverty every year. But first, these communities must have something to offer and so, only those rural areas that have a specific cultural and natural appeal can attract tourists and hence, have a significant impact on rural development (Mostowfi, 2000). And there are good examples of how certain rural regions decided to take responsibility for their own development. Already in the mid 90's the European Commission, through the European Network for Rural Development (ENRD), launched the LEADER Gateway (Liaison Entre Actions de Développement de l'Economie Rurale) which became an important component of EU Rural Development Policy for over 20 years. Likewise, the European Network of Village Tourism (2008) is an important initiative for the involvement of the local communities in the development of their tourist initiatives. The strategy of the network is to increase the visibility of the regions involved and the development of high quality products through personalized tourism experiences, i.e. hosts interact directly with guests. The sought outcome is to diminish seasonality by creating activities that can attract visitors all year round.

The next chapter will present a good practice case in which a very small Spanish village which was seriously threatened as a living community could not only survive but boom thanks to their own cultural heritage and the will and involvement of the local inhabitants. But first a brief introduction will be made on the importance of developing a building community approach in the rural environment.

2. The development of a small rural community: A Celtiberian story

“Tourism is too important a resource to be left to the tourism professionals.”

Bob McNulty, President, Partners for Livable Communities (www.livable.org)

In hard economic times, as the world is going through nowadays, persuading people of the benefits of preserving cultural heritage can be a challenge, otherwise this obviously results in less financial resources from either public or private bodies. But this is the time when local communities can take the lead, as collaborative participation may undoubtedly steer to succeed in developing cultural heritage attractions as a way to improve their quality of life

and also, strengthen the community. Consequently, the interests of the community become the core of cultural heritage tourism (McNulty & Koff, 2014). The involvement of the local inhabitants develops as well in an emotional connection when they integrate the past to create a bond to the present time by developing attractions they see as a celebration of their own culture. And the creative interpretation of heritage becomes an asset that cannot be ignored because of its huge potential in terms of tourist attraction and so, economic development. As McNulty and Koff claim: "... highlighting the culture and heritage of a place cultivates attachment to that place, and thus makes people want to settle in that area and lay their roots down." (2014, p. 10). It is therefore hardly surprising to find out how governments are eager to facilitate the boom of cultural tourism, since this is seen as a great opportunity for the growth and diversification of the economic structure and for the modification of the image that potential tourists may have about the urban area and its surroundings (Herrera & Devesa, 2011). By focusing on cultural heritage, public decision-makers strengthen a number of key values such as, the quality of life that is associated with art and culture.

By providing quality cultural experiences, rural communities can attract the powerful segment of LOHAS (Lifestyles of Health and Sustainability). Tourists in this group have higher incomes and can bring more resources to the communities they visit. Furthermore, they are more frequent travellers and don't mind travelling long distances in order to get the experience they want. Moreover, and this is very important, they spend more money than the average tourist. The community approach can provide this by seeking a balance among the interests of tourists, preservationists and the community members themselves. Surely, this can be done by involving community members in making all those basic decisions about what should be done. This way self-confidence and a sense of community pride are promoted among participants as well as a better understanding of their own history. Besides, there is a tangible improvement in the residents' quality of life through the construction and renovation of new and existing facilities, and through the expansion of economic opportunities. There is also an intangible improvement because of the increase in the sense of trust, respect and closeness among the community members. As a result, on the one hand, there is a promotion of a greater involvement in public life; and on the other, a more vibrant community is created. The outcome may be both a sustainable development and community empowerment.

2.1 Introducing the small community

The name of the small community is Garray. It is a very small village located in the province of Soria on the Spanish plateau, about 230 km to Madrid, the capital of the country. According to their population census (Garray Town Hall, 2016), the village has 533 inhabitants of which 53.3% are males, as is the usual case in rural Spain.

The main pillars of the community economy have always been rain-fed agriculture, mainly cereals such as wheat; and sheep breeding. Traditionally, families lived on those products, however the Spanish Civil War (1936-1939) and particularly, the post-war period throughout the 40-year fascist regime, led to an impoverishment of the Spanish population that had a largest impact on the rural economy. Money was worth nothing (the new regime coined new coins and banknotes and therefore, the currency from the previous regime – the Republic – had no value whatsoever) so that investments in agriculture and farming were not possible anymore, and families had to live on household ration cards. The most direct consequence of this situation was a migration from the countryside to the largest urban areas (such as Barcelona, Madrid, or Valencia) in search of a better life through employment in the early stages of the infant industry in the country, that led to the abandonment of farming and the traditional way of life in the small rural communities; some of them completely disappeared after a few years. Fortunately, this hasn't been the case of Garray where a few inhabitants decided to remain and carry on with their lives. The fact that the village is located only 7

kilometres away from the main town of the province (Soria) surely was a key element in the struggle to survive of the community, although it can only be said for the last 30 years when there was a development of industry in the area.

2.2 Introducing the heritage site

The Celtiberians were Celtic-speaking people of the Iberian Peninsula in the final centuries BC, based in what is now north-central Spain. They resulted from marriage between Celts and Iberians after a period of continuous wars since their first warfare through the north of the Peninsula. They were divided into tribes, the most powerful one being the Arevaci, who are the ones that play an important role in the present case, since they dominated the most powerful stronghold in the area, i.e. Numantia. This settlement became a legend throughout history because of the Celtiberian Wars, and it still represents the triumph of value and perseverance for Spanish people: after 20 years of hostilities with Rome, Scipio Aemilianus Africanus laid siege to this settlement for 13 months, after which, and knowing they had been defeated, the Numantians decided to burn their own village and die free rather than stay alive and become slaves.

The archaeological site of Numantia is located on a hill in the municipality of Garray. It is a vast area of archaeological remains that still need much work to be done in order to excavate and bring to light the whole settlement. But for over 30 years, every summer Archaeology under-graduate students from the prestigious Complutense University in Madrid have been staying in Garray for months developing their field research on this site. This obviously helped people in the local community to know more – and admire – their own roots and history, apart from having the opportunity to mingle with people from the capital and become aware that these people were their equals (something which was never the case during the fascist regime, as villagers were always regarded as ignorant illiterate hillbillies). This undoubtedly planted the seed for the community development that was to come later on in time.

2.3 Impact of the Celtiberian heritage on the community

Culture provides all the resources for development but communities must be able to become aware of this. Those rural areas that are capable to emphasize the wealth and diversity of their cultural heritage may develop an economy that would guarantee employment and also, added value to the community itself. Likewise, the enhancement of the local cultural identity and the improvement in the quality of life strengthen the community's pride and sense of belonging, both of which should be regarded as vital to the survival and development of a rural community. In the case being described here, there was an evident cohesion in the population of the local community in question, i.e. Garray. A feeling of self-esteem as well as a pride for their own cultural roots soon spread over the villagers, which in turn led them to become creative and willing to take action concerning a number of activities related to the Numantia site and its history. Furthermore, there is a strongly-rooted feeling that this experience must be sustainable and transmitted across generations; and this is the reason why whole families participate in those activities, from new-born babies to their grandparents – or even great-grandparents, thus enhancing the creation of a stronger bond among the rural community members.

Besides, the impact on economic development is outstanding. In 2015, over 33,000 tourists (all of them nationals) visited the archaeological site, a large number of visitors considering the size of the village and its population. This is in line with the gradual increase in the number of tourists and consequently, with the rise in the number of enterprises that have been

set up throughout the 15 years that the cultural heritage endeavours have been carried out, as can be seen in the following figures:

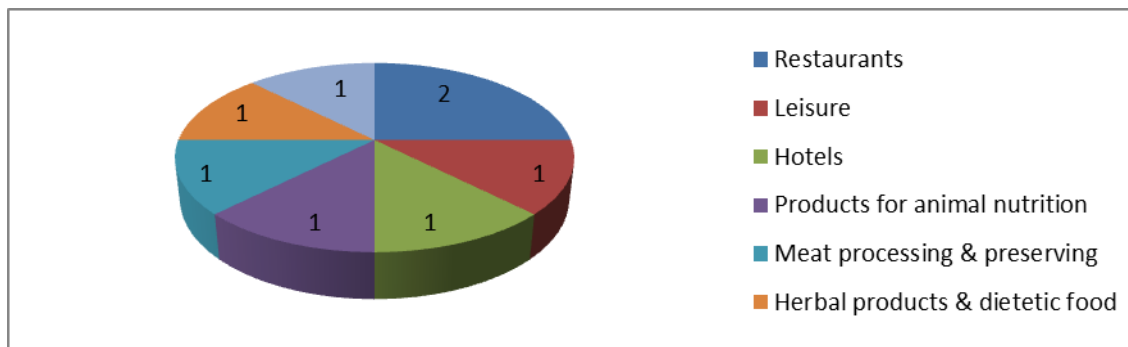


Figure 1 Number of enterprises before the year 2000

Although the above numbers may resemble too small, one cannot ignore the size of the village and its inhabitants. The most important companies deal with food and nutrition and have been in operation for over 35 years, which is only natural as the pillar of the economy had always been agriculture and livestock. However, there is a spectacular shift towards the creation of new small businesses from the year 2000:

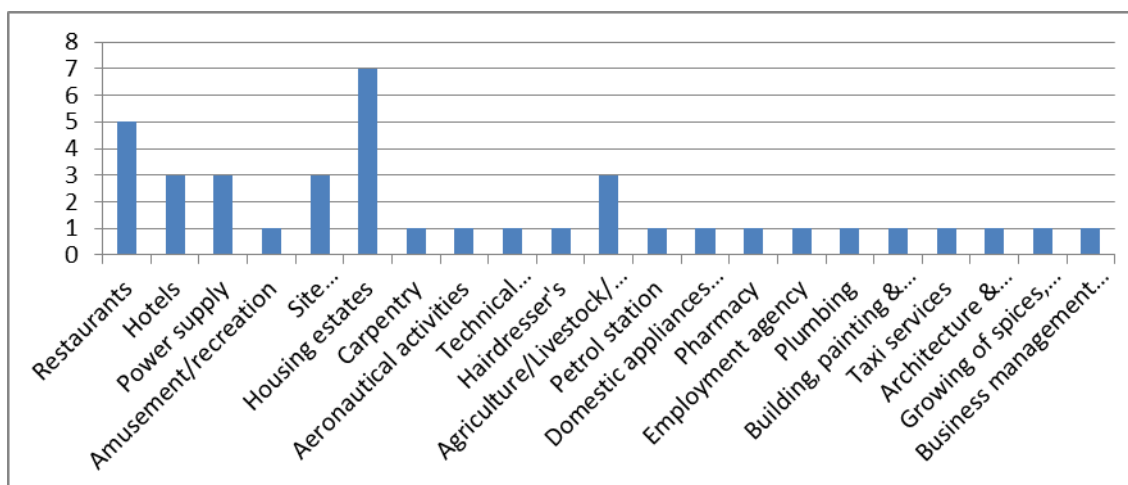


Figure 2 Number of enterprises after the year 2000

It is worth noting that altogether there are four new companies focusing on various aspects of the archaeological site, from amusement and recreation activities, particularly for children, to the marketing and advertising of the historical recreations; and also, a focus on social, economic, environmental, and ethnographic development as well as the conservation of the cultural heritage itself. Likewise, there are four new businesses related to agriculture & livestock but, differing from the past, these are now owned by young local people who finished their university studies and decided to come back to their roots and stamp a seal of technical innovation to these ancestral occupations. Furthermore, it is noteworthy the number of estate agents to cater particularly for those tourists who want to rent some rural accommodation for their holidays and also, the rise in service businesses that have been created to meet the needs of the visitors to the village.

Such a success always results in contributions from both public and private bodies and in this sense, the regional government has recently provisioned an important sum of money to the improvement of the archaeological site itself: new toilets for visitors; adapting the site to

make it more accessible for the physical disabled; and a new electric installation, lighting and sign-posting in order to better inform the visitor. Therefore, higher added value has been attached to the community again.

Besides, there was a clear growth in the community's demography as a direct consequence of the increase in the number of visitors to the village. This is due to their significant expenditure in the various businesses that started up in the wake of this new development which therefore, opened new chances to the villagers. This evolution can be seen in figure 3 where an analysis of the population census is made from the year 2000 up to 2016 (data has always been collected on January 1st of every year).

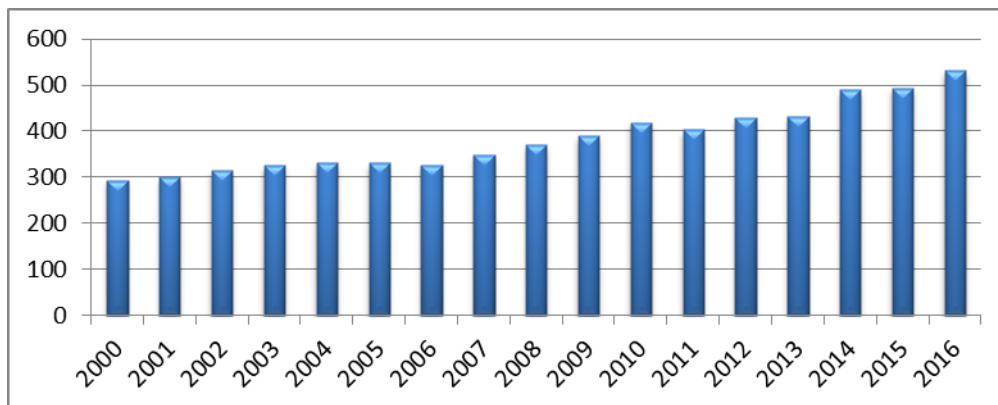


Figure 3 Population evolution, 2000-2016

It is worth noting that since 2000 the village's population has almost doubled, which is in accordance with the above considerations.

Finally, but most importantly, there is no doubt the villagers' altruistic contribution, vigour and willingness have made this tourist – and hence, economic – development a reality. As Obonyo & Fawaya (2012) claim, when local communities focus on their cultural heritage products, many rural issues such as service delivery, education and training, planning, or management may be supported. However, without a full participation of all the tourism stakeholders, it is not feasible to ensure that the products on offer are unique from other tourism products that may be found in the rest of the country. In the case of Garray, this was also crucial to the implementation of the various activities related to the archaeological site and thus, firstly, both the local town hall and the regional government offered their support and funds to develop a number of initiatives; and secondly, the business community in the region also granted some support and funds in the form of sponsorships. Thanks to their involvement, both the archaeological site and the village itself are being enhanced and renovated – which increases the attractiveness of the area – and also, special events and festivals related to the Celtiberian culture have been developed. It is worth noting here that what really matters to the local community is product quality and not product variety. They believe this is a crucial factor for maximizing the tourist's experience and consequently, for the sustainability of the events and businesses all year round. By focusing on authenticity and quality of the product, the community can establish itself as a unique tourist destination. Moreover, this can also lead to avoiding seasonality.

As rural tourism is a way of making the rural community participate in enterprises that require a local ownership, and even the management of tourism facilities (Viljoen & Tlabela, 2007), a non-for-profit association was founded by the villagers in 2003 aiming to promote the Celtiberian heritage and the local community itself. This initiative has meant the recovery and

culmination of the Celtiberian heritage that had been somewhat consigned to oblivion due to a number of social, economic, and political factors.

2.4 Outcomes of the community initiative

As mentioned above, a foremost outcome has been the increase in the number of SMEs in the village and surrounding area which consequently, has led to a reduction of the unemployment rates in this particular rural environment. Therefore, by having their lifestyle secured, villagers could happily turn towards the collaboration in all the actions brought about by their cultural association. They have not only brought to life an important episode of their own history but have also contributed to the development of the state of affairs concerning the cultural heritage itself by creating a Scientific Committee within the association whose role it is:

- a. To develop further the research on the Celtiberian history in the site itself. Experts on the subject as well as archaeology students from prestigious universities in Spain and abroad participate every year in the scientific study programmes that are carried out in the site of Numantia.
- b. To participate in workshops, conferences and the like so as to make people aware of the Celtiberian heritage. And as a result, the aim to draw potential tourists' attention towards the local community is also achieved.
- c. To exploit the traditional craft and artistic skills of the Celtiberians. Since these products are a symbol of the local culture, they have a large added value. Moreover, through this kind of initiatives they are recovered from a very likely abandonment, as is the tendency on many occasions in rural areas, unfortunately.
- d. To programme courses for both adults and particularly, children on the various issues concerning the Celtiberian culture, such as customs, garments, religion, art, among others. Likewise, the association visits schools in order to teach children their own heritage. All the courses are open and free for any person interested in this cultural heritage.
- e. To ensure the different activities carried out by the association are scientifically accurate. As far as cultural heritage tourism is concerned, tourists want to experience other cultures and learn about the past but it is fundamental not to forget that they are not necessarily specialists in the subject and consequently, they should be presented with an experience they are eager to enjoy in depth. Bearing this in mind, the association has developed a number of actions throughout the years:
 - Exhibitions in the village on the ancient Celtiberian and Roman daily lives.
 - Gastronomic days on the specific Celtiberian cuisine.
 - Participation in both national and international tourism fairs.
 - Collaboration with other Celtiberian/Iberian and Roman associations in their activities throughout the country.
 - The opening of a heritage and interpretative centre in the village. The old school building that hadn't been in use for years was renovated and turned into an interactive space where visitors can have their first experience on the Numantian

history before walking up the hill towards the site, and which has also become a valuable tourist centre for promoting the whole region.

- An annual performance outdoors by the Celtiberian remains. This performance has been done since 1999 when some of the villagers decided to take the risk and invited everyone in the region to attend. As it was a tremendous success, all the war episodes between the Numantians and the Romans have been staged since then once a year (end of July or beginning of August). At first, seats were arranged by one of the walls in the actual site. However, due to the increasing numbers of people attending these performances and consequently, the risk to damage the archaeological site, the association decided to build an open-air theatre just a few metres from the site but still on the very hill where Numantia was built. This way the public can still feel they are experiencing the historic episode in the actual historic place and too, the village has its own cultural venue.
- f. To work on the possibility to turn this important part of the Spanish cultural heritage into a film. Both a Hollywood and a Spanish film producer have shown an interest to put on film the history of Numantia.

These are only some examples of the actions carried out by the members of the association, i.e. by the local community villagers. By implementing all these cultural events – which are entirely free for the visitors, except for the visit to the archaeological site –, the whole population has become involved in the process of the local development. Furthermore, by combining those cultural programmes with gastronomic events, they have clearly aimed to increase the village's appeal and as a result, to encourage prolonged stays, thus contributing to the economy of the small rural hotels and restaurants scattered throughout the village. It is not surprising then that last year the association signed an agreement with the village's town hall and the regional government by which the association is responsible for the management of the guided tours in Numantia, returning the profits directly towards the enhancement of the archaeological site itself. Undoubtedly, it is a great recognition towards the local community's effort and stamina to go ahead.

3. Conclusions

In deprived rural areas that have the privilege of belonging to a rich cultural heritage, it is necessary to go for the encouragement of imagination and innovation and thus, creativity. The relics have always been there but in order to achieve a benefit from them, it is only the human factor that counts.

Surely, the human factor is not enough if all the stakeholders are not involved. In the case presented here, the active involvement of public bodies (the local town hall and the regional government), together with the regional business network, brought about an added value to this initiative and contributed to its success in terms of visitors to the site and economic development of the village.

However, the greatest success can be observed in the local community itself through:

- a. the creation of a spirit of cooperation and common goals within the community
- b. a re-invention of the sense of community
- c. an engagement of small enterprises in the tourist development

- d. the fact that more income has stayed locally by means of accommodation and restaurants; and also, by the fostering of crafts related to the ancient traditions of the Celtiberian heritage as well as of local products from agriculture and livestock.

However, it cannot be overlooked that this kind of initiatives involves the significant risk of on the one hand, overcrowding the experience with high numbers of tourists since this experience may turn into a nightmare and so, achieve the opposite effect to tourist attraction; and on the other, the relics, the sites, etc., may become the victims of their own success because serious damage can be inflicted on the remains which consequently, may endanger the cultural heritage of the community. Once again, this would derive in a decrease in the number of potential tourists already in the short term. Therefore, preservation is a must and this is particularly the main objective of the cultural Association that was created by the members of the small village regarding the Numantia archaeological site.

The fact that this community has managed to succeed is precisely due to their concern on the protection of their cultural heritage both tangibly (i.e. the remains themselves) and intangibly (i.e. the value of their historic past and roots). Not surprisingly, their effort has been rewarded both by the public, through the increase in the number of visitors; by the stakeholders, who believed in the community's initiative and supported them; and other organizations such as, TripAdvisor that has awarded the site of Numantia a Certificate of Excellence.

But surely the most important issue is that all of this simply started thanks to a very small group of villagers who had a vision and the courage to develop it much further.

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Virtualna stvarnost u marketingu

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Sažetak: Virtualna stvarnost (VR) posebno je okruženje koje simulira fizičku prisutnost u mjestima u stvarnom ili zamišljenom svijetu na računalu. VR tehnologija se prije svega počela primjenjivati na području kulturne baštine i arheologije, a danas se njezina primjena proširila na skoro sva područja, od znanstvene fantastike, likovne umjetnosti, video igrice, glazbe, zdravstva, sportskih treninga i obrazovanja, a posebno marketinga na što ćemo i staviti naglasak u ovome radu. Već je razvojem prvih računala čovjek pokušavao stvoriti virtualnu sliku svijeta koju bi na jednak način, kao i stvarni svijet, mogao doživjeti svim svojim osjetilima i u kojem bi mogao svojom virtualnom prisutnošću sudjelovati u procesima koji ga mijenjaju i oblikuju. Uređaji koji se koriste za virtualnu stvarnost su između ostalih uređaji za percepciju, tzv. izlazni, jer im računalo šalje generirane informacije o slici, zvuku, sili, mirisu, temperaturi te svemu onome što čovjek u stvarnom svijetu percipira, a sama svrha tih uređaja je pretvoriti dobivene informacije u oblik koji je prilagođen ljudskim osjetilima. Uređaji za interakciju ili ulazni uređaji, šalju računalu pretvorene informacije o ljudskim pokretima, ljudskom govoru, pulsu i slično. Svi se uređaji nastoje što bolje objediniti u jedan virtualni sustav kako bi čovjek što potpunije percipirao i ostvario interakciju sa stvarima u virtualnom svijetu. Ciljevi autora rada bili su, između ostalog, naglasiti da se virtualna stvarnost, koja će svoj boom tek doživjeti do kraja ove 2016. godine, može i mora koristiti kao jedan od najmoćnijih marketinških alata u budućnosti koja dolazi nikad brže.

Ključne riječi: *virtualna stvarnost, digitalni marketing, tehnološka podrška, VR marketinške kampanje*

1. Uvod

Virtualna stvarnost (eng. Virtual Reality) računalno je simulirano okruženje koje može simulirati fizičku prisutnost u mjestima u stvarnom svijetu ili u zamišljenim svjetovima. Virtualna stvarnost stvara trodimenzionalnu sliku koja okružuje korisnika i time mu daje potpuni doživljaj nekog mjesta ili situacije. Ona je oblik računalne simulacije u kojoj se korisnik osjeća kao da se nalazi u umjetnom okruženju. Tako primjerice korisnik može gledati kroz dva malena monitora (po jedan za svako oko). Senzori tada detektiraju kretanje glave ili položaj tijela, što za posljedicu ima promjenu virtualnog promatranja položaja. Korisnik može unositi podatke rukavicama (*datagloves*). Te rukavice su opremljene senzorima koji omogućuju korisniku podići ili pomaknuti virtualni objekti u simuliranoj okolini. Vide

virtualni svijet i dijelove svojeg tijela (ruke, tijelo, i sl.) kao dio virtualnog svijeta pomoću elektroničke opreme (rukavice, kaciga, odjeća, i drugo).

Ugledna kompanija Deloitte predviđa da će virtualna stvarnost u 2016. godini zaraditi svojih prvih milijardu dolara, od čega oko 700 milijuna dolara od prodaje hardverske opreme, a ostatak od prodaje nehardverskog sadržaja. Petnaesto izdanje *Predviđanja u sektoru tehnologije, medija i telekomunikacija* procjenjuje prodaju oko 2,5 milijuna primjeraka VR headsetova te igara u 10 milijuna primjeraka. Uz to, očekuje se da će na virtualnu stvarnost najviše novca utrošiti glavni korisnici, a ne povremeni igrači. To znači da će segment virtualne stvarnosti, premda će se svatko tko ima pametni telefon okušati u nekoj od inačica virtualne stvarnosti, većinu svojih prihoda u 2016. godini najvjerojatnije ostvariti od desetaka milijuna, a ne milijardi korisnika.¹

Virtualna stvarnost u posljednje je vrijeme glavna tema u javnosti i medijima, što i ne čudi, s obzirom na to da tehnologija koja se nekad viđala uglavnom u SF filmovima polako, ali sigurno postaje dio naše svakodnevice (Jelaska, D, Lovrić, I. i Jukić, I., 2014). Zato su zaslužne kompanije poput Facebooka, Oculus, Samsunga ili HTC-a koje ulažu sve napore da populariziraju i komercijaliziraju tehnologije virtualne stvarnosti. Međutim, ideja virtualne stvarnosti i nije toliko nova jer se na raznim konceptima i prototipovima počelo raditi i prije nego što su računala postala dio svakoga doma. U nastavku teksta autori rada opisuju nastanak pojma i primjenu virtualne stvarnosti.

2. Povijest virtualne stvarnosti

Kako bi se pobliže pojasnila virtualna stvarnost i njen utjecaj na stvarni svijet, u nastavku su nabrojani najvažniji događaji koji su prethodili virtualnoj stvarnosti kakvu danas poznajemo:

- Godine 1935. pisac SF-a Stanley G. Weinbaum objavljuje kratku priču *Pygmalion's Spectacles* u kojoj razvija ideju virtualne stvarnosti kojoj se pristupa korištenjem posebnih naočala.
- Godine 1957. filmaš i inovator Morton Hellig razvija Sensoramu, tada iznimno napredan simulator 3D slika, zvuka i mirisa.
- Godine 1961. kompanija Philco Corp. predstavlja projekt *Headsight* – kacigu s ugrađenim ekranom i sustavom praćenja pokreta, namijenjenu za vojne treninge.
- Godine 1968. računalni stručnjaci Ivan Sutherland i Bob Sproull stvaraju “Damoklov mač” – naglavni uređaj za virtualnu stvarnost spojen na računalo. Naravno, uređaj je u ono vrijeme mogao prikazivati tek jednostavnu računalnu grafiku.
- Godine 1978. znanstvenici s MIT-a razvijaju interaktivnu mapu grada Aspena, pod nazivom *Aspen Movie Map*. Riječ je o svojevrsnoj preteči Google Street Viewa.
- Godine 1982. virtualna stvarnost postaje tema zanimljiva i Hollywoodu, a rezultat je visokobudžetni uradak *Tron* koji se pamti po pionirskoj upotrebi 3D računalne animacije.
- Godine 1984. William Gibson objavljuje roman *Neuromancer*, čija se radnja velikim dijelom odvija u *cyberspaceu*, odnosno računalno kreiranoj stvarnosti. Zahvaljujući Gibsonu i ostalim žanrovskim piscima, cyberpunk estetika postaje jedno od obilježja kulture osamdesetih i ranih devedesetih.
- Godine 1987. pojam “virtualna stvarnost” ulazi u svakodnevnu upotrebu, a njegov nastanak pripisuje se računalnom znanstveniku, piscu i umjetniku Jaronu Lanieru (neki izvori pak tvrde kako je samo popularizirao već postojeći naziv).

¹ Podaci preuzeti s internetske stranice kompanije Deloitte: <http://www2.deloitte.com/hr/hr/pages/press/articles/tmt-prediction-2016.html> (03/2016)

- Godine 1991. Kompanija Virtuality Group lansirala nekoliko videoigara koje su se mogle igrati uz pomoć posebnih naočala i povezanih kontrolera.
- Godine 1993. Sega predstavlja svoje naočale za virtualnu stvarnost, međutim, sve je ostalo u fazi prototipa.
- Godine 1995. Nintendo lansirala 3D igrači sustav Virtual Boy koji ubrzo doživljava komercijalnu propast na tržištu.
- Godine 1999. SF film Matrix veliko je iznenađenje u svjetskim kinima, a zahvaljujući njemu koncept virtualne stvarnosti postaje neizostavan dio masovne pop-kulture.
- Godine 2011. Google razvija prototip svojih naočala za proširenu stvarnost – Google Glass.²
- Godine 2012. Startup Oculus VR razvija sustav i naočale za virtualnu stvarnost Oculus Rift te pokreće Kickstarter kampanju za financiranje projekta.
- Godine 2014. Facebook kupuje Oculus VR za dvije milijarde dolara. Iste godine Google razvija jednostavno rješenje za virtualnu stvarnost – Cardboard. Riječ je o jeftinom kartonskom “headseatu” s lećama koji se u kombinaciji s pametnim telefonom i pripadajućom aplikacijom pretvara u naočale za virtualnu stvarnost.
- Godine 2015. u suradnji s Oculusom, Samsung razvija uređaj za virtualnu stvarnost Gear VR, kompatibilan sa Samsungovim pametnim telefonima. Istodobno, konkurentski HTC predstavlja svoj virtualni sustav HTC Vive.
- Godine 2016. Samsung na Mobile World Congressu u Barceloni predstavlja nove modele svojih mobitela (Galaxy S7) i najavljuje kako će uz prednarudžbe darivati Gear VR uređaje. U Barceloni se neočekivano pojavljuje i vlasnik Facebooka Mark Zuckerberg koji u svome govoru najavljuje svijetlu budućnost virtualne stvarnosti.³

3. Tehnološka podrška virtualnoj stvarnosti

Najčešće krajnji korisnici nisu ni svjesni koliko je tehnološka podrška značajna kao podloga za razvoj virtualne stvarnosti jer oni u konačnici uživaju isključivo u krajnjem sadržaju. U ovom dijelu rada navest će se određena tehnološka rješenja, nužna za postizanje virtualne stvarnosti. Kako bi korisnici doživjeli virtualnu stvarnost za početak su vam dovoljne naočale namijenjene generiranju virtualne stvarnosti i slušalice kako bi se što bolje doživjela određena simulacija. Tehnologija se razvija pa se tako za još bolji doživljaj mogu koristiti rukavice ili čak cijela odijela.⁴

Ulazni uređaji:

- senzori pozicije/orijentacije (engl. *tracker*) - elektromagnetski, akustički, optički, mehanički, inercijski
- senzori sile/momenta sile - Spaceball i sl.
- senzori položaja tijela / ruke - DataGlove, BodySuit
- senzori pokreta - pokretna traka, bicikl ...
- ostalo - upravljanje putem disanja, slijeđenje lica, očiju.

Izlazni uređaji:

- vizualni izlazni uređaji - zaslon na glavi (HMD) - stereo ekrani - projekcijski sustavi
- zvuk
- haptički izlazni uređaji - taktilni izlazni uređaji - uređaji za povrat sile - pomične platforme
- ostalo < miris, vjetar, toplina.

² Primjer 3D modeliranja može se vidjeti na: <https://www.youtube.com/watch?v=e37Qmdcc-E> (prosinac, 2015.)

³ Preuzeto sa internetske stranice: <http://www.planb.hr/mali-vodic-kroz-povijest-virtualne-stvarnosti/> (veljača, 2016.)

U nastavku će se nabrojati nekoliko uređaja za virtualnu stvarnost koji su već na tržištu ili se tek trebaju pojaviti.

Oculus Rift trenutno je u Development Kit 2 fazi razvoja, s rezolucijom ekrana od 1920×1080 piksela (960×1080 po jednom oku) i brzinom osvježavanja od 90 Hz te senzorima za praćenje pokreta glave sa „6DOF“ (6 degrees of freedom) – detekcijom pokreta u svim smjerovima. Kako je u uređaju ekran koji se gleda na nekoliko centimetara razmaka od očiju, vrlo je bitno da je taj ekran visoke razlučivosti što pridonosi realnosti prikaza slike. Završna verzija za krajnje korisnike će tako imati još višu rezoluciju – 2160×1200 piksela (1080×1200 po svakom oku). Na računalo će se spajati preko DVI/HDMI i USB sučelja. Očekivani izlazak ovog uređaja na tržište je u prvom kvartalu 2016.⁵

HTC Vive: za razliku od Oculus Rifta ne koristi jedan ekran podijeljen na dva dijela, već dva zasebna ekrana rezolucije 1920×1080 piksela i brzinom osvježavanja od 90 Hz za svako oko. S razvojem su otišli korak dalje od Oculus Rifta te su razvili i dva uređaja za praćenje pokreta ruku koji se drže u šaci. Također dolazi sa dvije laserske bazne stanice koje postavljene na dva kraja sobe mogu prostorno pratiti pokrete osobe, u prostoru oko 20 metara kvadratnih. Ovaj uređaj ukupno koristi preko 70 senzora za praćenje pokreta.

Project Morpheus je Sonyjev VR headset. Moći će se koristiti isključivo s igračom konzolom PlayStation 4. Sonyjev Project Morpheus koristi ekran manje rezolucije od svojih konkurenata, 1920×1080 piksela (960×1080 po jednom oku), ali s brzinom osvježavanja od 120 Hz. Također će imati dva uređaja za praćenje pokreta ruku u kombinaciji s već dostupnim uređajem PS Eye, slično kao i HTC Vive. Planirani izlazak je u prvom kvartalu 2016. godine.

HoloLens - Microsoft je u siječnju predstavio HoloLens, impresivni uređaj virtualne stvarnosti. HoloLens izgleda puno elegantnije od Oculus Rifta. HoloLens bi u verziji za developere trebao doći na tržište u prvoj polovici 2016. godine.

Jump VR - Google je lansirao novu vrstu kamere za snimanje videa u virtualnoj stvarnosti. Jump uključuje 16 kamera poredanih u krug što omogućuje snimanje iz različitih perspektiva. Softver zatim pretvara snimke u 3D video.

Google Cardboard - Googleov kartonski uređaj za virtualnu stvarnost omogućuje svima da na jednostavan, zabavan i jeftin način iskuse virtualnu stvarnost.⁶

4. Marketinška primjena VR u praksi

Tehnologija virtualne stvarnosti se u svojim počecima primjenjivala na području baštine i arheologije, a danas se njezina primjena proširila na područja znanstvene fantastike, likovne umjetnosti, video igara, glazbenog svijeta, terapija, treninga, a i na područje obrazovanja.

Virtualna stvarnost otvara stručnjacima za marketing nova vrata za plasiranje sadržaja njihovim korisnicima. Izvrсна je platforma za kompanije u smislu prenošenja željenih poruka svojim ciljnim skupinama korisnika. Osim što će potrošačima pružiti jedinstveno iskustvo doživljaja proizvoda i usluga, virtualna stvarnost također ima velik potencijal u podršci i jačanju prodaje poduzeća. Slučaj je to, primjerice, kod prodaje turističkih aranžmana gdje, u usporedbi s brošurom ili web stranicom, potencijalnim korisnicima pruža znatno bolji doživljaj avanture u koju se upuštaju. Uz podršku prodaji, za virtualnu stvarnost navodi se

⁵ Primjer upotrebe Oculus Rift uređaja moguće je vidjeti na: <https://www.youtube.com/watch?v=JQvFidopZug> (veljača, 2016.)

⁶ Prvi pokušaj bile su Google naočale te se one i dalje razvijaju, a iz Google-a su se odlučili na suradnju sa Luxxoticom, kompanijom koja stoji iza brandova Oakley i Ray Ban. Googleovo partnerstvo naziva se "strateškom suradnjom u dizajniranju, razvoju i distribuciji Glass naočala" te obećava kako će korisnicima ponuditi gadget koji će biti nešto između high-fashiona, lifestylea i inovativne tehnologije (Google+, 2014). S obzirom da Luxxotica posjeduje 5.000 vlastitih prodajnih mjesta i distribucijskih kanala širom svijeta, da se primijetiti namjera Googlea da se Google Glass ne prodaje samo u trgovinama s tehničkom robom, već i u dućanima koji drže naočale najpopularnijih brandova. To bi im trebalo predstavljati garanciju da pametne naočale neće kupovati samo „techno freakovi“ već da postanu prestižni modni detalj s dodatkom visoke tehnologije.

kako veoma velik potencijal ima i u edukaciji potrošača o proizvodu ili usluzi, prenošenju iskustva različitih događanja, maloprodaji, regrutaciji i zapošljavanju te istraživanju tržišta (Jelaska, D, Lovrić, I. i Jukić, I., 2014).

4.1. Marketinške kampanje uz pomoć virtualne stvarnosti

Marketinške kampanje uz pomoć virtualne stvarnosti koriste se u različitim industrijskim sektorima, ali svima je zajedničko da su stvorili uzbudljive načine na koji korisnici mogu komunicirati s omiljenim brendovima. VR pomaže u rješavanju niza problema koje marketinški stručnjaci imaju oko angažmana i svijesti iz sljedećih razloga:

Interaktivnost - korisnici koji nose slušalice su potpuno uronjeni u sadržaj, a to znači manje ometanja i više pažnje na poruke.

Dojmljivost - intenzitet iskustva VR-a je veći nego kod tradicionalnih medija, stvarajući snažne emocije u korisnicima koji su vezani na stvarne promjene u ponašanju.

Pamtljivost - naši mozgovi su izgrađeni tako da zapamte događaje povezane s mjestima, to znači da iskustvo VR-a ima dublji trag u sjećanju publike.

U nastavku, autori su odabrali neke od najupečatljivijih i najuspješnijih primjera virtualne stvarnosti u marketingu.⁷

Marriott – The Teleporter

Kompanije Framestore VR Studio i Relevant udružile su se s tvrtkom Marriott kako bi stvorili jedinstveno iskustvo teleportacija za široke mase. Framestore VR Studio napravio je "revolucionarno 4D turističko iskustvo za Hotele Marriott, koje vas prvo teleportira u hotel Marriott, a zatim na plažu na Havajima." Unutar konstrukcije koja sliči na telefonsku govornicu, koristi se Oculus Rift, grijači i mlaznice vjetra kako bi se korisnike povelu na izlet do Havaja i Londona. Iako to nije sasvim isto kao i zapravo biti tamo, moglo bi pomoći da se korisnici odluče o odabiru budućih putovanja. Također je pomoglo hotelima Marriott da se pozicioniraju kao relevantan brend na tržištu turističkih usluga.

Merrell - Trailscape

Ova kampanja je bila usmjerena na podršku lansiranju nove čizme za planinarenje - Capra. Merrell je stvorio VR iskustvo pod nazivom *Trailscape* koje vas vodi na opasno pješčenje planinama. Sudionici hodaju po pozornici koja je ucrtana na virtualnu mapu kako bi se stvorila nova razina interaktivnosti. Tehnologija *motioncapture* dozvoljava pustolovima istražiti planinu, s taktilnim elementima poput šetnje užetom i nestabilnim drvenim mostovima što čini ovu kampanju jednom od najvažnijih i najupečatljivijih VR iskustava do sada. Prikazana je prvi puta na Sundance Film Festivalu, 2015. godine, a zamisao je kompanije Merrell, agencije Hill Holliday i Framestore VR Studija.

Ujedno je i prva komercijalna upotreba "*walk around*" virtualne stvarnosti u kojoj korisnici istražuju virtualni svijet šetnjom.

Patron – The Art of Patron

Može se učiniti da kompanija koja se bavi proizvodnjom tekile i nije očigledan korisnik VR marketinške strategije, ali kompanija Patron koristi moć VR-a da ispriča zanimljivu priču oko svojih proizvoda. Koristeći mješavinu žive akcije i računalne grafike, stvorili su 3D iskustvo životnog ciklusa proizvoda, od polja agave, što je glavna sirovina za proizvodnju tekile, do posluživanja gotovog proizvoda na glamuroznoj zabavi. Cjelokupna produkcija trajala je šest mjeseci, a razvijena je od strane kreativne agencije Firstborn, postprodukcije agencije Legend i agencije za dizajn zvuka Antfood. Kad Patron radi događaje, donose virtualnu stvarnost te pokazuju publici čitav proces proizvodnje i distribucije. U kampanji korišten je binauralni (3D) zvuk te po mjeri napravljen dron s pripadajućom GoPro kamerom.

⁷ Preuzeto s internetske stranice: <http://www.mbryonic.com/best-vr/> (veljača, 2016.)

Volvo – XC90 TestDrive

Test vožnja automobilom uz pomoć virtualne stvarnosti itekako ima smisla ako nemate distributera automobila u neposrednoj blizini. Sjajno je vidjeti da je Volvo napravio aplikaciju za podršku lansiranju svojeg modela automobila XC90 SUV. VR vas stavlja u kokpit automobila i vodi vas na idiličnu vožnju kroz zemlju. Iako je većina korisnika primijetila da je iskustvo malčice nestvarno i netočno, svi su bili oduševljeni idejom. Ova kampanja je također odrađena od strane Framestore VR Studija.

Immersive VR – Apollo 11 Mission

Apollo 11 je kulna svemirska misija iz 1969. godine, kada je prvi čovjek stupio nogom na Mjesec. Kompanija Immersive VR Education odlučila je educirati entuzijaste te ponovno stvoriti taj događaj u virtualnoj stvarnosti pod istim imenom. Korisnici su mogli osjetiti kako je to biti astronaut.⁸

Sir Paul McCartney – LiveConcert

Kompanija Jaunt producirala je video zapis, posebnom 360 tehnologijom, koncerta Sir Paul McCartneyja u Candlestick parku. Aplikacija se može preuzeti na iOS ili Androidu te doživjeti događaj. Ova aplikacija instalirana je na više od 500.000 mobilnih uređaja.

TopShop – Catwalk Experience

Ovaj primjer kampanje je malo stariji, ali je toliko bio uspješan da ga se mora spomenuti u ovom radu. TopShop ponudio je javnosti jedinstveni pogled na prednji red njihove ekskluzivne modne piste tijekom London Fashion Weeka pomoću panoramskog video streama s 360 tehnologijom. Sretni dobitnici su doživjeli ovo iskustvo u posebnom pop-up prostoru u najvećoj i najpoznatijoj trgovini kompanije TopShop u Londonu. Kao bonus, korisnik može pronaći dodatne scene snimke iz backstagea te tako doživjeti potpuno iskustvo ovog modnog događaja. Ovo iskustvo stvoreno je od strane London VR studija Initium. Ova kampanja osvojila je nagradu za projekt godine na BT Retail Week Technology Awards 2014. godine te također Najbolji Hybrid Event/Najbolji virtualni događaj na Event Tech Awards 2014. godine.⁹

New York Times – Displaced

Jedan od socijalno osviještenih primjera marketinga i VR-a je onaj iz kampanje New York Timesa. Rat je raselio 30 milijuna djece iz njihovih domova. The New York Times ispričao je te tragične priče u upečatljivom dokumentarcu koji je dostupan za preuzimanje kao mobilna aplikacija te putem Google Cardboarda. Ovo nije bila tipična marketinška kampanja, ali je New York Times pomogao u distribuciji milijun besplatnih Google Cardboarda svojim čitateljima, a ta vijest bila je vijest mjeseca na skoro svim relevantnim portalima i medijima. Ovu kampanju i aplikaciju stvorio je Vrse.works studio te se smatra jednom od njihovih najvećih uspješnica.

5. Ostale primjene VR-a

Moguća područja primjene virtualne stvarnosti, osim kao marketinškog alata su:

- Proizvodnja i održavanje

Najvažniji primjer primjene virtualne stvarnosti u procesu proizvodnje jest da se vizualne instrukcije prikazuju direktno na opremi ili strojevima, te da operater ne mora proučavati upute jer ima sve potrebne informacije na pravom mjestu i pravo vrijeme. prikazuje motor s virtualnim oznakama dijelova. Kada korisnik obilazi motor oznake s nazivom tog dijela i osnovnom funkcijom pojavljuje na svim vidljivim dijelovima.¹⁰

⁸ Primjer ove kampanje se može pogledati na: <https://www.youtube.com/watch?v=nOHM8gnin8Y> (ožujak, 2016)

⁹ Primjer ove kampanje se može pogledati na: <https://www.youtube.com/watch?v=c8jSlq8Tqlc> (ožujak, 2016)

¹⁰ Podaci preuzeti s internetske stranice: <http://www.tportal.hr/gadgeterijska-tehnologija/376633/Virtualna-i-prosirena-stvarnost-vrijedit-ce-milijarde-dolara.html> (ožujak, 2016.)

- Zdravstvo

Virtualna stvarnost se već neko vrijeme koristi u raznim medicinskim terapijama. Psihijatri na Sveučilištu u Louisvilleu primjerice koriste VR u kognitivno-bihevioralnoj terapiji ponašanja kako bi liječili osobe koje pate od socijalne anksioznosti, straha od letenja, govora u javnosti ili visine. Kontrolirana okolina omogućava liječnicima da pacijente izlože simulacijama i nauče ih kako da se na pravi način nose sa svojim strahovima. Osim toga, medicinski časopis *Frontiers in Neuroscience* objavio je prošle godine studiju o korištenju virtualne stvarnosti u liječenju fantomske boli u nozi ili ruci kod ljudi koji su ostali bez jednog uda. Terapija se sastoji u korištenju senzora koji hvataju informacije iz živčanih stanica u mozgu, a pacijenti kontroliraju virtualni ud. Ako pacijent osjeća kao da mu netko steže šaku, dok gleda virtualnu šaku koju sam kontrolira uči kako opustiti svoju šaku.

Virtualna stvarnost se ostvaruje tako da se medicinske slike preklapaju s pacijentom, čime se dobiva vrsta virtualnog rendgena u stvarnom vremenu. Dobiva se takav efekt da liječnik vidi organe pacijenta kao da je tijelo prozirno. Najčešće se primjenjuje u kirurgiji, prilikom planiranja ili izvedbe zahvata. Budući da je za ostvarenje takvih primjena proširene stvarnosti potrebna izuzetna preciznost, one za sada još nisu u širokoj uporabi.

- Zabava

Zabava će vjerojatno biti jedan od prvih i najboljih primjera promjene koju će virtualna stvarnost donijeti. Primjerice aplikacija kao što je Oculus Cinema omogućava korisnicima gledanje filma koji je na raspolaganju samo njima. Ukoliko pak ne vole glasnu glazbu i bučnu publiku, osobe mogu pratiti koncert uz pomoć virtualne stvarnosti. Mogu primjerice slušati Eltona Johna i osjećati se kao da sjede pored njegova klavira ili zvučnika dok on izvodi "*Candle in the wind*" u svojoj VR aplikaciji.

- Automobilska industrija

Kompanija Ford već koristi virtualnu stvarnost u svom laboratoriju za uživanje kako bi pružila osjećaj koji ima kupac u svom novom automobilu. Pritom koristi uređaj *Oculus Rift* kako bi osobi omogućila pogled na interijer i eksterijer automobila. Također je razvila alate koji će biti korišteni u VR iskustvu razgledavanja automobila u mraku. To je vrlo korisno jer Ford može brže raditi na razvoju proizvoda bez čekanja na fizički prototip novog modela. I Audi će koristiti virtualnu stvarnost kako bi potencijalnim kupcima automobila pružio dubinski pogled na automobile.

Toyota je koristila virtualnu stvarnost u sklopu svoje kampanje *TeenDrive365* kako bi educirala tinejdžere i roditelje o dekoncentraciji u vožnji. Simulator dekoncentracije u vožnji uključuje senzore koji prevode ono što korisnik čini s pedalama ili volanom u simulaciju te uključuje odvlačenje pažnje poput zvonjave mobitela i brbljavih prijatelja na stražnjem sjedalu.

- Obrazovanje

U učenju se uvelike može koristiti VR - postoji potencijal za obuku gotovo svih stručnjaka - od mehaničara do kirurga. Za mlade učenike virtualna stvarnost u učionici može podrazumijevati virtualne izlete, igre u koje je potrebno udubiti se, a VR iskustva mogu biti korisna čak i djeci s posebnim potrebama uz pomoć kojih im je učenje maksimalno prilagođeno.

- Turizam

Kompanija Destination British Columbia lansirala je VR iskustvo pod nazivom *The Wild Within*, koje nudi dvije opcije - vožnju brodicom i planinarenje tom kanadskom pokrajinom. U promocijskom videu za aplikaciju, menadžer za marketinški razvoj turističke tvrtke Destination British Columbia tvrdi da ona pomaže putniku koji razmišlja o posjetu toj destinaciji.

- Vojska i policija

Nedavno je britanska vlada objavila da će koristiti *Oculus Rift* u obuci medicinskog osoblja za liječenje ozljeda zadobivenih u bitkama. Druga vojna korištenja VR-a predstavljaju simulacije koje uče pripadnike vojske ponašanju s eksplozivnim napravama - a simulacije poput tih mogu biti ponovljene - iz grešaka se ovdje može učiti.

6. Zaključak

Virtualna stvarnost nesumnjivo je budućnost marketinga, no unatoč velikom porastu oglašavanja na internetu i mobilnim uređajima, kao i tvrdnjama o umiranju tiskanih uređaja i klasične televizije, prema većini istraživanja upravo su potonji mediji na kojima se još uvijek najviše troši na oglašavanje. Virtualna stvarnost bi mogla, predviđaju vodeći japanski znanstvenici, postati najjači medij koje je čovječanstvo ikada imalo na raspolaganju.

Potaknuti futurističkim vizijama i znanstvenom fantastikom, tehnološke kompanije ulažu milijune dolara na razvoj sustava virtualne stvarnosti, a prema predviđanjima analitičara iz Goldman Sachsa, ova bi industrija do 2025. godine mogla biti teška čak 80 milijardi dolara.

Sustav virtualne stvarnosti za sada se primjenjuje u zabavnoj industriji i *gameingu*, ali od njega bi vrlo skoro mogli profitirati i dizajneri interijera, automobilska industrija i ostali ponuđači proizvoda i usluga.

No također ne smijemo zanemariti i moguće negativne učinke. Došlo je do zabrinutosti zbog moguće povezanosti virtualne stvarnosti i desenzibilizacije. Misli se na to da na osobu više ne utječu ekstremni vidovi ponašanja kao što je npr. nasilje te da osoba ne pokazuje znakove empatije ili sućuti kao rezultat prevelike izloženosti virtualnoj stvarnosti. Ovo se najviše primijetilo na igračima video igrica, a posebno na onima koji igraju tzv. pucačine iz prvog lica (*first person shooter*) koje zahtijevaju visok stupanj "uranjanja" u virtualni svijet. Stručnjaci su također zabrinuti i zbog još jedne bihevioralne pojave tzv. "cyber ovisnosti". Postoje ljudi koji su postali ovisni o virtualnoj stvarnosti, a kao posljedica toga, počinju brisati granicu između stvarnog i virtualnog života. Provedu ogromne količine vremena u virtualnom okruženju, a što ima štetan učinak na njihov život u stvarnom svijetu.

Gore opisani nedostaci virtualne stvarnosti minorni su u odnosu na prednosti virtualne stvarnosti kao cjeline, ali je također jako važno da se o ovim problemima piše i razmišlja.

Zamislite samo kada bi mogli uskočiti u hologramski dnevni boravak ili prošetati svojom novom kućom i prije nego je izgrađena. Zvuči jako zanimljivo, a u doglednoj budućnosti i ostvarivo. Budućnost nikada nije bila bliže.

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Virtual reality in marketing

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Abstract. Virtual reality (VR) is a special environment that uses a computer to give a user the experience of being physically present in real or imaginary places. VR technology was first used in the field of cultural heritage and archaeology, and today its application has spread to almost all areas, from science fiction, art, video games, music, health, to sports training and education, and in particular marketing - which is the focus of this paper. Ever since the development of the first computer, people were trying to create a virtual image of the world which would be similar to the real world, an experience for all of a user's senses, a place where the user's virtual presence can participate in the processes that alter it and shape it. Devices that are used for virtual reality (e.g. perception devices) are also called output devices because the computer relays the generated image information, sounds, force, smell, temperature, and everything that a person in the real world is perceiving, and the very purpose of these devices is to convert the information into a form that is adapted to human senses. Interaction or input devices send information to the computer about human movements, human speech, the pulse, etc. There have been attempts at consolidating all these devices into a single virtual system so that the consumer can fully perceive and interact with things in the virtual world. The primary objective of the authors of this paper was to emphasize that virtual reality, whose boom is expected in 2016, can be used as one of the most powerful marketing tools in the future - that is coming faster than ever.

Key Words: *virtual reality, digital marketing, technological support, VR marketing campaigns*

Zaštita turističkih potrošača u Europskoj uniji i Hrvatskoj

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Sažetak. Obilježja turističkog tržišta i promjene u preferencijama turističkih potrošača, učinile su turistički aranžman dominantnim proizvodom suvremenog turističkog tržišta. Turistički aranžman sastoji se od niza dobara i usluga različitih ponuđača koje vremenski, prostorno i sadržajno moraju biti usklađene. Ulogu posredovanja između velikog broja ponuđača turističkih proizvoda i usluga koje su sastavni dio turističkog aranžmana te prostorno udaljenih turističkih potrošača preuzimaju organizatori putovanja. Upravo organizatori putovanja kreiraju različite suvremene turističke proizvode koje od njih kupuju turistički potrošači. Organizatori putovanja izravno odgovaraju za izvođenje, ali i garantiranu kvalitetu usluga turističkog aranžmana. Međutim, činjenica da turistički potrošači u okviru jedinstvenog turističkog aranžmana konzumiraju različita dobra i usluge koje ne isporučuju sami organizatori putovanja, otvara pitanje preuzimanja odgovornosti te naglašava potrebu adekvatne zaštite potrošača na turističkom tržištu. S druge strane, budući da se u okviru istog turističkog aranžmana usluge mogu konzumirati u više destinacija različitih zemalja, stvara se potreba usklađenosti nacionalnih okvira zaštite turističkih potrošača. Cilj ovoga rada je objasniti okolnosti koje su dovele do potrebe uvođenja jedinstvenih odredbi zaštite turističkih potrošača u Europskoj uniji. Usporedbom odredbi iz područja zaštite turističkih potrošača na razini Europske unije s onima koje su u nadležnosti pojedinih zemalja članica, istaknut će se potreba usklađenosti pojedinih propisa, ali i prezentirati, na primjeru Hrvatske, konkretna rješenja primjene odredbi europskih direktiva u nacionalnom zakonodavstvu zemalja članica u području zaštite turističkih potrošača.

Key words: *turistički aranžman, organizator turističkih putovanja, zaštita turističkih potrošača*

1. Uvod

Uloga posrednika na turističkom tržištu značajna je od razdoblja kada se turizam počinje razvijati kao masovna pojava, a u uvjetima kada turizam postaje globalni fenomen, uloga posrednika na turističkom tržištu postaje nezamjenjiva.

Specifičnost turističkog tržišta proizlazi iz obilježja turističke ponude i turističke potražnje, te njihovog međusobnog odnosa. Obilježja turističke ponude, s jedne strane, te turističke potražnje, s druge strane, dovode do potrebe stvaranja posebnog gospodarskog subjekta koji će tvoriti vezu između ova dva pola turističkog tržišta.

Jedno od najznačajnijih obilježja turističke potražnje u uvjetima razvoja turizma kao globalne pojave je fizička pokretljivost turističke potražnje. Naime, osuvremenjivanje prometne infrastrukture i razvoj prometnih sredstava učinio je daleke destinacije fizički dostupnijima unatoč tome što se razlike u kulturi, običajima, komunikaciji nisu smanjivale. S druge strane vremenska koncentriranost turističke potražnje na određeno razdoblje godine, što je jedno od

najuočljivijih obilježja turističke potražnje koje literatura poznaje pod nazivom sezonalnost, uvjetuje potrebu za određenom vrstom regulacije koja će svojim mehanizmima nastojati smanjiti pritisak na špicu sezone te ravnomjernije rasporediti turističku potražnju, u cilju smanjenja negativnih implikacija sezonalnosti. Budući da turističku potražnju sačinjavaju brojni subjekti koji su međusobno vrlo različiti s aspekta svojih turističkih motiva i preferencija, te mogu biti fizički vrlo udaljeni od subjekata turističke ponude, nužno trebaju posrednika koji će im pomoći pronaći one ponuditelje koji na najbolji mogući način mogu zadovoljiti njihove potrebe. S druge strane, turistička ponuda često je sastavljena od velikog broja malih gospodarskih subjekata, fizički vrlo udaljenih od turističke potražnje, koji ne raspolazu potrebnim znanjima o načinu funkcioniranja tržišta i tržišnom natjecanju. Njihovi kapaciteti vezani su za mjesto nastanka, ne mogu se fizički približavati turističkoj potražnji, a ne mogu joj se ni na druge načine u kratkom roku prilagoditi.

Iz ovakvih obilježja sudionika turističkog tržišta javlja se potreba za gospodarskim subjektom koji će povezati sudionike turističke ponude i turističke potražnje, a tu ulogu na turističkom tržištu na sebe preuzimaju posrednici. Posrednici na turističkom tržištu povezujući ponudu i potražnju uklanjaju njihove međusobne prepreke u komunikaciji, premošćuju razlike u kulturi, okupljaju i okrupnjuju heterogenu skupinu turističkih potrošača usmjeravajući je prema turističkoj ponudi od koje na sebe preuzimaju dio aktivnosti iz domene tržišnog poslovanja. Među posrednicima na turističkom tržištu posebno se ističu turističke agencije i turoperator.

Specifičnost zaštite turističkih potrošača proizlazi iz specifičnosti turizma kao pojave, karakteristika turističkog tržišta, odnosno specifičnosti turističke ponude i potražnje.

Iako su prednosti korištenja usluga tržišnih posrednika na turističkom tržištu brojne, da bi se mogle razumjeti potencijalne opasnosti za turističke potrošače koje proizlaze iz trojnog odnosa na turističkom tržištu te potreba i značaj zaštite potrošača na turističkom tržištu, potrebno je objasniti obilježja samog turističkog proizvoda.

2. Turistički aranžman i rizik koji sa sobom nosi

Iako se uobičajeno navodi da je turistički (paket) aranžman najznačajniji proizvod turoperatora, promjena trendova turističke potražnje i ponude te dinamičko okruženje koje vlada na turističkom tržištu doveli su do toga da se opstanak i razvoj turističkih agencija veže uz napuštanje klasičnih poslova posredništva u prodaji pojedinačnih usluga subjekata turističke ponude te promjenu poslovnog usmjerenja prema stvaranju i plasmanu vlastitih turističkih proizvoda, turističkih aranžmana.

Turistički aranžman sastoji se od dvije usluge ili više njih, koje su u vremenu i po sadržaju sinkronizirane, a nude se potencijalnom turistu bilo po vlastitoj odluci agencije, bilo na traženje klijenta, kojima turist zadovoljava u potpunosti ili djelomično svoju turističku potrebu (Vukonić, 2003.). Zakon o pružanju usluga u turizmu (čl. 5.) definira paket aranžman (paušalno putovanje) kao unaprijed utvrđenu kombinaciju od najmanje dvije pojedinačne usluge koje se sastoje od prijevoza, smještaja ili drugih turističkih i ugostiteljskih usluga što čine cjelinu, a pružaju se u vremenu dužem od 24 sata ili uključuju barem jedno noćenje te se prodaju po ukupnoj unaprijed utvrđenoj (paušalnoj) cijeni.

Turistički (paket) aranžman, najvažniji proizvod putničke agencije, čine usluge i proizvodi davatelja različitih djelatnosti s kojima turist često nije u direktnom ugovornom odnosu, već njihove usluge koristi temeljem različitih ugovora s turoperatorom ili putničkom agencijom.

Obilježja turističkog (paket) aranžmana koja ga čine drugačijim i specifičnim u odnosu na robu i proizvode široke potrošnje su: nemogućnost izlaganja kao robnog uzorka, nemogućnost provjere i pregleda prije kupnje, kao i nemogućnost iskušavanja, mogućnost korištenja samo uz prisutnost korisnika, nemogućnost uskladištenja, nemogućnost zamjene manjkavog

aranžmana, plaćanje se u pravilu odvija unaprijed, kupovina je vezana uz subjektivnu predodžbu o proizvodu, u trenutku korištenja proizvoda potrošač ostvaruje kontakt sa svim pružateljima usluga koje su sastavni dio integriranog proizvoda (Čavlek, 1998.).

Kupnjom turističkog aranžmana korisnici ostvaruju određene prednosti (Čačić, 1995.) koje se odnose na činjenicu da se odluka o kupovini paketa usluga u okviru turističkog aranžmana može donijeti relativno jednostavno i uz uštedu vremena koje je potrebno za organiziranje takvoga putovanja jer se kupovina može izvršiti i u mjestu stalnog boravka turista. Troškovi putovanja i boravka poznati su unaprijed i iskazani su kroz paušalnu cijenu aranžmana, tako da je rizik od pojave neočekivanih troškova sveden na minimum. U pravilu se financijske obveze prema agenciji podmiruju unaprijed što pruža veću sigurnost kod putovanja. Veći broj usluga prodaje se po jedinstvenoj cijeni koja je niža od one koju bi turist platio kada bi usluge kupovao pojedinačno od pružatelja usluga. Sigurnost korisnika aranžmana posljedica je činjenice da je složen posao pripreme i organiziranja turističkog putovanja obavila profesionalna organizacija te da je izvođenje aranžmana povjereno stručnim osobama koje odredi agencija. Raznovrsnost asortimana turističkih aranžmana koje agencija nudi na tržištu potencijalnim korisnicima nudi mogućnost izbora i donošenje odluke o kupovini onog proizvoda koji odgovara njihovim potrebama. Za suvremenog potrošača u turizmu veliku ulogu igra i garancija kvalitete koju pružaju organizatori putovanja kada organiziraju putovanje.

Turistički aranžmani su neopipljivi i heterogeni, odnosno, ne može se izvršiti kontrola kvalitete prije potrošnje i nema doživljaja potrošača koji je isti kao prethodni. Izvor problema može biti turoperator, ali i prijevoznik, hotel, putnička agencija ili bilo koji drugi izravni isporučitelj turističkih usluga uključenih u aranžman. Zbog toga je potrebno definirati propise koji utvrđuju minimalne standarde koji se moraju poštivati (Radosavljević, 2009.).

Osim toga, turistička putovanja sadržana u turističkim aranžmanima su vrlo često međunarodnog karaktera, što znači da turist ne poznaje zemlju, pravo ni običaje zemlje davatelja usluga u kojoj privremeno boravi. To je samo jedan od razloga zbog kojih je potrošač u turizmu često osjetljiviji na rizike u usporedbi sa drugim potrošačima.

Nadalje, potrošači su sve informiraniji i izbirljiviji u prihvaćanju sve šireg asortimana ponuđene robe i usluga. Osjećaj sigurnosti i zaštićenosti osobe i imovine pri korištenju usluge nezaobilazan je faktor zadovoljstva potrošača. Čim je rizik veći, tim je jači utjecaj osjećaja sigurnosti i zaštićenosti na odluku o korištenju određene usluge. Naime, po logici stvari, kod istovrsnih ili sličnih usluga rast će potražnja za onim uslugama pri čijem se korištenju potrošač osjeća sigurnijim i zaštićenijim. Viša razina zaštite potrošača znači i veće zadovoljstvo klijenta što rezultira lojalnošću klijenata i pozitivnom slikom, a time i povećanjem konkurentnosti i smanjenjem troškova pridobivanja novih i zadržavanja postojećih klijenata. Prvobitno povećanje troškova poslovanja uzrokovano uvođenjem mjera zaštite potrošača, dugoročno dovodi do smanjivanja troškova nuđenja usluga. Stoga će davatelji usluga u turizmu i sami poduzimati različite aktivnosti kojima će povećati razinu zaštite svojih klijenata, sve u cilju povećanja konkurentnosti svojih usluga. Naravno da i sami potrošači, individualno ili putem udruga potrošača, poduzimaju aktivnosti radi zaštite svojih prava i interesa. To znači da svi subjekti u turizmu poduzimaju određene mjere zaštite korisnika usluga u turizmu, tj. da su nositelji zaštite potrošača u turizmu (Pešutić, 2008.).

3. Zaštita turističkih potrošača u Europskoj uniji

Potreba za zaštitom turističkih potrošača nametnula se tek na određenom stupnju razvoja turizma. Na zaštitu potrošača gledalo se kao na proširenje obveza pružatelja turističkih usluga. U vrijeme ekspanzije turoperatora na turističkom tržištu i turoperatoru su nastojali umanjiti svoju odgovornost i svoje obveze. Međutim, učinak takvog ponašanja turoperatora izazvao je

negativne izravne i neizravne posljedice – nezadovoljstvo, gubitak klijenata i negativnu multiplikativnu usmenu komunikaciju (Gardijan, 2001.).

Studije su pokazale da se 40% žalbi odnosi na jeftine paket aranžmane koji ne garantiraju odgovarajući smještaj. S jedne strane, turoperatori nastoje nižim cijenama privući potrošače, a s druge strane potrošači su nezadovoljni uslugom koju su dobili (Holloway, 2009.). Budući da su turoperatori u pojedinim zemljama imali vrlo različit stupanj odgovornosti prema svojim klijentima te da je prodaja i ponuda aranžmana bila različito pravno regulirana, radi zaštite sve većeg segmenta potrošača koji je konzumirao proizvod turoperatora Europska unija je inicirala potrebu unificiranja zakona, propisa i administrativnih odredaba unutar zemalja članica koji se odnose na ponudu i prodaju aranžmana na teritoriju Europske unije (Spasić, 2013.).

Početkom 90-ih godina prošlog stoljeća započinje razvoj pravnog okvira zaštite turističkih potrošača u Europskoj uniji. Za poslovanje turoperatora od posebnog je značaja donošenje Direktive o putovanjima, odmorima i kružnim putovanjima u paket aranžmanima u srpnju 1990. godine. Direktiva je osmišljena kako bi razjasnila i proširila odgovornost na sve djelatnosti koje mogu biti uključene u stvaranje i plasiranje paket aranžmana na tržištu (Holloway, 2009.).

Direktivom se štiti potrošač, bez obzira na to da li je on ugovorna strana ili netko u čije je ime druga osoba zaključila ugovor ili osoba na koju je prenijeto pravo korištenja paket aranžmana. Pod paket-aranžmanom se podrazumijeva unaprijed utvrđena kombinacija najmanje dvije pojedinačne usluge koje se prodaju po cijeni koja uključuje razne usluge koje se pružaju u vremenu dužem od 24 sata ili uključuju smještaj i noćenje. Usluge koje se mogu kombinirati su: prijevoz, smještaj i ostale turističke usluge koje nisu pomoćne prijevozne ili smještajne usluge, a predstavljaju znatan dio paket aranžmana.

Direktiva stavlja naglasak na sljedeće odredbe (90/314/EEZ): Brošura koja se daje potrošaču na uvid mora na čitljiv, razumljiv i točan način određivati cijenu i pružati odgovarajuće podatke o odredištu i prijevoznim sredstvima te kategorijama korištenih prijevoznih sredstava, vrsti smještaja, njegovoj lokaciji te njegovim glavnim osobinama, odobrenju te klasifikaciji koju ima u skladu s propisima zemlje članice domaćina, planu prehrane, rasporedu putovanja, tome jesu li potrebne putovnice i vize za državljane zemalja članica te o zdravstvenim formalnostima potrebnim za putovanje i boravak, novčanom iznosu ili postotku od cijene koji je potrebno uplatiti na račun te redoslijedu ostalih uplata do konačnog podmirenja iznosa, tome je li potreban određeni broj osoba kako bi se paket aranžman ostvario, te ukoliko jest, koji je krajnji rok u kojem će potrošač biti obaviješten o eventualnom otkazu putovanja.

Organizator i/ili prodavatelj paket aranžmana mora u pisanom ili drugom primjerenom obliku potrošaču pravovremeno prije početka putovanja dati i podatke o vremenu i mjestu usputnih zaustavljanja te detaljima o mjestu koje putnik zauzima (npr. u kabini ili mjestu na brodu), imenu, adresi i telefonskom broju lokalnog predstavnika organizatora i/ili prodavatelja ili ako ga nema lokalnih agencija kojima se potrošač može obratiti za pomoć u teškoćama, odnosno ako takve agencije ne postoje, potrošač mora dobiti telefonski broj za slučaj izvanrednog događaja, mogućnostima sklapanja neobvezne police osiguranja radi pokrivanja troškova za slučaj da potrošač otkaže ugovor ili za slučaj troškova pružanja pomoći, uključujući povratak u domovinu u slučaju nesreće ili bolesti.

Ako je potrošač spriječen u ostvarenju paket aranžmana, svoju rezervaciju može prenijeti na osobu koja ispunjava sve uvjete koje se odnose na paket aranžman, ako o tome prije polaska organizatoru ili prodavatelju aranžmana dostavi opravdanu obavijest.

Na ugovorne cijene ne primjenjuju se promjene cijena osim ako je ugovorom izričito predviđena mogućnost revidiranja naviše ili naniže, a odstupanja se dopuštaju samo u

troškovima prijevoza (uključujući i troškove goriva), davanjima, taksama ili pristojbama koje se naplaćuju za određene usluge (npr. takse za slijetanje ili ukrcaj/iskrcaj u pomorskim i zračnim lukama) te valutnim tečajevima koji se primjenjuju na pojedine aranžmane. Tijekom dvadeset dana prije datuma polaska cijena navedena u ugovoru ne smije se povećavati.

Ukoliko je organizator aranžmana prije polaska prisiljen znatno izmijeniti bilo koji od bitnih uvjeta iz ugovora (npr. cijenu) u najkraćem roku mora o tome obavijestiti potrošača kako bi mu omogućio da donese odluku o odustanku od ugovora bez ugovorne kazne ili prihvaćanja dodatka ugovoru u kojem se utvrđuju izmjene i njihov učinak na cijenu, a potrošač je dužan organizatora ili prodavatelja aranžmana o svojoj odluci obavijestiti u najkraćem mogućem roku.

Ukoliko potrošač odustane od ugovora ima pravo prihvatiti zamjenski paket aranžman odgovarajuće ili više kvalitete ako mu organizator može ponuditi takvu zamjenu, a ako je ponuđeni zamjenski paket niže kvalitete, organizator mora potrošaču vratiti novac u iznosu razlike u cijeni ili na povrat svih uplaćenih iznosa prema ugovoru i to u najkraćem roku.

Ako nakon polaska znatan dio ugovornih usluga nije pružen, ili ako organizator utvrdi da neće biti u stanju osigurati znatan dio usluga koje treba pružiti, organizator je dužan pronaći, bez dodatnih troškova za potrošača, odgovarajuća zamjenska rješenja radi nastavka realizacije paket aranžmana, a ako je primjereno, nadoknađuje potrošaču i razliku između cijena ponuđenih i pruženih usluga. Ukoliko zamjenska rješenja nisu moguća ili ukoliko ih potrošač iz valjanih razloga ne prihvati, organizator potrošaču bez dodatnih troškova osigurava prijevoz do mjesta polaska ili do nekog drugog mjesta povratka s kojim se potrošač suglasio, te kada je to primjereno, potrošaču isplaćuje naknadu.

Države članice dužne su poduzeti potrebne mjere kako bi osigurale da organizator i/ili prodavatelj bude odgovoran potrošaču za ispravno izvršenje obveza iz ugovora, bez obzira na to da li te obveze moraju izvršiti organizator i/ili prodavatelj ili pružatelj usluga, ne dovodeći u pitanje pravo organizatora i/ili prodavatelja da poduzima mjere protiv drugih pružatelja usluga.

U pogledu štete koja je za potrošača nastala zbog neizvršenja ili nepravilnog izvršenja ugovora, države članice moraju poduzeti potrebne mjere kako bi se osigurala odgovornost organizatora i/ili prodavatelja, osim ako se odgovornost za neizvršenje ne može pripisati njima nego se odgovornost pripisuje potrošaču, trećoj strani koja ničim nije povezana s pružanjem ugovornih usluga pa je neizvršenje nepredvidivo ili neizbježno ili je do neizvršenja došlo zbog djelovanja više sile ili zbog događaja koji organizator i/ili prodavatelj ili pružatelj usluga nisu mogli predvidjeti ili spriječiti.

Organizator je dužan odmah pružiti pomoć potrošaču u nevolji.

U slučaju naknade štete uslijed neizvršenja ili neodgovarajućeg izvršenja obaveza, države članice mogu ograničiti naknadu u skladu sa međunarodnim konvencijama koje uređuju te usluge. Kada je u pitanju šteta, s iznimkom tjelesnih ozljeda, koja je posljedica neizvršenja ili nepravilnog izvršenja usluga obuhvaćenih paket aranžmanom, države članice mogu dopustiti da se naknada ograniči ugovorom, a takvo ograničenje ne smije biti nerazumno.

Potrošač mora o svakom uočenom propustu u izvršenju ugovora odmah obavijestiti pružatelja usluga na kojeg se to odnosi, a organizatora i/ili prodavatelja pisanim putem ili na neki drugi primjeren način, čim se za to ukaže prilika. Ta se obveza mora jasno i izričito navesti u ugovoru.

U slučaju podnošenja pritužbe organizator i/ili prodavatelj ili njihov lokalni zastupnik, ukoliko postoji, moraju odmah učiniti sve što mogu kako bi pronašli odgovarajuće rješenje.

Ugovorna stranka organizator i/ili prodavatelj dužni su pružiti dovoljne dokaze o sigurnosti povrata uplaćenog novca i povratka potrošača u domovinu u slučaju insolventnosti.

Države članice mogu radi zaštite potrošača donijeti ili zadržati strože propise u području na koje se odnosi ova direktiva.

Komisija za interno tržište Europske unije ozbiljno radi i u području konzumerizma koje se odnosi na izričitu zaštitu potrošača, a sa ciljem: zaštite građana Europske unije od pogrešnih informacija koje se odnose na paket aranžmana, proširivanje odgovornosti agencija i organizatora putovanja prema klijentu (prije i poslije putovanja) i uvođenja jedinstvenog postupka za rješavanje nastalih spornih slučajeva. Zaštita turista i njihovih interesa ne znači samo financijsku zaštitu. Nužno je da turisti imaju punu i konkretnu informaciju koja se odnosi na njihov odmor. Komisija inzistira da pogrešno i netočno informiranje mora biti suzbijeno i sankcionirano. Propisi Europske unije koji se odnose na zaštitu potrošača u turizmu, kao i mnogi drugi propisi preuzeti su uglavnom iz zakonodavstva i propisa udruženja europskih zemalja – članica i nečlanica, zbog sveobuhvatnije i bolje zaštite (Živković, 2013.).

4. Zaštita turističkih potrošača u Republici Hrvatskoj

Zaštita prava potrošača jedna je od temeljnih vrijednosti koje promiče Europska unija, a zagovara i Hrvatska jer je hrvatsko tržište dio zajedničkog unutarnjeg tržišta Europske unije. Hrvatski zakoni i propisi koji sektorski uređuju određena pitanja bitna za potrošača i njegovu zaštitu na tržištu, usklađeni su s pravilima Europske unije u području zaštite potrošača. Turisti – potrošači, ostvaruju podjednako visoku razinu zaštite svojih temeljnih potrošačkih prava kao i u bilo kojoj drugoj članici Europske unije (Ministarstvo gospodarstva, 2013).

U Hrvatskoj su pitanja zaštite potrošača – korisnika turističkih usluga regulirana Zakonom o pružanju usluga u turizmu, Zakonom o zaštiti potrošača i Zakonom o obveznim odnosima.

Zakon o pružanju usluga u turizmu (čl. 17.) navodi da je turistička agencija dužna za svako putovanje koje organizira (bilo da se radi o paket aranžmanu ili izletu) izdati program, prospekt ili katalog (promidžbeni materijal - tiskani ili elektronički) koji treba staviti na raspolaganje putniku prije sklapanja ugovora o organiziranju putovanja. Ugovor o organiziranju putovanja ovisno o uslugama mora sadržavati obavijesti o cijeni putovanja, odredištu (destinaciji), sredstvu, karakteristikama i kategoriji prijevoza, vrsti smještajnog objekta, njegovoj lokaciji i kategoriji te turističkoj klasifikaciji prema pravu države u kojoj se objekt nalazi, broju dnevnih obroka, planu putovanja, iznosu ili postotku predjuma te o broju i iznosu obroka otplate ostatka cijene, graničnim, viznim i zdravstvenim formalnostima u pogledu putovanja i boravka u odredištu, najmanjem broju putnika koji je potreban za organiziranje putovanja te o roku u kojem će putnik biti obaviješten o otkazivanju putovanja ako za putovanje nije prijavljen dovoljan broj putnika.

Zakon (čl. 18.) također nalaže da je turistička agencija koja organizira putovanje dužna za svaki paket aranžman osigurati jamčevinu banke ili osiguravajućeg društva kako bi putniku mogla nadoknaditi plaćenu cijenu putovanja ako zbog platne nemogućnosti ili stečaja turističke agencije izostanu usluge putovanja i troškove koji su nastali zbog platne nemogućnosti ili stečaja putničke agencije za povratak putnika u mjesto polaska. Jamčevina koju je turistička agencija dužna osigurati može biti u obliku police osiguranja, gotovinskog pologa ili bankovnog jamstva (odnosno, garancije).

Turistička agencija koja organizira putovanje (odnosno, paket aranžman) dužna je s osiguravateljem sklopiti ugovor o osiguranju od odgovornosti za štetu koju prouzroči neispunjenjem, djelomičnim ispunjenjem ili neurednim ispunjenjem obveza koje se odnose na paket aranžman.

Zakon o zaštiti potrošača osim što uređuje zaštitu osnovnih prava potrošača pri kupnji proizvoda i usluga kao i pri drugim oblicima stjecanja proizvoda i usluga na tržištu (pravo na zaštitu ekonomskih interesa potrošača, pravo na zaštitu od opasnosti za život, zdravlje i imovinu, pravo na pravnu zaštitu potrošača, pravo na informiranje i izobrazbu potrošača,

pravo na udruživanje potrošača u svrhu zaštite njihovih interesa te pravo na predstavljanje potrošača i sudjelovanje predstavnika potrošača u radu tijela koja rješavaju pitanja od njihovog interesa) u području poslovnih aktivnosti u domeni turizma posebno regulira pitanja vezana za ugovor o dugotrajnom turističkom proizvodu kao ugovor koji se sklapa na razdoblje duže od godine dana kojim potrošač uz naknadu prvenstveno stječe pravo na popust ili druge pogodnosti vezane uz smještaj, odvojeno ili zajedno s putovanjem ili drugim uslugama.

Zakon o obveznim odnosima propisuje sadržaj ugovora o organiziranju putovanja, temeljnog dokumenta koji pravno obvezuje organizatora paket aranžmana i turiste, te propisuje njihova temeljna prava i obveze. Prema Zakonu o obveznim odnosima (čl. 881.) ugovor o organiziranju putovanja obvezuje organizatora putovanja da pribavi putniku najmanje dvije usluge koje se sastoje od prijevoza, smještaja ili drugih turističkih usluga što čine cjelinu i koje se pružaju u vremenu dužem od 24 sata ili uključuju barem jedno noćenje (paket-aranžman), a putnik se obvezuje platiti mu za to jednu ukupnu (paušalnu) cijenu, pri čemu se organizatorom putovanja smatra i osoba koja prodaje paket aranžman koji je pripremila neka druga osoba.

Promidžbeni materijali, poput programa putovanja ili brošura, koji se odnose na paket aranžman, a koje je organizator putovanja stavio putniku na raspolaganje ne smiju sadržavati zavaravajuće obavijesti u pogledu cijene ili bilo koje druge odredbe ugovora o organiziranju putovanja. Osim obveznih informacija koje moraju biti sastavni dio promidžbenih materijala, kako propisuje i Zakon o pružanju usluga u turizmu, Zakon o obveznim odnosima nalaže da podaci sadržani u promidžbenim materijalima obvezuju organizatora putovanja i mogu biti izmijenjeni jedino na temelju sporazuma s putnikom ili ako je putnik o tim izmjenama obaviješten prije sklapanja ugovora, u kojem slučaju ta mogućnost mora biti izričito navedena u promidžbenim materijalima.

Ugovor o organiziranju putovanja sklapa se u pisanom obliku ili putem drugog trajnog, putniku dostupnog i razumljivog oblika, s tim da barem jedan primjerak ugovora mora biti dostavljen putniku. Ovisno o uslugama koje su njime obuhvaćene, ugovor o organiziranju putovanja mora sadržavati odredbe o tvrtki ili nazivu, odnosno imenu i prezimenu te sjedištu i adresi organizatora putovanja te njegova osiguravatelja, ako je osiguranje obuhvaćeno paket aranžmanom; odredištu te vremenu i nadnevku boravka u odredištu; sredstvu, karakteristikama i kategoriji prijevoza, nadnevku, vremenu i mjestu polaska i povratka; vrsti smještajnog objekta, njegovoj lokaciji i kategoriji, njegovim osnovnim karakteristikama te turističkoj klasifikaciji prema pravu države u kojoj se objekt nalazi; broju dnevnih obroka; planu putovanja; izletima, obilascima i drugim uslugama koje su obuhvaćene paket aranžmanom i koje su uključene u cijenu; cijeni i mogućnosti izmjene cijene te pristojbama za određene usluge koje nisu uključene u cijenu (primjerice, turističkim pristojbama, pristojbama za ukrcaj i iskrcaj u zračnim i ostalim lukama); načinu i vremenu plaćanja cijene; posebnim zahtjevima putnika o kojima je obavijestio organizatora putovanja prilikom rezerviranja putovanja, a koje je ovaj prihvatio; najmanjem broju putnika koji je potreban za organiziranje putovanja te roku u kojem će putnik biti obaviješten o otkazivanju putovanja ako za putovanje nije prijavljen dovoljan broj putnika; roku u kojem putnik mora iznijeti svoje prigovore u pogledu neispunjenja ili neurednog ispunjenja ugovora.

Zakon o obveznim odnosima također regulira sljedeće obveze organizatora putovanja (čl. 885. – 893.):

- zaštitu prava i interesa putnika (koja nalaže da je organizator putovanja dužan putniku pružiti usluge koje imaju sadržaj i svojstva predviđene ugovorom i skrbiti se o pravima i interesima putnika, u skladu s poslovnim običajima djelatnosti)
- obvezu obavješćivanja (koja nalaže da je organizator putovanja dužan u razumnom roku

prije započinjanja putovanja, u pisanom obliku ili drugom trajnom, putniku dostupnom obliku obavijestiti putnika o: mjestu međuođredišta ili izmjene prijevoznog sredstva te vremenu dolaska u to mjesto; njegovu mjestu u prijevoznom sredstvu, imenu i prezimenu, adresi i broju telefona mjesnog zastupnika organizatora putovanja ili, osobi kojoj se putnik može obratiti u slučaju poteškoća ili, broju telefona ili drugom sredstvu koje mu omogućuje kontakt s organizatorom putovanja; u slučaju putovanja maloljetnika, načinu uspostave neposredne veze s njim ili za njega odgovornom osobom; mogućnosti sklapanja ugovora o osiguranju kojim se osiguravaju troškovi raskida ugovora od strane putnika ili troškovi pomoći i povratka putnika u mjesto polazišta u slučaju nesreće ili bolesti)

- obvezu čuvanja tajne (koja nalaže da organizator putovanja obavijesti koje dobije o putniku, njegovoj prtljazi, njegovim kretanjima i imenima njegovih suputnika smije priopćiti trećim osobama samo s odobrenjem putnika ili na zahtjev nadležnog tijela javne vlasti)
- odgovornost za štetu (koja nalaže da Organizator putovanja odgovara za svu štetu koju prouzroči putniku neispunjenjem, djelomičnim ispunjenjem ili neurednim ispunjenjem obveza koje se odnose na organiziranje putovanja)
- odgovornost za štetu kad je pružanje pojedinih usluga organizator povjerio trećim osobama (koja nalaže da organizator putovanja koji je povjerio trećim osobama izvršenje usluga prijevoza, smještaja ili drugih usluga vezanih za izvršenje putovanja, odgovara putniku za štetu koja je nastala zbog potpunog ili djelomičnog neizvršenja tih usluga)
- sniženje cijene (koje nalaže da ukoliko su usluge iz ugovora o organiziranju putovanja nepotpuno ili neuredno izvršene, putnik ima pravo na razmjerno sniženje cijene pod uvjetom da je stavio prigovor organizatoru putovanja u roku od osam dana od dana završetka putovanja)
- jamčevinu za organiziranje putovanja (koja nalaže da je organizator putovanja dužan za svako organizirano putovanje osigurati jamčevinu kod banke ili osiguravajućeg društva za povrat cijene putniku, ako zbog njegova stečaja ili nesposobnosti plaćanja putovanje ne bude poduzeto, odnosno naknade troškova povratka putnika u mjesto polaska, ako bi iz istih razloga putovanje bilo prekinuto).

Obveze putnika prema Zakonu o obveznim odnosima odnose se na (čl. 894. – 898.):

- plaćanje cijene (putnik je dužan organizatoru putovanja platiti ugovorenu cijenu za putovanje u vrijeme kako je ugovoreno, odnosno uobičajeno)
- obveze davanja podataka (putnik je dužan na zahtjev organizatora pravodobno dostaviti sve podatke potrebne za organiziranje putovanja, a posebno za pribavljanje prijevoznih karata, rezervaciju smještaja te isprave potrebne za prelazak preko granice)
- ispunjavanje uvjeta predviđenih propisima (putnik je dužan brinuti se da on osobno, njegove osobne isprave i njegova prtljaga ispunjavaju uvjete predviđene graničnim, carinskim, sanitarnim, monetarnim i drugim propisima)
- odgovornost putnika za štetu (putnik odgovara za štetu što je prouzroči organizatoru putovanja neispunjenjem obveza koje za njega proizlaze iz ugovora)
- obavješćavanje o nedostacima ispunjenja (putnik je dužan, u pisanom ili drugom odgovarajućem obliku, obavijestiti o neispunjenju ili neurednom ispunjenju bilo koje usluge iz ugovora osobu koja je tu uslugu pružila, što je prije moguće, a organizatora putovanja u roku od 8 dana od dana završetka putovanja).

Od posebnih prava i obveza ugovornih strana koje regulira Zakon o obveznim odnosima u dijelu koji se odnosi na Ugovor o organiziranju putovanja izdvajaju se:

- pravo putnika na raskid ugovora (čl. 901.) koje nalaže da putnik može u svakom trenutku potpuno ili djelomično raskinuti ugovor. Međutim, ako putnik prije početka putovanja raskine ugovor u razumnom roku koji se određuje s obzirom na vrstu aranžmana

(pravodobni raskid), organizator putovanja ima pravo samo na naknadu administrativnih troškova. S druge strane, u slučaju nepravodobnog raskida ugovora organizator putovanja može od putnika zahtijevati naknadu u određenom postotku ugovorene cijene koji se utvrđuje razmjerno vremenu preostalom do početka putovanja i koja mora biti ekonomski opravdana. Važno je naglasiti da organizator putovanja ima pravo samo na naknadu troškova ako je putnik raskinuo ugovor zbog okolnosti koje nije mogao izbjeći ili otkloniti i koje bi, da su postojale u vrijeme sklapanja ugovora, bile opravdan razlog da ne sklopi ugovor, a i u slučaju ako je putnik osigurao odgovarajuću zamjenu ili je zamjenu našao sam organizator te

- pravo organizatora putovanja na raskid ugovora (čl. 902.) koje nalaže da organizator putovanja može raskinuti ugovor, potpuno ili djelomično, bez obveze naknade štete putniku, ako prije ili za vrijeme ispunjavanja ugovora nastupe vanjske izvanredne i nepredvidive okolnosti koje se nisu mogle spriječiti, izbjeći ili otkloniti, a koje bi, da su postojale u vrijeme sklapanja ugovora, bile za njega opravdan razlog da ugovor ne sklopi te ukoliko se za putovanje nije prijavio broj putnika koji je potreban za organiziranje putovanja, ako je o toj okolnosti putnika obavijestio u primjerenom roku koji ne može biti kraći od pet dana prije dana kad je putovanje trebalo započeti. Bitno je naglasiti da u slučaju raskida ugovora prije započinjanja s njegovim ispunjenjem organizator mora u cijelosti vratiti ono što je primio od putnika, a ukoliko je organizator raskinuo ugovor zbog izvanrednih okolnosti koje su nastupile za vrijeme njegova ispunjavanja, dužan je vratiti putniku razliku u cijeni između ugovorenih i pruženih usluga i poduzeti sve mjere nužne za zaštitu interesa putnika.

Uvidom u regulativu koja uređuje pitanje zaštite potrošača u Europskoj uniji, prvenstveno Direktivu o putovanjima, odmorima i kružnim putovanjima u paket aranžmanima (90/314/EEZ), koja je pravno obvezujuća za sve zemlje članice, u smislu da su zemlje članice dužne sve odredbe Direktive izravno inkorporirati u svoje zakonodavstvo te pregledom zakonskih odredbi hrvatskog zakonodavstva (Zakona o pružanju usluga u turizmu, Zakona o zaštiti potrošača i Zakona o obveznim odnosima) koje se bavi pitanjima zaštite turističkih potrošača, može se uočiti da su sve odredbe Direktive 90/314/EEZ uistinu našle svoje mjesto u hrvatskom zakonodavstvu, te da su određena pitanja vezana za zaštitu turističkih potrošača u hrvatskim zakonima regulirana strožije nego je predviđeno Direktivom 90/314/EEZ (što je također situacija koja je Direktivom navedena kao moguća).

5. Zaključak

Turizam je postao globalni fenomen u kojem sudjeluju potrošači iz cijeloga svijeta koji nastoje zadovoljiti svoje turističke potrebe stupajući u odnos s ponuditeljima turističkih usluga. Promjene trendova na strani turističke ponude i potražnje naglasile su potrebu posredovanja između subjekata turističke ponude i prostorno i vremenski udaljenih turističkih potrošača. Ulogu posrednika na turističkom tržištu preuzeli su turoperatori i turističke agencije. Još od pojave prvih turoperatora na tržištu, turistički aranžman postaje njihov dominantan proizvod. S druge strane, promjene u okruženju nagnale su turističke agencije, da poslovanje preusmjere iz područja klasičnog posredovanja u pružanju usluga na stvaranje i distribuciju vlastitih proizvoda, turističkih aranžmana.

Zbog obilježja turističkog aranžmana, koji se sastoji od različitih usluga (i proizvoda) različitih ponuđača, a najčešće se kupuje kod turističkog posrednika koji nije izravni isporučitelj niti jedne od tih usluga, osiguravanje odgovarajuće razine kvalitete postaje ključno pitanje i za turističkog potrošača i za posrednika na turističkom tržištu. Stoga je pitanje zaštite potrošača na turističkom tržištu složenije od istog pitanja na drugim, na primjer tržištima roba.

Europa je najznačajnija turistička regija, kako s aspekta emitivnog tako i receptivnog značaja. Budući da je zaštita sigurnosti i prava potrošača prioritet svih politika Europske unije, Europska unija donijela je regulativu koja definira razinu zaštite turističkih potrošača u Europskoj uniji. Donošenjem direktive o putovanjima, odmorima i kružnim putovanjima u paket aranžmanima (90/314/EEZ), Europska unija obvezala je sve zemlje članice da sve odredbe iz direktive inkorporiraju u nacionalno zakonodavstvo.

Analizom odredbi koje su sastavni dio Direktive 90/314/EEZ te hrvatskog zakonodavnog okvira (prvenstveno Zakona o pružanju usluga u turizmu, Zakona o zaštiti potrošača te Zakona o obveznim odnosima) može se utvrditi da je zakonodavna vlast, uz činjenicu da je sve odredbe navedene direktive uključila u nacionalni zakonodavni okvir, čak u određenim segmentima strože regulirala pitanja vezana za zaštitu potrošača na turističkom tržištu. Stroža zakonska regulativa u odnosu na regulativu na razini Europske unije u pitanjima vezanim za zaštitu turističkih potrošača doprinosi porastu povjerenja turističkih potrošača u kvalitetu ponuđenih usluga, što je svakako jedan od preduvjeta za održivi razvoj hrvatskog turizma.

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Tourism consumer protection in the European Union and Croatia

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Abstract. The aspects of the tourism market and the changes in consumer preferences among tourists have made package tours the dominant product of the modern tourist market. A package tour consists of a number of goods and services from different providers that must be content harmonized, and spatially and temporally coordinated. The role of intermediation between the numerous providers of tourism products and services (that are an integral part of the package tour) and spatially distant tourist consumers is performed by tour organizers. More specifically, tour organizers are the creators of various modern tourist products that are purchased by tourist consumers. Tour organizers are directly responsible for the performance, but must also guarantee the service quality level of a package tour. However, the fact that tourist consumers on unique package tours consume different goods and services that are not provided by tour organizers, raises the question of taking responsibility, and emphasizes the need for adequate consumer protection on the tourism market. On the other hand, since services can be consumed in several destinations (and in different countries) as part of the same package tour, this points to the need to harmonize national frameworks to protect tourism consumers. The aim of this paper is to explain the circumstances that led to the introduction of unique provisions to protect tourism consumers in the European Union. Comparing the provisions in the field of tourism consumer protection in the European Union with those that are under the jurisdiction of individual member countries will emphasize the need for harmonization of certain regulations, but also present, in the case of Croatia, a concrete solution to the problem of implementing the provisions of European directives in national legislation of the member states in the field of tourism consumer protection.

Key words: *package tour, tour organizer, tourism consumer protection*

Doprinos turističkih vodiča poslovanju turističkih agencija

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Sažetak. Promjene na turbulentnom turističkom tržištu zahtijevaju od turističkih agencija da svoje poslovanje preusmjere iz područja klasičnog posredovanja prema stvaranju složenih turističkih proizvoda tzv. turističkih aranžmana. Međutim, u oba slučaja bit poslovanja ostaje u djelatnosti pružanja usluga. Preduvjet kvalitetnog pružanja usluga je visokovrijedan ljudski kapital. Iako široka paleta aktivnosti koje poduzimaju turističke agencije prilikom stvaranja i prodaje turističkih aranžmana zahtijeva angažiranje kadrova različitih znanja i vještina, fokus ovoga rada je usmjeren na ulogu i doprinos turističkih vodiča poslovanju turističkih agencija. Turistički vodiči smatraju se neslužbenim predstavnicima zemlje domaćina pred stranim turistima budući da izravno prezentiraju atraktivnosti destinacije turistima te stoga moraju i osigurati razinu kvalitete koju turističke agencije obećavaju svojim klijentima. Iako se od turističkih vodiča zahtijeva formalno obrazovanje stečeno najčešće uz neko drugo zanimanje, promjene u preferencijama turističkih potrošača zahtijevaju i specijalizaciju turističkih vodiča u užim područjima interesa. Bez turističkih vodiča ne bi bilo moguće realizirati tzv. vođenu turo, kao poseban oblik izleta koji je vrlo popularan u ponudi turističkih agencija. S druge strane, nitko osim usko specijaliziranih turističkih vodiča ne može kreirati tematski vođene ture, koje na poseban način obogaćuju ponudu destinacije. Ipak, turističke agencije vrlo rijetko zapošljavaju turističke vodiče u stalni radni odnos, nego se njihovim uslugama koriste po potrebi. Na takav način stvara se potencijalni problem za turističku agenciju pri pronalasku kvalitetnog turističkog vodiča s dovoljno profesionalnog iskustva, koji može garantirati razinu kvalitete usluge obećanu od strane turističke agencije.

Ključne riječi: turistička agencija, turistički vodič, vođena tura, tematska vođena tura

1. Uvod

Dinamičnost i neizvjesnost okruženja mijenja okvire turističke agencije nalažući joj prilagodbu, prihvaćanjem novih izazova i mogućnosti iz okoline kako općenito u poslovanju, tako i uže, u vlastitoj proizvodnji (Mihajlović, 2013). Iako je iskonski motiv osnivanja turističkih agencija bio posredovanje na turističkom tržištu, odnosno povezivanje prostorno i vremenski udaljenih subjekata turističke ponude i turističke potražnje, promjene u okruženju nagnale su turističke agencije da fokus svog interesa preusmjere iz područja posredovanja na stvaranje i prodaju vlastitih složenih turističkih proizvoda. I definicija profesora Vukonića koji definira turističku agenciju kao “gospodarstvenu organizaciju čija je osnovna djelatnost organiziranje i prodaja usluga putovanja i boravka te pružanje drugih usluga putnicima i sudionicima turističkog prometa” (Vukonić, 2003.), naglašava uslužnu djelatnost kao okvir unutar kojega se agencija fokusira na stvaranje vlastitog uslužnog programa posredujući i

dalje između subjekata koji nude turističke usluge i krajnjih korisnika, ali u kombinaciji koja predstavlja jedinstveni proizvod, turistički aranžman.

Utvrđivanjem uslužnog programa turističke agencije definiraju poslove kojima će se baviti na tržištu. Kako bi osigurale svoj opstanak u uvjetima stalnih promjena na turističkom tržištu koje odražavaju promjene u željama i preferencijama turističkih potrošača, ali i promjene u kanalima distribucije turističkih proizvoda, turističke agencije svoje uslužne programe prilagođavaju zahtjevima tržišta. U pripremi uslužnog programa za obavljanje agencijske djelatnosti nužno je osigurati ljudske i materijalne resurse i niz drugih uvjeta za rad koji su u velikom broju zemalja regulirani posebnim zakonskim regulativama. Poslovanje turističkih agencija na suvremenom tržištu karakterizira složenost i brojnost poslovnih operacija što utječe i na relativnu složenost procesa formiranja kadrovske strukture. To se prvenstveno odnosi na zahtjev za višom razinom općeg obrazovanja svih zaposlenika. Poseban utjecaj na kvalitetu pruženih usluga imaju kadrovi koji stupaju u izravan odnos s potrošačima obavljajući poslovne aktivnosti u prodaji i izvršenju turističkih aranžmana (Spasić, 2013.).

Pravilnikom o radu i Statutom, agencije utvrđuju sistematizaciju, popis i opis poslova te osnovne uvjete za realizaciju radnih zadataka (Bunja, 2007.). U literaturi se najčešće navodi podjela na komercijalno, pomoćno i specijalizirano osoblje. Komercijalno osoblje mora poznavati opću turističku problematiku, sve turističke usluge i njihove karakteristike, prilike na turističkom tržištu, dok pomoćno osoblje obavlja poslove dostave, čišćenja i slične pomoćne poslove. Za formiranje uslužnog programa turističke agencije zaslužno je specijalizirano osoblje koje je pretežito zaposleno na poslovima formiranja, prodaje i realizacije turističkih usluga te stoga mora posjedovati znanja iz zemljopisa, povijesti, kulturne baštine i običaja pojedinih naroda. Turistički vodiči spadaju u specijalizirano osoblje. To su osobe koje informativno obavještavaju turiste o određenoj zemlji, regiji ili gradu te svojom komunikativnom sposobnošću propagiraju dotično mjesto u kojem se turisti kreću.

Intenzivan razvoj turizma i složenost turističkog tržišta i odnosa koji na njemu vladaju, već davno upućivali su sudionike na tom tržištu na suradnju, koordinaciju svojih aktivnosti, izmjenjivanje iskustava i stvaranje što povoljnijih uvjeta za vlastito poslovanje. I država je nalazila svoj interes u povezivanju nositelja ponude u turizmu jer njihova suradnja i koordiniranost aktivnosti ujedno znači i sređeno djelovanje tržišta bez konflikata među poduzećima, što se odražava i na ukupnost ekonomskih odnosa i efikasnost poslovanja na nacionalnoj razini. Na isti način se udružuju i turističke agencije, iz različitih razloga i na različite načine. Udružuju se radi unaprjeđenja vlastitog poslovanja, uspješnijeg uključivanja u međunarodno turističko tržište te radi jačanja svog konkurentskog položaja. U novije je vrijeme sve više razlog udruživanja zaštita potrošača i partnera turističkih agencija. Suradnja turističkih agencija može se postići na više načina, a najčešće poprima oblik nacionalnih i međunarodnih profesionalnih organizacija. Danas, gotovo više i nema zemlje u Europi koja nema vlastito nacionalno udruženje turističkih agencija (Vukonić, 2003.).

2. Turistički vodič i njegova uloga u poslovanju turističkih agencija

Zakon o pružanju usluga u turizmu (čl. 5.) definira turističku agenciju kao trgovačko društvo, trgovca pojedinca, obrtnika ili njihovu organizacijsku jedinicu koji pružaju usluge organiziranja putovanja ili posredovanja usluga vezanih za putovanje i boravak turista. U svakom radnom procesu, kako onom koje se pretežito događa na turističkom tržištu, tako i izvan njega, sudjeluju različiti proizvodni čimbenici. Uvažavanje specifičnosti poslovanja određene djelatnosti prilikom kombiniranja proizvodnih čimbenika, pri čemu se na turističkom tržištu javlja zahtjev za angažiranjem veće količine proizvodnog čimbenika rada, pridonosi općoj i posebnoj učinkovitosti poslovanja svakog poduzeća. Iako su sredstva materijalna osnova poslovanja turističke agencije, osoblje je živi element koji osmišljava,

stvara i plasira na tržište temeljni proizvod turističke agencije - turistički aranžman, ali i pruža ostale usluge koje su predmet poslovanja turističke agencije. Tek zajedničkim i usklađenim djelovanjem živog rada i materijalnih sredstava agencija može ostvariti svoje zadatke i postavljene ciljeve te zadovoljiti vlastiti probitak i zadovoljstvo putnika odnosno korisnika usluge.

Uspjeh poslovanja turističke agencije ovisi o kvalitetno i kvalificirano obavljenom kreiranju, prodaji i izvršenju turističkih aranžmana. Dakako, kvalificiranost osoblja koje radi na tim poslovima dolazi u prvi plan. Za razliku od drugih djelatnosti, putničke agencije moraju raspolagati zaposlenicima koji imaju viši stupanj obrazovanja. Međutim, osim formalnog obrazovanja, koje može biti stečeno na različitim obrazovnim institucijama čak vrlo različitog profesionalnog usmjerenja, turistička se agencija u svom poslovanju najviše oslanja na osoblje koje ima specijalizirana znanja. Dakle, osim o specijaliziranim (posebnim) znanjima, govorimo i o specijalističkim poslovima pa i o specijalističkim kadrovima. U takve kadrove u turističkim agencijama ubrajamo: turističke vodiče, turističke (agencijske zastupnike) i prodavače putnih karata u zračnom prometu (Vukonić, 2003.).

Prema Federaciji Europskih udruga turističkih vodiča (FEG) turističkim vodičima smatraju se osobe koje vode posjetitelje, na jeziku po njihovom izboru te interpretiraju kulturnu i prirodnu baštinu određenog prostora. Ove osobe posjeduju dozvole i kvalifikacije priznate od strane odgovarajućih vlasti (http://www.feg-touristguides.com/cen_definitions.php). Osnovni zadatak turističkog vodiča je prezentacija turističke destinacije i tumačenje pojedinih aktivnosti pa se često navodi kako se turistički vodiči smatraju neslužbenim predstavnicima zemlje domaćina pred stranim turistima budući da izravno prezentiraju atraktivnosti destinacije turistima. Osim visokog stupnja obrazovanja, turistički vodiči moraju stalno raditi na prikupljanju i obradi informacija (Spasić, 2013.), a njihovo neformalno obrazovanje, hobiji i interesi daju dodatnu vrijednost širini i kvaliteti njihovog rada. Turistički vodiči moraju se doimati sigurno i suvereno vladati podacima koje pružaju te biti spremni kvalitetno odgovoriti na postavljena pitanja.

Glede djelovanja turističkih vodiča u Hrvatskoj Zakonodavac je donio i određene pravilnike kao: Pravilnik o stručnom ispitu za turističke vodiče i ispitnom programu za turističke pratitelje, Pravilnik o upisniku turističkih vodiča i Pravilnik o iskaznici turističkog vodiča.

Pravilnikom o stručnom ispitu za turističke vodiče propisuje se način polaganja stručnog ispita, ispitni program te sastav ispitne komisije. Stručni ispit za turističke vodiče polaže se na hrvatskom jeziku pred komisijom koju imenuje ministar nadležan za turizam pri odgovarajućem visokom učilištu. Sjedišta visokih škola na kojima se polaže stručni ispit su: Dubrovnik, Split, Šibenik, Zadar, Opatija, Pula, Zagreb te Osijek. O položenom ispitu visoko učilište kandidatu izdaje uvjerenje o položenom stručnom ispitu za turističkog vodiča (http://www.mint.hr/UserDocsImages/150113_ZoPUuT.pdf). Kompetencije koje vodiči stječu vezane su za područja političkog i gospodarskog sustava Republike Hrvatske, hrvatske povijesti, kulturno-povijesnih znamenitosti Republike Hrvatske, kulture govorenja i pisanja, osnova turizma i turističkog zakonodavstva, turističkog zemljopisa Hrvatske te poznavanja stranog jezika. Budući da se pojavljuju kao formalni, ali i neformalni uvjeti za obavljanje poslova vođenja turista, pitanje stručne spreme i poznavanja stranih jezika imaju bitnu ulogu. Što više jezika znaš to više vrijediš, stara je izreka koja u obavljanju poslova vođenja turista ima dobronamjernu primjenu. Vodič koji govori više jezika u nemjerljivoj je prednosti pred onim koji govori samo materinji jezik. Poznavanje stranih jezika bitno je u više dimenzija: radi komunikacije s turistima, radi pripreme za vođenje, istraživanja, prikupljanja i selektiranja informacija i upoznavanja kulture, obrazovnog, političkog i gospodarskog sustava zemlje u kojoj se vođenje odvija te radi komunikacije s lokalnim stanovništvom, lokalnim davateljima usluga i vlastima.

Dakle, poslovima turističkog vodiča ne može se baviti osoba koja ne zadovoljava uvjete propisane u navedenim Pravilnicima. Turistički vodiči polaganjem stručnog ispita, dobivaju licencu (dozvolu) vođenja za određenu turističku cjelinu (lokalitet). Turistički vodič može pružati uslugu i na ostalom području Republike Hrvatske koje nije određeno kao turistička cjelina (lokalitet) ako je položio samo opći dio stručnog ispita za turističkog vodiča. Također, ove bi osobe morale biti snalažljive, okretne, komunikativne te poznavatelji više stranih jezika. Bitno je naznačiti da Zakonodavac regulira i osobe koje mogu voditi turiste, a ne smatraju se turističkim vodičima. Naime, članak 26. stavak 8. Zakona o pružanju usluga u turizmu navodi da se turističkim vodičem ne smatra osoba koji obavlja poslove stručnog vođenja u muzeju, galeriji, zaštićenom području prirode, na arheološkom lokalitetu i sl., gorski vodič, planinski vodič, speleološki vodič, voditelj u ronilačkom turizmu te vodič u lovu i ribolovu. Za pružanje usluga turističkog vodiča turistički vodič mora imati odobrenje koje mu izdaje nadležni ured na čijem području djeluje.

Čitav je niz usluga počevši od dočekivanja i ispraćaja turista, prevođenja, transfera, asistencije pri smještaju i prehrani, preko organizacije zabave, animacije pa do realizacije, razgleda, izleta i tura u kojima značajnu ili čak i presudnu ulogu imaju turistički vodiči. Neovisno o kojoj se konkretnoj usluzi radi u svojoj biti, poslovi vođenja sastoje se od operativno tehničkih poslova s jedne strane, te pokazivanja i stručnog objašnjavanja turistima s druge strane (Trezner, 2008.). Ipak, postoje velike razlike u načinu na koji se poslovi organiziraju te kako se za njih osposobljavaju osobe koje vode turiste ovisno o tome dolaze li one s turistima iz zemalja njihova prebivališta ili ih dočekuju i obavljaju vođenje u zemlji koja je turističko odredište. Oko operativno tehničkih poslova vođenja nema značajnijih razlika niti razmimoilaženja, dok kod poslova pokazivanja i stručnog objašnjavanja postoji značajna rasprava u domaćima, ali i u europskim okvirima. Problem nastaje u smislu prava pokazivanja i tumačenja znamenitosti tijekom turističkog putovanja. S jedne strane pravo je organizatora putovanja da, u zemlji iz koje turisti polaze, samostalno prema svojim kriterijima osposobljava osobe koje će pokazivati i tumačiti znamenitosti prije svega zbog kvalitetnije interpretacije usklađene s obrazovanjem i sustavom vrijednosti turista. Na drugoj strani su interesi i prava lokalnih zajednica i zemalja u koje turisti dolaze da zaštite pravo interpretacije svoje baštine prvenstveno za domaće vodiče koji se osposobljavaju po posebnim pravilima uvažavajući nacionalne i lokalne specifičnosti, prije svega povijest i kulturu koju bi strani vodiči mogli pogrešno ili zlonamjerno interpretirati.

Razlikuju se dvije skupine turističkih vodiča (Vukonić, 2003.): turistički vodiči specijalizirani i ovlašteni za razgled određenog mjesta, grada ili područja i vodiči – pratitelji aranžmana (turistički pratitelj).

Turistički vodiči specijalizirani za razgledavanje određenih mjesta, gradova ili područja obično su osobe koje su za taj posao osposobljene i verificirane od strane nadležnih institucija nakon odslušanog i položenog ispitnog programa koji se sastoji od općeg i posebnog dijela. Turistički vodiči najčešće su organizirani u posebnim strukovnim organizacijama, neovisno o poslovanju turističkih agencija, a agencije se njima koriste temeljem ugovora i prema potrebama. Posao vodiča je da po potrebi vode grupe obično inozemnih turista i da im na njihovom materinskom jeziku pružaju usluge pokazivanja i stručnog objašnjavanja prirodnih ljepota i rijetkosti, kulturno-povijesnih spomenika, umjetničkih djela, etnografskih i drugih znamenitosti, povijesnih događaja, ličnosti, legendi o tim događajima i ličnostima, gospodarskih i političkih tijekova i zbivanja (Zakon o pružanju usluga u turizmu, čl. 26., st. 1.). S obzirom na izravan kontakt koji vodiči imaju s inozemnim turistima, često se zovu turističkim ambasadorima svoga grada ili svoje zemlje jer se njihova aktivnost ne iscrpljuje samo u spomenutim informacijama. Zbog svog relativno visokog obrazovanja takvi se kadrovi koriste u turističkoj agenciji i za druge potrebe, na primjer, prilikom obavljanja transfera u dolasku i odlasku, prilikom dočeka i ispraćaja turista (Vukonić, 2003.).

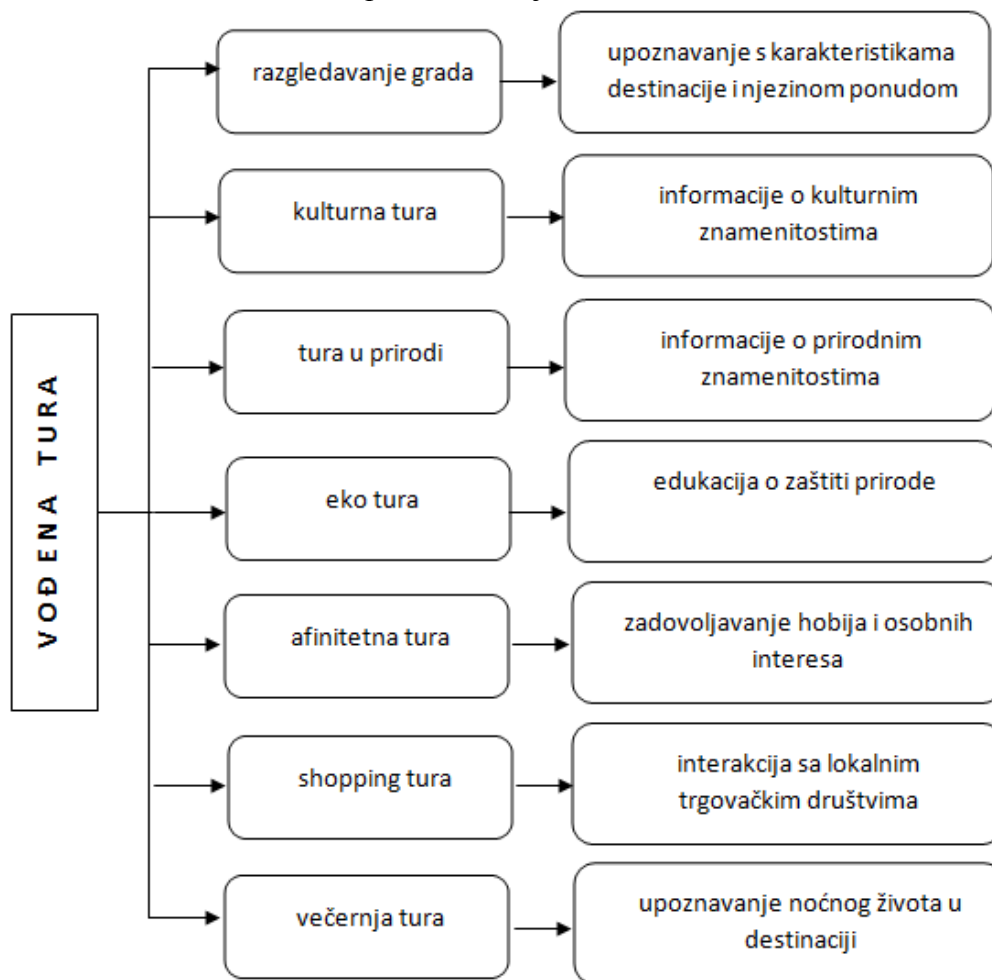
Turistički pratitelj obavlja operativno-tehničke poslove u vođenju i praćenju turista, a također može tijekom putovanja, osim u turističkim cjelinama (lokalitetima), davati putnicima osnovne informacije o područjima obuhvaćenim putovanjem (Zakon o pružanju usluga u turizmu, čl. 37., st. 1.). Zakon također nalaže da turistički pratitelj za pružanje usluga turističkog pratitelja mora imati položen ispit za turističkog pratitelja. Bitno je naglasiti da su osobe koje imaju položen stručni ispit za turističkog vodiča oslobođene obveze polaganja ispita za turističkog pratitelja. Zadaća je turističkog pratitelja da u ime svoje agencije, vodi brigu za što bolje izvršenje svih prodanih aranžmana od početka do završetka putovanja. Prije početka putovanja on mora biti detaljno upoznat sa svim pojedinostima aranžmana, mora točno provjeriti jesu li izvršene i potvrđene sve rezervacije te sve eventualne nejasnoće mora unaprijed rasvijetliti odnosno otkloniti. Drugi njegov važni zadatak je temeljito proučavanje itinerera, radi što boljeg i potpunijeg davanja informacija sudionicima putovanja o mjestima i krajevima kroz koje se prolazi. Turistički pratitelj mora sigurno i pouzdano voditi klijente kroz razne gradove, područja i mjesta, pri čemu klijenti ne smiju voditi nikakvu brigu o organizaciji putovanja, a svu odgovornost za rješavanje eventualnih problema rješava sam turistički pratitelj. On je u stalnom kontaktu sa putnicima, iz razgovora s njima ne doznaje samo njihove posebne želje u pogledu smještaja, izleta ili nabavke raznih predmeta, nego i o tome što ih, za vrijeme putovanja u krajevima i mjestima kojima prolaze, najviše zanima. Turistički pratitelj treba posjedovati tri glavne karakteristike: hladnokrvnost, okretnost i brzu snalažljivost u svakoj situaciji. Nervozan, nespretn i nesnalažljiv čovjek ne može biti dobar turistički pratitelj jer bi i sam mogao dovesti turiste u neugodne situacije (Vrignanin, 1957.).

Turistički vodiči udružuju se u strukovne udruge radi zaštite profesije turističkih vodiča te pružanja turističkih usluga, unaprjeđenja kvalitete usluga turističkih vodiča odnosno lokalnog turizma te turizma uopće kao i zaštite i promicanja kulturne, povijesne baštine na području cijele Hrvatske (http://www.zagrebguides.com/download/STATUT_ZG-GUIDES.pdf). Udruge turističkih vodiča imaju važnu ulogu kako na nacionalnoj tako i na međunarodnoj razini. Na razini Republike Hrvatske poznate su udruge turističkih vodiča grada Zagreba, Splita, Dubrovnika, Pule, Zadra, Šibenika dok se u Europi izdvajaju udruge turističkih vodiča Njemačke, Austrije, Engleske, Italije, Danske, Portugala, Španjolske i drugih (http://www.feg-touristguides.com/links.php#european_tourist).

3. Vođene ture kao specifičan proizvod putničkih agencija

U pogledu definiranja pojma vođene ture ima različitih stavova, prije svega zbog toga što se pojam „tura“ poistovjećuje s kružnim putovanjem. Vođene ture podrazumijevaju ture koje mogu varirati od kratke prezentacije turističkog vodiča na nekom posebnom mjestu tijekom ograničenog perioda ili, pak, uključivati produženi kontakt između vodiča i turističke grupe koji traje danima, ponekad i tjednima (Rabotić, 2009.). Pojam „vođena tura“ nije obvezno sinonim za pojam „turistički aranžman“ kako se uobičajeno misli pa između dva navedena pojma treba povući jasnu razliku. Turistički aranžman, kao kombinacija usluga, ne podrazumijeva obvezno i uslugu turističkog vodiča. S druge strane, vođena tura nije uvijek i kombinacija usluga jer ponekad uključuje samo uslugu turističkog vodiča (pješačka tura, tura u muzeju). Drugim riječima, turistički aranžman može u cjelini imati oblik vođene ture ili u nekim segmentima svog programa uključivati pojedine vođene ture dok vođena tura dobiva karakteristiku turističkog aranžmana kada osim turističkog vođenja sadrži na primjer i uslugu prijevoza. Stoga čak i poludnevne ili cjelodnevne ture, ukoliko se ostvaruju prijevoznim sredstvom, imaju karakter turističkog aranžmana. Vođene ture dijelimo s obzirom na kriterije kao što su: dužina trajanja putovanja, sezona, lokacija, način prijevoza, skupina turista i slično. Brojne su vrste vođenih tura koje se mogu izvoditi na određenom lokalitetu ovisno o čimbenicima atraktivnosti koji se nalaze na samom lokalitetu. Kratki pregled vrsta vođenih tura prikazuje shema 1.

Shema 1. Vrste vođenih tura prema sadržaju



Izvor: prilagođeno prema Rabotić, 2010.

Također, u poslovanju turističkih agencija bitno je razlikovati mikroturu od makroture (Rabotić, 2010.). Mikrotura je poludnevni ili cjelodnevni program razgledavanja određene atrakcije ili više njih koji se ostvaruje pješice, autobusom ili nekim drugim prijevoznim sredstvom. Karakterističan primjer mikroture je razgledavanje grada, pojedinih lokaliteta ili atrakcija. Pod makroturom, s druge pak strane, podrazumijevamo višednevni turistički aranžman, čiji program obuhvaća obilazak većeg broja turističkih destinacija (uz moguće angažiranje turističkog vodiča na određenim područjima). Razgledavanje uz turističkog vodiča postalo je ključni segment turističkog putovanja, ali i doživljaja koje turisti ostvaruju u turističkoj destinaciji.

Iz sociološke perspektive, nekoliko je prednosti vođenih tura. Vođena tura rješava problem izbora onoga što treba vidjeti u okviru ograničenog vremena te nudi psihološku sigurnost turistima, budući da su unaprijed poznati svi elementi turističkog putovanja, s naglaskom na program i troškove putovanja. Vođena tura također razvija solidarnost unutar same grupe. Prednost vođene ture iz perspektive lokalne zajednice i turističkog gospodarstva ogleda se u činjenici da vođena tura kontrolira broj turista koji posjećuju određeno mjesto. Bitno je da su prilikom izvođenja same ture turisti upućeni na upoznavanje za njih značajnih atrakcija određenog lokaliteta, a istovremeno udaljeni od svega što im nije interesantno. Vođena tura daje prednost aktivnom ili obrazovnom načinu korištenja slobodnog vremena, a budući da kombinira pustolovinu, bijeg od svakodnevnice i kulturni doživljaj, uz zajamčenu sigurnost sve je omiljenija među različitim segmentima turističkih potrošača.

Zajedničko za sve navedene vrste vođenih tura je činjenica da niti jedna vođena tura ne može biti realizirana bez nazočnosti licenciranog turističkog vodiča. Upravo stoga, svaka vođena tura je jedinstvena jer je pod utjecajem osobnih interesa i preferencija turističkog vodiča koji će uvijek na svoj jedinstveni način nastojati oživjeti u očima turista određeni lokalitet. S druge strane, na samo izvođenje i sadržaj vođene ture veliki utjecaj ima skupina turista kojoj se prezentira lokalitet jer u skladu s njihovim interesima, njihovoj znatizelji i prethodnom poznavanju lokaliteta, turistički vodič će nastojati na licu mjesta prilagoditi samu turu. S tim u vezi postaje jasno da kvaliteta vođene ture ovisi o kvalificiranosti, iskustvu, maštovitosti i prilagodljivosti turističkog vodiča, a poseban interes turističkih agencija postaje pronaći kvalitetne turističke vodiče koji mogu osigurati potrebnu razinu kvalitete usluge koju izravno pružaju posjetiteljima.

Posebna vrsta vođenih tura su tzv. tematske ture. Razvoj tematskih tura ovisi o čimbenicima atraktivnosti destinacije ali i o sposobnosti organizatora tematskih tura da oživi povijesne događaje, legende, bajke ili neke druge detalje koji se mogu povezati s lokalitetom, a mogu na poseban način probuditi interes turista u destinaciji. Osmisliti i ponuditi tematsku turu u destinaciji mogu samo najkvalitetniji turistički vodiči koji poznaju sitne karakteristične detalje lokaliteta, a u stanju su od njih kreirati priču koja govori o skrivenom kulturno-povijesnom, etnografskom, gastronomskom i drugom naslijeđu destinacije.

Jedna od najpoznatijih tematskih tura u svijetu je kombinirana autobusno-pješačka tura pod nazivom „Jack Trbosjek“ koju nudi britanska turistička agencija Evan Evans (<https://evanestours.com/sightseeing-tours/london-tours/afternoon-london-jack-the-ripper-combo/>).

U Hrvatskoj najbolju ponudu tematskih tura imaju gradovi: Zagreb, Osijek i Dubrovnik. Shema 2 daje kratki prikaz najzanimljivijih tematskih tura u navedenim gradovima sa kratkim opisom njihovog sadržaja.

Shema 2. Tematske ture na hrvatskom turističkom tržištu

Lokalitet	Naziv tematske ture	Kratak opis tematske ture
Zagreb	Opsjednuti Zagreb	Prva zagrebačka tura duhova koja se provodi u večernjim satima i otkriva najjezovitija mjesta i tajanstvene stanare ovoga grada.
	Uspavani zmaj	Jedna od nebrojenih zagrebačkih zmijskih legendi, govori o ukletoj zmijskoj kraljici koja ljubomorno čuva izgubljeno medvedgradsko blago.
	Zagrebarium	Tura koja vodi u steampunk potragu za futurističkom prošlošću, ekscentričnim ličnostima, stogodišnjim brendovima te zaboravljenim snovima o budućnosti.
	Zagrebačka zimska bajka	Sezonsko razgledavanje grada koje oživljava stare običaje i zagrebačku povijest.
Dubrovnik	Games of Thrones	Otkrivanje čari King's Landinga po lokacijama gdje se snimala istoimena serija.
Osijek	Osječki parkovi i rijeka Drava	Doživljaj živog svijeta parkova, flore i faune te „zelene ljepotice“ rijeke Drave koja se nedaleko od Osijeka ulijeva u Dunav, a svojim vodama natapa i obližnji park prirode Kopački rit.
	Život pod Osmanskim carstvom	Tura u pratnji kostimiranog „Sulejmana Veličanstvenog“ kroz interakciju s grupom oživljava priču o životu sultana, osmanskog kulturi i načinu života, kao i o Osijeku u vrijeme Osmanskog carstva.

	Srednjovjekovni Osijek obitelji Korogy	Tura koja predočava srednjovjekovne dane “ponosa i slave” osječkih vladara, a sam grad Korod (Korogyvar) očarava veličinom, a začara brojnim legendama s kojima se povezuje.
	Fijaker stari gradom luta	Najromantičniji način upoznavanja Grada na Dravi je vožnja starim fijakerom s upregnutim plemenitim konjima, uz kočijaša odjevenog u crni frak s cilindar šeširom.
	Osijek iz zraka	Pogled na gradske znamenitosti s visine omogućava uživanje u vizuri Drave i njenim rukavcima koji se razlijevaju uokolo grada te obrađenim slavonskim poljima i šumama.

Izvor: <http://hr.secret-zagreb.com/obilasci-zagreba/>, <http://karaka.info/hr/game-of-thrones/>, <http://www.tzosijek.hr/index.php/upoznajte-osijek/tematske-ture-gradom>

Tematske ture od velikog su značaja za ponudu turističke destinacije. Tematske ture omogućavaju turistima koji se vraćaju u destinaciju da otkriju čari i detalje skrivene u legendama, bajkama, narodnim pričama kao i povijesnim zapisima, a obogaćujući ponudu turističke destinacije pružaju mogućnost lokalnoj zajednici da na što kvalitetniji način turistički valorizira raspoložive resurse.

4. Zaključak

Uspješnost poslovanja turističkih agencija ovisi o njihovom najvažnijem proizvodnom čimbeniku, ljudskom kapitalu. Iako je za osmišljavanje, stvaranje i plasiranje na tržište najznačajnijeg proizvoda turističkih agencija, turističkog aranžmana, potrebno osigurati kvalitetne zaposlenike koji raspolažu različitim znanjima i vještinama, kvalitetu turističkog aranžmana klijenti percipiraju prema razini kvalitete izravnih isporučitelja turističkih usluga, koje su sastavni dio samog aranžmana.

Turistički vodiči, iako u pravilu nisu zaposlenici turističkih agencija, izravna su veza turističkih agencija s njihovim klijentima te je njihova uloga u poslovanju turističkih agencija izuzetno važna. Oni izravno na turističkom lokalitetu oživljavaju proizvod koji je klijent kupio od turističke agencije. Stoga je jako bitno da agencija i turistički vodič pravovremeno informiraju jedni druge o svim bitnim detaljima, preferencijama, željama i interesima klijenata, kako bi percipirajući njihove želje i potrebe mogli još dodatno personalizirati pruženu uslugu te time podići razinu kvalitete isporučene usluge.

Specifičan turistički proizvod, koji se ne bi mogao realizirati bez angažiranja turističkih vodiča, vođene su ture. Zbog promjena trendova na turističkom tržištu koje se na strani turističke potražnje ogledaju kroz težnju turista da aktivno dožive turističku destinaciju koju posjećuju, vođene ture postaju sve značajniji segment turističkih aranžmana, ali i samostalan proizvod koji se zasebno nudi na tržištu. Budući da su vođene ture pod izravnim utjecajem turističkog vodiča koji ih izvodi, svaka je jedinstvena, a u interakciji sa turistima postaje u potpunosti personalizirana usluga. Od velikog broja različitih vođenih tura koje se mogu realizirati u destinaciji, možda su najzanimljivije tematske ture, koje bez novostvorene materijalne vrijednosti, na povijesnom naslijeđu, narodnim pričama, legendama i sl. grade novi turistički proizvod koji uistinu obogaćuje ponudu turističke destinacije. Uloga turističkih vodiča u osmišljavanju tematskih tura nezamjenjiva je jer jedino oni, kao poznavatelji potencijala lokaliteta te dojmova turista o zanimljivostima destinacije, pronalaze niše kojima golicaju maštu turista koji su uvijek spremni za nove doživljaje.

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Contribution of tourist guides to the business of travel agencies

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Abstract. Changes in the turbulent tourism market prompt travel agencies to refocus their business ventures from the field of classical intermediation towards the creation of complex tourist products, the so-called package tours. However, in both cases, core business remains in the activities of providing services. The prerequisite for providing quality services is high-quality human capital. Although a wide range of activities undertaken by travel agencies in the creation and sale of package tours require the staff to be familiar with different knowledge and skills, this paper focuses on the role and contribution of tourist guides to the business of travel agencies. Tourist guides are considered as unofficial representatives of the host country to the foreign tourists, since they present tourists with destination attractiveness and must therefore ensure the level of quality that travel agencies promised to their clients. Even though tourist guides are required to provide confirmation of formal education, acquired most often with some other profession, changes in consumer preferences of tourist demand also impose the need for the tourist guides to specialize in smaller specific areas of interest. Without tourist guides, it would not be possible to realize the so-called guided tour, as a special form of excursion which is a very popular product offered by travel agencies. On the other hand, no one other than highly specialized tourist guides can create thematic guided tours which, in a special way, enrich the offer of the tourist destination. However, travel agencies rarely employ tourist guides on a permanent basis, and they usually only hire them when it is necessary. This creates a potential problem for a travel agency in finding a quality tourist guide with sufficient professional experience, who can guarantee the level of quality of service promised by the travel agency.

Key words: *travel agency, tourist guide, guided tour, thematic guided tour*

Zaštita malih i srednjih poduzetnika od nepoštenog trgovanja

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Sažetak. Danas su veliki trgovački lanci sve češće izravni konkurenti malim i srednjim proizvođačima i trgovcima jer imaju vlastite trgovačke marke. Zbog bolje pregovaračke pozicije veliki poduzetnici su u mogućnosti ucjenjivati male i srednje poduzetnike odnosno ponašati se nepošteno prilikom sklapanja ugovora, ali i tijekom trajanja ugovornog odnosa. Odredbe o nepoštenom trgovanju u našem pravnom sustavu sadržane su u Zakonu o trgovini, koji ne razlikuje male i srednje poduzetnike od velikih te posljedično tome ne sadrži posebne odredbe o zabrani zlouporabe veće pregovaračke moći. Zbog nedostatne zaštite malih i srednjih poduzetnika od nepoštenog trgovačkog prakse u nacionalnim zakonodavstvima, Europska komisija je u siječnju 2013. godine donijela Zelenu knjigu o nepoštenim trgovačkim praksama među poduzećima u opskrbnom lancu prehrambenih i neprehrambenih proizvoda u Europi. U ovom radu analizirat će se najčešća djela nepoštenog trgovanja u odnosu na male i srednje poduzetnike te će se ispitati mogućnosti njihove pravne zaštite prema važećim propisima Republike Hrvatske.

Ključne riječi: nepošteno trgovanje, mikro, mali i srednji poduzetnici, zlouporaba pregovaračke moći

1. Uvod

Trgovina na malo predstavlja jednu od važnijih gospodarskih djelatnosti u Europskoj uniji pa tako prema podacima Eurostata iz 2010. čini 4.3 % BDP-a EU, zapošljava 8.3 % radnika EU, a 17 % te djelatnosti obavljaju srednja i mala poduzeća (SME).¹ Njome se osigurava distribucija robe i usluga, od poljoprivredno prehrambenih proizvoda, malih elektroničkih uređaja, odjeće, kozmetičkih proizvoda i sl.

Zadnja dva desetljeća ova djelatnost doživljava značajne promjene i to prvenstveno zbog ekonomskih, demografskih i socijalnih razloga koji su posljedica pojačanja globalizacije, razvoja e-trgovine, ali i proširenja EU na 28 država članica. Sve to dovodi do pojačanog tržišnog natjecanja među multinacionalnim konglomeratima, ulaska velikih multinacionalnih kompanija i pripajanja manjih poduzeća od strane velikih pa su tako neki veliki trgovci na malo poput *Metro Group* i *Carrefour* prisutni u 30-40 država, a *Casio*, *Auchan*, *Metro Group* ili *Schwarz Group* ostvaruju više od 60 % godišnjih prihoda izvan države svoga sjedišta.²

U takvim okolnostima manji broj relativno jakih trgovaca na malo stječe značajnu pregovaračku moć koja je sama po sebi uobičajena i legitimna pojava u trgovačkim odnosima,

¹ COM (2013) 37 Final of 31 January 2013, Green Paper on Unfair Trading Practices in the Business-To-Business Food and non-Food Supply Chain in Europe.

² Study on the Legal Framework Covering Business-to-Business Unfair Trading Practices in the Retail Supply Chain, Final Report, 26 February 2014.

ali upravo zloupotreba te moći utječe na stvaranje nepoštenih trgovačkih praksi. Naime, takvi trgovci razvijaju vlastitu praksu i standardizirane obrasce ugovora kojima kontroliraju lanac opskrbe i to pogotovo u onim državama čiji pravni sustavi odgovornost za propast ili oštećenje stvari prebacuju na prodavatelja.³ Upravo je u tome njihova snaga jer nametanjem takvih obrazaca ugovora, koje druga strana u pravilu prihvaća, onemogućava ravnopravnost sudionika tog poslovnog odnosa.

Europska komisija je još 2009. godine raspravljala o pojavi nepoštenih poslovnih praksi u prehrambenom sektoru⁴ i to zbog toga što su one značajno utjecale na prava potrošača na način da su potrošačima onemogućavale poštenu ponudu šire palete proizvoda kao i njihovih cijena, a s druge strane su posrednici, prerađivači hrane i trgovci na malo značajno ograničili moć poljoprivrednih proizvođača. Kako lanac opskrbe hranom⁵, koji obuhvaća niz različitih tržišnih subjekata (proizvođači, prerađivači, trgovci na malo) predstavlja značajnu stavku u svakodnevnom životu građana EU⁶, jasno je zašto je ovaj problem toliko značajan.

Stoga je Europska komisija 2013. donijela Zelenu knjigu o nepoštenim trgovačkim praksama među poduzećima u opskrbnom lancu prehrambenih i neprehrambenih proizvoda u Europi (u nastavku - Zelena knjiga) u kojoj je i navela glavne kategorije nepoštenih trgovačkih praksi.

Osim toga odredila je i subjekte kojima može nastati šteta korištenjem nepoštenih trgovačkih praksi, a to su odnosi među poduzetnicima ili poduzetnicima i osobama javnog prava u opskrbnom lancu prehrambenih i neprehrambenih proizvoda odnosno lanca koji služi dostavi robe prvenstveno namijenjenoj široj javnosti ili potrošnji u kućanstvu. Kako su većina tih poduzetnika u lancu opskrbe hranom mala, srednja i mikro poduzeća, primijećena je njihova ranjivost u odnosu na jače i veće trgovačke partnere i upravo njih najviše pogađaju nepošteno trgovačke prakse. One mogu imati izravne učinke koje utječu na njihovu sposobnost opstanka na tržištu, nova financijska ulaganja u proizvode i tehnologiju te razvoj prekograničnih aktivnosti malih, srednjih i mikro poduzeća na jedinstvenom tržištu, ali i neizravne učinke koji se očituju u strahu od ostvarivanja trgovinskih odnosa s potencijalnim partnerima.⁷

2. Pojam mikro, malih i srednjih poduzetnika

Mikro, mali i srednji poduzetnici smatraju se pogonom europske ekonomije te je devet od deset poduzeća mikro, mali ili srednji poduzetnik i zapošljavaju dva od tri radnika te je prema tome njihova uloga ključna za jačanje tržišnog natjecanja i povećanje zapošljavanja.⁸ Pojam mikro, malih i srednjih poduzetnika u europskom pravu, kao i u pravima država članica Europske unije određen je prvenstveno radi mogućnosti korištenja politika, programa, mjera i potpora koje daju Europska komisija i nacionalne države, kako bi ih se potaklo na financiranje i ulaganje u razvoj i inovacije. Stoga, definiciju mikro, malih i srednjih poduzetnika ne nalazimo u primarnom pravu Europske unije, kao niti u obveznom pravu nacionalnih država jer se radi o trgovcima koji se do sada nisu smatrali zasebnom kategorijom kojoj se dodjeljuje

³ Ibid.

⁴ Više o tome vidi u : A better functioning food supply chain in Europe, (COM(2009)591, 28 October 2009)

⁵ Lanac opskrbe hranom ima snažnu međunarodnu dimenziju i osobitu važnost u okviru jedinstvenog tržišta EU, jer prekogranična trgovina među državama članicama čini otprilike 20% ukupne proizvodnje hrane u EU, dok je barem 70% ukupnog godišnjeg izvoza poljoprivrednih proizvoda država članica namijenjeno drugim državama članicama. European Commission to tackle unfair practices in the food supply chain, Press Release, Brussels/Strasbourg, 15 July 2014

⁶ Prema podacima Eurostata iz 2012. čak 14% njihovih kućanskih izdataka otpada na hranu. U Hrvatskoj je situacija još nepovoljnija, jer prema podacima Državnog zavoda za statistiku o osnovnim karakteristikama potrošnje kućanstva u 2014. godini, Hrvatima čak 29.5% kućnih izdataka otpada na hranu i bezalkoholna pića.

⁷ COM (2014) 472 Final of 15.7.2014 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions; Tackling unfair trading practices in the business-to-business food supply chain

⁸ Vidi: file:///D:/Downloads/smedefinitionguide_en.pdf.

posebna pravna zaštita u odnosu na veće trgovce, premda su neki propisi doneseni prvenstveno radi njihove zaštite.⁹

Europska definicija sadržana je u čl. 2. Aneksa Preporuke Komisije iz 2003/361/EZ, prema kojoj su mikro, mali i srednji poduzetnici neovisna poduzeća koja zapošljavaju manje od 250 osoba i čiji godišnji promet ne prelazi 50 milijuna eura i /ili prema godišnjim financijskim izvješćima ne prelazi 43 milijuna eura.¹⁰

U Republici Hrvatskoj definicija je sadržana u Zakonu o poticanju razvoja malog gospodarstva.¹¹ Malo gospodarstvo u smislu tog Zakona čine subjekti u poduzetništvu i obrtu koji zapošljavaju prosječno godišnje manje od 250 radnika, u poslovanju su neovisni odnosno autonomni subjekti koji nisu klasificirani kao partnerski subjekti te povezani subjekti, sukladno Preporuci Komisije 2003/361/EC od 6. svibnja 2003. godine, prema financijskim izvješćima za prethodnu godinu ostvaruju godišnji poslovni prihod u iznosu protuvrijednosti do 50.000.000,00 eura ili imaju ukupnu aktivu ako su obveznici poreza na dobit odnosno imaju dugotrajnu imovinu ako su obveznici poreza na dohodak, u iznosu protuvrijednosti do 43.000.000,00 eura. Subjekti malog gospodarstva su fizičke i pravne osobe koje samostalno i trajno obavljaju dopuštene djelatnosti radi ostvarivanja dobiti odnosno dohotka na tržištu. Neovisnost u poslovanju, u smislu tog Zakona, znači da druge fizičke ili pravne osobe, koje ne udovoljavaju kriterijima iz stavka 1. ovoga članka, pojedinačno ili zajednički, nisu vlasnici više od 25 % udjela u vlasništvu ili pravu odlučivanja u subjektu malog gospodarstva. Neovisnost u poslovanju postoji i ako je prekoračen udjel od 25 % iz stavka 3. ovoga članka, u slučajevima: ako udio u vlasništvu ili pravu odlučivanja u subjektu malog gospodarstva ima investicijski fond ili drugi institucionalni ulagatelj, pod uvjetom da nemaju kontrolu nad subjektom malog gospodarstva, bilo pojedinačno ili zajednički ili ako raspored udjela u vlasništvu u subjektu malog gospodarstva nije moguće odrediti te se na osnovi posebne pisane izjave subjekta malog gospodarstva može opravdano pretpostaviti da druge fizičke ili pravne osobe, koje ne udovoljavaju navedenim kriterijima, pojedinačno ili zajednički nisu vlasnici više od 25 % udjela. Mikro subjekti malog gospodarstva su fizičke i pravne osobe iz članka 2. ovoga Zakona koje: prosječno godišnje imaju zaposleno manje od 10 radnika, prema financijskim izvješćima za prethodnu godinu ostvaruju godišnji poslovni prihod u iznosu protuvrijednosti do 2.000.000,00 eura ili imaju ukupnu aktivu ako su obveznici poreza na dobit odnosno imaju dugotrajnu imovinu ako su obveznici poreza na dohodak, u iznosu protuvrijednosti do 2.000.000,00 eura. Mali subjekti malog gospodarstva su fizičke i pravne osobe, koje prosječno godišnje imaju zaposleno manje od 50 radnika, prema financijskim izvješćima za prethodnu godinu ostvaruju godišnji poslovni prihod u iznosu protuvrijednosti do 10.000.000,00 eura ili imaju ukupnu aktivu ako su obveznici poreza na dobit odnosno imaju dugotrajnu imovinu ako su obveznici poreza na dohodak, u iznosu protuvrijednosti do 10.000.000,00 eura. Srednji subjekti malog gospodarstva su fizičke i pravne osobe čiji je godišnji prosječni broj radnika, ukupni godišnji promet ili zbroj bilance odnosno dugotrajna imovina veća od utvrđenih za malog subjekta.

⁹ Npr. u točki 1. Preambule Direktive 2000/35/EZ od 29. lipnja 2000. o borbi protiv kašnjenja u plaćanju u poslovnim transakcijama navodi da je Europski parlament u svojoj rezoluciji o integriranom programu u korist malog i srednjeg poduzetništva i obrtništva pozvao Komisiju da podnese prijedlog o rješavanju problema kašnjenja u plaćanju, iako se odredbe te Direktive primjenjuju na sva plaćanja izvršena radi naplate u transakcijama između poduzetnika, odnosno između poduzetnika i javnih tijela koja rezultiraju isporukom robe ili pružanjem usluga za naknadu.

¹⁰ U praksi nije lako odrediti radi li se o mikro, malom i srednjem poduzetniku. Europska komisija izdala je stoga upute za SME definiciju, vidi: file:///D:/Downloads/smedefinitionguide_en.pdf

¹¹ Narodne novine br. 29/02, 63/07, 53/12, 56/13.

3. Nepoštene trgovačke prakse

Nepoštene trgovačke prakse smatraju se prakse koje značajno odstupaju od dobrog poslovnog ponašanja, koje su oprečne dobroj vjeri i poštenoj trgovini te koje je jedan trgovinski partner jednostrano nametnuo drugome.¹²

Zelena knjiga uočila je neke od najučestalijih primjera nepoštene trgovačke prakse kao što su dvosmislene ugovorne odredbe, nepostojanje pisane forme ugovora, jednostrane promjene troška ili cijene proizvoda ili usluga s retroaktivnim učinkom, prijenos neopravdanog ili nerazmjernog rizika na ugovornu stranu, nepošteno korištenje informacija, jednostrani prekid poslovnog odnosa bez otkaznog roka ili prekid koji podliježe nerazumno kratkom otkaznom roku i bez objektivno opravdanog razloga i teritorijalne zabrane u opskrbi. Osim tih navedenih u Zelenoj knjizi, spomenut ćemo jednu koja se ne spominju u njoj, a u odnosu na koju je već donesena europska regulativa, a to je kašnjenje u plaćanju.

Svima je zajedničko da se one javljaju u "ozračju straha"¹³ u kojem je slabija ugovorna strana u strahu od prekida poslovnog odnosa s jačom stranom i upravo ta neravnopravnost stranaka stvara mogućnost nastanka nepoštene trgovačke prakse. Tipičan primjer takve situacije je prijetnja izbacivanja proizvoda iz ponude koju veliki trgovci na malo koriste da bi izravno ili neizravno iznudili razne oblike neopravdane i jednostrane koristi od dobavljača hrane.¹⁴

3.1 Nepoštene trgovačke prakse i Zakon o obveznim odnosima

Zakon o obveznim odnosima¹⁵ (u nastavku – ZOO) ne spominje direktno primjere nepoštene trgovačke prakse, što je i razumljivo jer se radi o Zakonu koji uređuje sve obvezne (ugovorne i izvanugovorne) odnose, ali ipak sadrži opća načela koja se primjenjuju na sve sudionike obveznog odnosa¹⁶. Tu se prije svega misli na načelo ravnopravnosti sudionika u obveznom odnosu, načelo savjesnosti i poštenja, načelo dužnosti suradnje te zabrane prouzročenja štete u skladu s kojima se treba promatrati svaki ugovor i poslovni odnos. Ova načela izgledaju suprotstavljena općem načelu slobode ugovaranja. Međutim, u nepoštenoj i neravnopravnoj situaciji nema prave slobode ugovornih stranaka. Sama činjenica da je netko ekonomski jača strana, ne predstavlja povredu prava, već kada je ta strana nepošteno postupila odnosno da je s drugom sklopila nepošteni ugovor ili ugovornu odredbu kao rezultat pregovora. Osim općih načela, u ZOO-u postoje i posebne odredbe koje mogu poslužiti kao rješenje za otklanjanje nekih od nepoštenih trgovačkih praksi.

3.1.1 Dvosmislene ugovorne odrede

Jedan od primjera nepoštene trgovačke prakse spomenute u Zelenoj knjizi je i postojanje dvosmislenih odredaba u ugovoru koje otvara mogućnost da se njihovim tumačenjem nameću dodatne obveze slabijoj ugovornoj strani. Naš ZOO ima rješenje za takvu praksu jer u čl. 320. propisuje da u slučaju kad je ugovor sklopljen prema unaprijed otisnutom sadržaju ili kad je ugovor na drugi način pripremila i predložila jedna ugovorna strana, nejasne odredbe tumačit će se u korist druge strane.

¹² COM (2016) 32 Final of 29.1.2016. Report from the Commission to the European Parliament and the Council on unfair business-to-business trading practices in the food supply chain

¹³ Europska komisija je razvila koncept koji naziva eng. „fear factor“.

¹⁴ COM (2013) 37 Final Mišljenje Stručne skupine za jedinstveno tržište, proizvodnju i potrošnju o Zelenoj knjizi o nepoštenim trgovačkim praksama među poduzećima u opskrbnom lancu prehrambenih i neprehrambenih proizvoda u Europi

¹⁵ Narodne novine br. 35/05, 41/08, 125/11, 78/15

¹⁶ Sudionici obveznih odnosa su fizičke i pravne osobe, bez obzira radi li se o trgovcima (B2B) ili potrošačima (B2C).

3.1.2 Nepostojanje pisane forme ugovora

Uočeno je da se nepoštena trgovačka praksa pojavljuje puno češće u ugovorima koji nisu sklopljeni u pisanoj formi. Naime, u takvim slučajevima je puno teže dokazati postojanje nepoštenih trgovačkih praksi. Naš zakonodavac ne propisuje obvezatnost određenog oblika pravnog posla, osim kao iznimke koje su posebno propisane. Ipak, bez obzira na sklapanje ugovora u usmenoj formi, ZOO u čl. 287. propisuje ovlaštenje bilo koje strane da od druge zahtijeva pisanu potvrdu usmeno sklopljenog ugovora sve dok druga strana ne ispuní obvezu iz ugovora. U slučaju da strana kojoj je upućen ovakav zahtjev isti odbije, druga strana može zahtijevati od suda da utvrdi postojanje ugovora i naknadu štete pretrpljene zbog toga što nije izdana pisana potvrda.

3.1.3 Prijenos neopravdanog ili nerazmjernog rizika na ugovornu stranu

Snošenje poslovnog rizika trebalo bi biti ravnomjerno podijeljeno između stranaka. Međutim, primijećeno je da trgovac na malo često prenosi rizik odgovornosti za krađu ili uništenje robe na dobavljača, iako mu je puno lakše kontrolirati krađu odnosno nestanak robe u svojim prostorijama. Nakon prenošenja rizika na dobavljača, interes trgovca na malo za provođenjem preventivnih mjera za sprječavanje krađe, odnosno nestanka robe drastično pada. Drugi načini nepoštenih trgovačkih praksi su i financiranje poslovnih aktivnosti drugog trgovca (npr. značajna ulaganja u njegove poslovnice) ili ubacivanje nekih dodatnih usluga uz prodaju proizvoda koje trgovac naplaćuje dobavljaču (npr. naknade za transport i promociju proizvoda, usluge vezane za korištenje prostora na policama i sl.). Stranke u ugovoru su slobodne odstupiti od dispozitivnih normi obveznog prava, međutim, ako su takve odredbe mikro, malom ili srednjem poduzetniku nametnute, tada se radi o nepoštenim ugovornim odredbama. Jači poduzetnik ne bi smio zlouporabom veće pregovaračke moći slabijem partneru nametnuti neravnomjerne obveze, tako da on snosi rizik i nakon predaje robe. Također, nepošteno je i da mu naplaćuje naknade za neisporučene usluge odnosno neisporučena dobra pa bi takve odredbe bile suprotne poslovnom moralu, kao dijelu koncepta morala društva, za što je propisana posljedica ništetnosti (čl. 322. st. 1. ZOO-a).

3.2 Nepoštene trgovačke prakse i Zakon o trgovini

Zakon o trgovini¹⁷ (u nastavku – ZOT) kao specijalni zakon za trgovinu u čl. 63. st. 1. daje definiciju nepoštenog trgovanja kao radnji trgovca kojima se radi tržišnog natjecanja povređuju dobri trgovački običaji¹⁸. To je generalna klauzula, koja se može primijeniti na sve slučajeve u ugovornom i izvanugovornom odnosu kada trgovac na tržištu postupi protivno poslovnom moralu.

U odnosu na definiciju iz Zelene knjige definicija iz ZOT-a je šira jer obuhvaća veći broj slučajeva koji se mogu podvesti pod definiciju nepoštenih trgovačkih praksi te ih ne ograničava na one slučajeve praksi koju je jedan trgovinski partner jednostrano nametnuo drugome. Razlika je i što ZOT navodi nepoštenu radnju trgovca, dok Zelena knjiga govori o praksi trgovca.

ZOT izričito zabranjuje nepošteno trgovanje, a kao posljedicu propisuje naknadu štete. U čl. 64. nabrajaju se primjeri nepoštenog trgovanja, koji se uglavnom razlikuju od onih nabrojanih u Zelenoj knjizi. No, s obzirom na propisanu generalnu klauzulu iz čl. 63. i svaka zlouporaba veće pregovaračke moći može se podvesti pod djelo protivno dobrim trgovačkim običajima. U nastavku ćemo prikazati neke od najčešćih primjera nepoštenih trgovačkih praksi spomenutih u Zelenoj knjizi.

¹⁷ Narodne novine br. 87/08, 96/08, 116/08, 76/09, 114/11, 68/13, 30/14

¹⁸ Pojam „dobri poslovni običaji“, označavaju poslovni moral, a koji pojam se razlikuje od trgovačkih običaja iz ZOO-a, kao dispozitivnog izvora prava.

3.2.1 Nepošteno korištenje informacija

Uobičajena razmjena podataka između trgovca i dobavljača o proizvodima koji su predmet kupoprodaje ne predstavljaju nepoštenu trgovačku praksu. Međutim, kada se ti podaci koriste za razvijanje vlastitog (konkurentskog) proizvoda, koji će spriječiti slabiju stranu u postizanju vlastite inovativnosti, onda korištenje takvih informacija predstavlja nepoštenu trgovačku praksu. Nepošteno korištenje informacija može predstavljati i odbijanje jedne strane da potpiše ugovor o tajnosti podataka ili nepoštivanje odredaba takvog ugovora.

ZOT u čl. 64. st. 1. al. 10. sadrži odredbu prema kojoj je zabranjeno protupravno pribavljanje poslovne tajne drugog trgovca ili bespravno iskorištavanje povjerene poslovne tajne drugog trgovca. Dakle, na ovaj slučaj naveden u Zelenoj knjizi kada veći poduzetnik zahtijeva od mikro, malog ili srednjeg poduzetnika otkrivanje podataka kako bi razvio vlastiti proizvod, mogla bi se primijeniti navedena odredba iz ZOT-a, jer bi tada veći poduzetnik bespravno koristio povjerenu poslovnu tajnu tog manjeg poduzetnika.

3.2.2 Jednostrani prekid poslovnog odnosa bez otkaznog roka ili prekid koji podliježe nerazumno kratkom otkaznom roku i bez objektivno opravdanog razloga

Ispunjenjem dugovane činiidbe redovito prestaje i poslovni odnos među strankama. Međutim, ponekad okončanje tog odnosa može predstavljati nepoštenu trgovačku praksu. Na primjer ZOT propisuje da nepošteno trgovanje predstavljaju radnje trgovca usmjerene na prekid poslovnih odnosa, između drugih trgovaca ili koje sprječavaju ili otežavaju poslovne odnose drugih trgovaca te neopravdano neispunjavanje ili raskidanje ugovora s pojedinim trgovcem kako bi se sklopio isti ili povoljniji ugovor s drugim trgovcem. Dakle, ZOT posebno ne navodi da je nepošteno i kad je poslovni odnos prekinut iznenada i bez ostavljanja primjerenog otkaznog roka. Prema tome, kada je na taj način veliki poduzetnik prekinuo poslovni odnos s mikro, malim ili srednjim poduzetnikom, trebalo bi se to primjenom odredbe iz čl. 63. ZOT-a smatrati nepoštenim trgovanjem jer mikro, mali i srednji poduzetnik treba predvidjeti trajanje ugovora kako bi imao vremena isplatiti svoju investiciju ili barem dobiti primjereni otkazni rok.

3.2.3 Teritorijalne zabrane u opskrbi

Primijećeno je da pojedini multinacionalni lanci, koristeći teritorijalne zabrane u opskrbi, sprječavaju trgovce na malo da nabave određene proizvode preko granice u centralnim skladištima i distribuiraju ih dalje po državama članicama. Naime, proizvođači jakih trgovačkih marki koji kontroliraju logistiku i veleprodajni lanac nemaju interesa za smanjivanjem cijena te će pregovarajući o uvjetima ugovora, nastojati održati razlike u cijeni proizvoda na razini država članica.

S druge strane, trgovci na malo nastoje nabaviti te proizvode po jeftinijim cijenama u veleprodajnim outletima ili podružnicama dobavljača i tako stvoriti pritisak proizvođačima, sklapajući ugovore direktno s konkurentskim dobavljačima koji nude vlastite trgovačke marke.

Trgovci u manjim državama članicama upozoravaju da u situacijama kada traže proizvode od stranih veletrgovaca ili direktno od dobavljača iz drugih, po cijeni puno konkurentnijih tržišta, oni ih upućuju na svoje podružnice odgovorne za to geografsko područje ili njihove nacionalne veletrgovce, koji imaju teritorijalne ugovore s dobavljačima. Upravo takva ograničenja stvaraju podjele na tržištu, koje u konačnici, rezultiraju značajnim razlikama u cijeni među državama članicama.¹⁹ Sve ovo negativno utječe na potrošače, kojima su cijene proizvoda više, a izbor uži, što je oprečno s koristima koje bi trebali imati na unutarnjem

¹⁹ Prema podacima Irskog parlamentarnog odbora iz veljače 2009, cijene određenih proizvoda u Irskoj i Ujedinjenom Kraljevstvu se značajno razlikuju, čak do 130%.

tržištu EU-a. Inače, prema pravu zaštite tržišnog natjecanja ništetni su ugovori kojima se dijele tržišta. Međutim, kada poduzetnici nisu sklopili ugovor o podjeli tržišta, a određena praksa poduzetnika dovodi do *de facto* podjele tržišta, tada se može raditi o nepoštenom trgovanju u smislu odredbe iz čl. 63. ZOT-a.

3.3 Nepoštene trgovačke prakse i ostali propisi

Pojedini primjeri trgovačke prakse koji nisu navedeni u Zelenoj knjizi niti poimence u ZOT-u ipak predstavljaju značajna kršenja dobre trgovačke prakse i ne samo što značajno otežavaju poslovanje malim trgovcima, nego ih u nekim situacijama dovode do stečaja i likvidacije. I u ovim slučajevima postoje razrađeni mehanizmi kako izbjeći takvu praksu, ali ih zbog već spomenutog straha slabije strane kojoj je takva praksa nametnuta, ta strana rijetko koristi.

3.3.1 Kašnjenja u plaćanju

Zakonom o financijskom poslovanju i predstečajnoj nagodbi²⁰ (u nastavku - ZFPPN) propisani su rokovi ispunjenja novčanih obveza i pravne posljedice zakašnjenja u cilju suzbijanja zakašnjenja s ispunjenjem novčanih obveza. Tako je ZFPPN-om određen rok plaćanja za poslovne transakcije između poduzetnika i osoba javnog prava u kojima je osoba javnog prava dužnik novčane obveze. Pravilo je da se u odnosima između poduzetnika može ugovoriti rok plaćanja koji nije dulji od 60 dana²¹, dok u slučaju kada stranke propuste ugovoriti taj rok, isti ne može biti dulji od 30 dana. U poslovnim transakcijama između poduzetnika i osoba javnog prava u kojima je osoba javnog prava dužnik novčane obveze, može se ugovoriti rok ispunjenja novčane obveze do 30 dana²². Isti rok važi i ako ga stranke nisu ugovorile.

Bez obzira na rokove, mnogi mali trgovci iz straha od prekida poslovanja s velikim supermarketima, ne poduzimaju nikakve radnje radi prisilne naplate takvih dospjelih potraživanja. Naime, svjesni da će u takvom slučaju teško plasirati svoje proizvode na tržište, prešutno odustaju od rokova propisanih ZFPPN-om što u većini slučajeva dovodi do otežane likvidnosti, a na kraju i stečaja malih trgovaca.

4. Zaključak

Mikro, mali i srednji poduzetnici su važan čimbenik u gospodarstvu pa su Europska unija i nacionalne države razvile niz politika, programa i mjera za njihovo poticanje. Kako su mikro, mali i srednji poduzetnici profesionalci koji u pravnom prometu trebaju postupati s povećanom pažnjom, do sada nisu razvijena posebna pravila koja ih štite od većih trgovaca. Međutim, zbog sve većeg rasta određenih poduzetnika koji dobivaju značajnu pregovaračku moć, na tržištu su se počele javljati nepoštene poslovne prakse u odnosu na mikro, male i srednje poduzetnike. Budući da nepoštena trgovačka praksa utječe i na ekonomska prava potrošača kao i na pravilno funkcioniranje unutarnjeg tržišta, Europska komisija je 2013. donijela Zelenu knjigu o nepoštenim trgovačkim praksama među poduzećima u opskrbnom lancu prehrambenih i neprehrambenih proizvoda u Europi u kojoj je navela glavne kategorije nepoštenih trgovačkih praksi. Nepoštene trgovačke prakse javljaju se kada jača strana zlouporabi svoju poziciju kako tijekom pregovora tako i tijekom ugovornog odnosa. Tako naš Zakon o obveznim odnosima sadrži niz načela i posebnih odredbi koje se mogu primijeniti na nepoštene ili nejasne ugovorne odredbe ili u slučaju kada pisani ugovor nije sklopljen. Također, u preostalim slučajevima, do donošenja posebne regulative Europske unije, moguće

²⁰ Narodne novine br. 108/12, 144/12, 81/13, 112/13, 71/15, 78/15. Zakon je dijelom usklađen s Direktivom 2011/07/EU Europskog parlamenta i Vijeća od dana 16. veljače 2011. godine o suzbijanju zakašnjenja s plaćanjem u trgovačkim ugovorima (SL 048, P. 0001 – 0010, 23. 02. 2011.).

²¹ Iznimno se taj rok može produljiti do 360 dana.

²² Iznimno se taj rok može produljiti do 60 dana.

je primijeniti posebne odredbe Zakona o trgovini ili ako pojedino djelo nije navedeno tada generalnu klauzulu, koja pruža široku osnovu za zaštitu oštećenog poduzetnika.

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Protecting small and medium entrepreneurs from unfair trade

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Abstract. Today, big chain stores frequently compete directly with small or medium manufacturers or traders, via their own house brands. Moreover, a favorable bargaining position enables big entrepreneurs to dominate small and medium entrepreneurs and to act unfairly when signing contracts, as well as during the course of the contractual relationship. In our legal system, stipulations related to unfair trading can be found in the Trade Act, which does not differentiate between small, medium and big entrepreneurs, and consequently does not include specific stipulations on prohibiting abuse of superior bargaining power. Due to inadequate protection of small and medium entrepreneurs from unfair trading practice in national legislatures, the European Commission has issued the "Green Paper

on unfair trading practices in the business to business food and non-food supply chain in Europe" in January 2015. In this paper, we analyze the acts of unfair trading in regards to small and medium entrepreneurs, and look into possibilities of legal protection in accordance with the current regulations of republic of Croatia. Finally, the paper shows the necessity of legislative intervention and modernization of our regulations on unfair trading.

Key words: *unfair trade practice, small and medium entrepreneurs, abuse of superior bargaining power*

Utjecaj logistike na maloprodaju i fizičku distribuciju u prehrambenoj industriji

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Sažetak. Globalizacijom tržišta i rastom trgovine prehrambenih proizvoda pred proizvođače se postavljaju sve kompleksniji zadaci. Cilj je u što kraćem vremenu isporučiti prehrambene proizvode i time zadovoljiti sve zahtjevnije potrošače. S druge strane, procesi distribucije koji uključuju pakiranje, skladištenje, transport, manipulativne operacije i druge usluge, često su kritična točka u opskrbnom lancu. Kvalitetan sistem distribucije prehrambenih proizvoda podrazumijeva primjenu određenih standarda i procedura na kompletnom logističkom lancu. Svježi izgled hrane povećava prodaju, a kupci često kvalitetu namirnice poistovjećuju s kvalitetom prodajnog mjesta. Stoga kvaliteta i zdravstvena ispravnost proizvoda moraju biti ciljevi svima koji su uključeni u prehrambeni lanac, od proizvođača, preko distributera do maloprodajnih objekata koji proizvode isporučuju do krajnjeg potrošača. Proizvođači postaju svjesni kako bez učinkovitog sustava upravljanja kvalitetom skladištenja i transporta ne mogu biti sigurni da će do kupca stići siguran i kvalitetan proizvod. U ovom radu dajemo osvrt na nove tehnologije u području logistike te na tržišne trendove koji utječu na specifičnost isporuke prehrambenih proizvoda, njihovu kvalitetu i sigurnost.

Ključne riječi: logistika, fizička distribucija, maloprodaja, prehrambeni proizvodi.

1. Uvod

Pod utjecajem informatizacije, internacionalizacije i globalizacije dogodile su se dramatične promjene u maloprodaji kao što su ubrzavanje maloprodajnih procesa, stvaranje novih prodajnih oblika i ubrzani rast prihoda. U posljednjih desetak godina najveći utjecaj na daljnji razvoj maloprodaje ima logistika kroz smanjenje troškova i poboljšanje razine kvalitete usluga unutar maloprodaje. Unutar logistike dolazi do promjena koje su posljedice tržišnih trendova koji utječu na logistiku. Među najznačajnijim trendovima je dramatično skraćivanje životnog ciklusa proizvoda koji tjera sudionike na ključnu promjenu dosadašnjih procesa i na međusobnu suradnju, komunikaciju i partnerstvo u cjelokupnom lancu opskrbe u cilju očuvanja profitabilnosti poslovanja (Vouk, 2005) .

Logistički lanac opreme i isporuke prehrambenih proizvoda obuhvaća niz procesa i aktivnosti vezanih za pakiranje, transport, skladištenje, manipulativne operacije i druge usluge neophodne za isporuku robe krajnjem potrošaču. Svi navedeni procesi i aktivnosti predstavljaju potencijalno mjesto opasnosti i rizika koji mogu dovesti do oštećenja robe i smanjivanja kvalitete i sigurnosti hrane. Kvalitetan sistem distribucije prehrambenih

proizvoda podrazumijeva primjenu određenih standarda i procedura na kompletnom logističkom lancu.

Preduvjet u participaciji u globalnoj trgovini hranom je kreiranje strategije koja uključuje transparentnost u cijelom postupku od proizvodnje do potrošača i razmjenu informacija unutar svih subjekata u lancu. Sljedivost je važan alat bez kojega kontinuirano praćenje i kontrola ne bi bila moguća koji kao dio zakona EU 2005. godine je obvezujući za veliki broj proizvođača hrane i pića koji žele sudjelovati na tom tržištu.

2. Praćenje kvalitete prehrambenih proizvoda

Kvaliteta prehrambenih proizvoda postaje sve važnija kupcima iz Europske unije kojima odluka o kupnji sve češće postaje rezultat informativnih oznaka na proizvodima pri čemu kupci žele znati odakle proizvodi dolaze i kako su proizvedeni (Dimara i Skuras, 2005).

Osiguranje kvalitete prehrambenih proizvoda posebno je kompleksno u situaciji kada se za proizvodnju proizvoda koriste proizvodi više dobavljača, što je skoro uvijek slučaj. U tom slučaju moguće je primijeniti model osiguranja kvalitete (engl. quality assurance model) u prehrambenom lancu dobavljača (engl. food supply chain) koji se smatra dokazanim mehanizmom za proizvodnju kvalitetnih proizvoda i usluga (Manning, 2006).

2.1. Konceptija sljedivosti proizvoda

Konceptija sljedivosti proizvoda znači pravodobno i točno praćenje fizičkog kretanja gotovih proizvoda i njegovih sastojaka kroz prostor i vrijeme odgovarajućim tijekom podataka, strogo redosljedno, po sekvencama s mogućnošću vraćanja unatrag.

Moe, Baines i Chadd (1998) smatraju da prema široj koncepciji sljedivosti sustav mora biti u mogućnosti povijesno pratiti proizvodne serije duž cijelog proizvodnog lanca ili njegova dijela od trenutka žetve, preko transporta, skladištenja, prerade, distribucije i prodaje (lanac sljedivosti) ili interno unutar neke od funkcija spomenutih u lancu sljedivosti.

Prema Schwagele, (2005) možemo razlikovati dva različita pravca praćenja u procesu sljedivosti :

- 1) Praćenje (engl. Tracking) je mogućnost da se slijedi put specificirane jedinice ili serije proizvoda kroz silazni protok lanca od početne točke do kraja. Ovaj se smjer praćenja naziva još i „niz tijek“ (engl. Downstream ili top-down), a opisuje postupke i alate ugrađene sa svrhom lociranja događaja nakon prijenosa vlasništva ili fizičkog prijenosa robe partnera iz lanca, trećem korisniku. Smisao bi bila da se može odrediti i pozvati aktualni status pošiljke, njene karakteristike u bilo kojoj točki lanca, npr. u logističke svrhe.
- 2) Traženje (engl. Tracing) je mogućnost identificiranja podrijetla specificirane jedinice ili serije proizvoda locirane unutar lanca, upućivanjem na zapise koje drže sudionici u smjeru prema početku lanca ili uzlaznom tijeku lanca „uz tijek“ (engl. upstream ili bottom-up). Osnovni smisao je mogućnost rekonstrukcije prošlosti neke pošiljke, pakiranja i sl. na način da se odredi lokacija proizvoda unutar svih točaka lanca kroz koje je prošao. Na taj se način postiže jednostavnost opoziva, odnosno povlačenja s tržišta.

Informacije koje se putem sustava sljedivosti prate mogu se pohraniti na dva načina: lokalno, u pojedinoj točki lanca tako da se sljedećoj točki šalju samo identifikatori proizvoda ili globalno, sve informacije kreću se duž lanca zajedno s proizvodom (Moe, 1998). U praksi se većina informacija pohranjuje lokalno, a manji broj slijedi proizvod tj. globalno. Razvijanje sustava sljedivosti ima za cilj osigurati da te informacije budu lako i brzo dostupne svim sudionicima aktivnosti i tokovima proizvodnog procesa. Moguće metode za postizanje tog cilja bile bi:

- 1) Kodirati proizvod i njegovu lokaciju u svakoj fazi;
- 2) Pohraniti i povezati podatke: odrediti vrijeme čuvanja podataka, metodu pohrane, lokacije i osnovne podatke koji se čuvaju i
- 3) Utvrditi i prikazati odgovornost za pojedinu fazu slijeđenja.

Osnovno je da svi članovi duž lanca imaju jednake standarde za kvalitetu i jednaku infrastrukturu informacija. Rješenje problema prikupljanja, transferiranja i analiziranja podataka unutar prehrambene industrije jest postojanje zajedničkog standarda komuniciranja dostupnog svima (Wilson i Clarke, 1998).

3. Standardi Europske unije za sljedivost

Zbog zakonodavnih promjena, tijekom devedesetih godina došlo je do porasta standarda i organizacija koje ih izdaju i pomaže ubrzavanju primjene sustava sljedivosti cjelovito i na čitavom području industrije hrane. Neki od tih standarda su obveznog karaktera, poput HACCP-a dok je primjena većeg broja standarda dobrovoljna.

Osnovne smjernice za razvoj standarda i njegovu provedbu nalaze se u Zakonu o hrani Europske unije iz 2002. godine. Njihova se svrha odnosi na poboljšanje standarda i konzistenciju dobavljača, uklanjanje nedostataka proizvoda, izbjegavanje višestrukih provjera te osiguranju jasnih informacija i potpore u slučaju incidenata s hranom (Vellema i Boselie, 2003). Kako sljedivost ima ključnu ulogu u prevenciji potencijalni šteta i rizika u prehrambenom lancu, na način da identificira i izolira rizike te poduzima korektivna akcije u slučaju incidenata, inkorporirana je u sve standarde za sigurnost i očuvanje kvalitete kao nezaobilazan element.

3.1. CIES (Food Business Forum)

Organizacija se sastoji od 175 vodećih međunarodnih trgovačkih lanaca i dobavljača iz preko 150 zemalja cijelog svijeta, zapošljava preko 4,5 milijuna ljudi i surađuje s približno 600 trgovina. CIES je od svog osnutka isticao kako je sigurnost hrane kao i zaštita potrošača i njihovo povjerenje prioritet u poslovanju. CIES je razvio Globalnu inicijativu za sigurnost hrane (GFSI) kojoj je svrha harmonizacija postojećih standarda kako bi se dobila jedinstvena norma umjesto sadašnje prakse gdje svatko definira vlastite standarde (Omejec i Pejić Bach, 2007).

3.2. IFS

Međunarodni standard za hranu (International Food Standard) razvili su njemački maloprodajni lanci radi provjere privatnih robnih marki, a prihvatila ga je i Nacionalna udruga njemačkih trgovaca 2002. godine. Cilj je bio razviti međunarodnu sigurnosnu normu za tvrtke koje se bave proizvodnjom privatnih robnih marki za trgovačke lance s jednoobraznim formulama, postupcima provjere i uzajamnim prihvaćanjem tih provjera. IFS norma osigurava visoku razinu transparentnosti diljem lanca isporuke robe, tj. prometa hrane (Omejec i Pejić Bach, 2007).

3.3. SQF (Safe Quality Food)

SQF predstavlja certifikat kojim se jamči da je proizvod, proces ili usluga potpuno u skladu s međunarodnim zakonodavnim i drugim specifičnim standardima (SQF Institute, 2006). Svrha certifikata je da svojom metodologijom spriječi i smanji slučajeve neadekvatne i opasne hrane na tržištu, a pridržavanje standarda koji propisuje SQF osigurava proizvodima visoki stupanj prihvaćenosti na globalnom tržištu (Omejec i Pejić Bach, 2007).

4. HACCP sistem u logistici

U proizvodnji i distribuciji hrane najznačajniji su njena kvaliteta i sigurnost. Svi sudionici proizvodnje i distribucije obvezni su izvršiti mjere prevencije kako bi se tržištu ponudila kvalitetna i zdrava hrana. Kao rezultat ovih nastojanja razvijen je koncept za analizu opasnosti i kritičnih kontrolnih točaka koji je nazvan HACCP (Hazard Analysis Critical Control Points). Originalni koncept HACCP-a je javnosti predstavljen 1971. godine, a 1985. Američka nacionalna akademija nauka (National Academy of Science) preporučila je korištenje ovog sistema.

U tadašnjim državnim propisima o ispravnosti i sigurnosti hrane, ali i u praksi, uočen je veliki broj nedostataka i zahtijevano je da se u buduću kao osnova za kontrolu procesa i sigurnosti hrane u SAD upotrebljava HACCP, a kasnije se počeo primjenjivati i u cijelom svijetu. Primjena HACCP sistema je nužna u svim područjima i fazama lanca proizvodnje, distribucije i konzumiranja hrane.

4.1. Razvoj HACCP sustava i standarda

Prema Cliver i Tajkarimi (2007) HACCP sustav čine dvije osnovne komponente:

- 1) HA (Hazard Analysis) – analiza rizika (identifikacija opasnosti u svakoj od faza proizvodnje i isporuke hrane i procjena značaja tih opasnosti za ljudsko zdravlje) i
- 2) CCP (Critical Control Points) – kritične kontrolne točke u lancu hrane u kojima je moguće spriječiti ili u potpunosti eliminirati rizik ili njegov utjecaj svesti na prihvatljiv nivo kao i vršiti njihovu kontrolu.

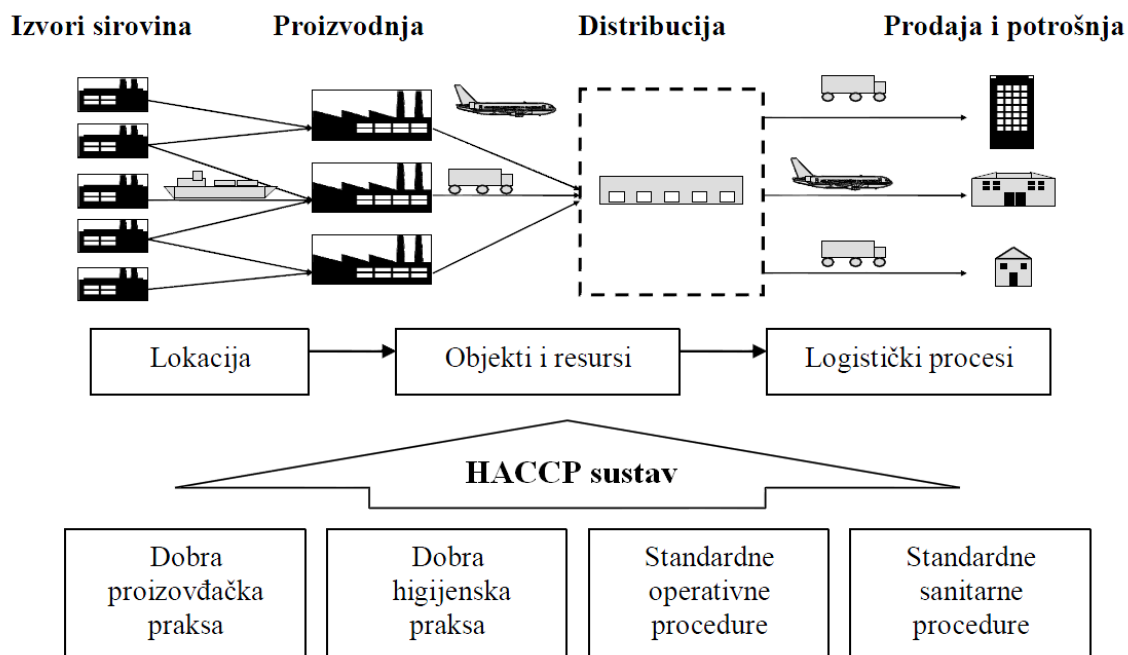
Uvođenje HACCP-a i standarda ISO 22000:2005 je imperativ za dostizanje tržišne konkurentnosti. Od 01. siječnja 2006. god. standardi sigurnosti hrane, posebno HACCP-a su obavezni na tržištu EU i Svjetske trgovinske organizacije. Implementacija HACCP-a je uvjet za izvoz naših prehrambenih proizvoda kao i uvjet da bi se uopće počelo pregovarati s velikim kupcima iz razvijenih zemalja.

Na području logistike i opskrbe prehrambeni proizvodi su izloženi utjecaju različitih rizika i opasnosti koji mogu ugroziti sigurnost hrane i ugroziti zdravlje potrošača. Svi logistički sistemi koji se bave distribucijom i isporukom hrane moraju razvijati i uvoditi HACCP sistem i druge standarde sigurnosti hrane.

Uspješna primjena HACCP sistema uključuje cijeli tim eksperata različitih struka jer je nužan timski pristup rješavanju problema. Implementacija HACCP sustava mora uključiti i analizu kritičnih kontrolnih točaka kao potencijalnih mjesta opasnosti. Pri tome je potrebno voditi računa o lokaciji logističkih sustava koji će osigurati sigurno skladištenje, pakiranje, rukovanje i transport prehrambenih proizvoda, a da nisu izložena zagađenom okruženju ili nisu u blizini industrijskih postrojenja i drugih izvora kontaminacije hrane; objektima, sredstvima i opremi koja se koristi za kretanje i skladištenje prehrambenih proizvoda i logističkim procesima i aktivnostima vezanim za prijem, rukovanje, skladištenje, pakiranje i transport robe.

U program obavezne implementacije HACCP sistema moraju biti uključene i logističke kompanije koje se bave distribucijom i isporukom prehrambenih proizvoda. Ne može se govoriti o sigurnosti i zdravstvenoj ispravnosti prehrambenih proizvoda u lancu opskrbe ukoliko se ne primjenjuju odgovarajuće procedure, principi i standardi. Svi koji dolaze u dodir sa proizvodom u bilo kojoj fazi njegove obrade, prerade ili distribucije moraju primjenjivati HACCP koji omogućava „sljedivost“ i praćenje proizvoda u kompletnom logističkom lancu, a „sljedivost“ (engl. Traceability) je važan element u proizvodnji hrane, a povezuje se s identificiranjem proizvoda, praćenjem podrijetla materijala i sirovina, proizvodnje, prerade, distribucije i prodaje.

Svaka karika lanca proizvodnje, prerade, pakiranja, skladištenja, transporta, distribucije i rukovanja hranom predstavlja dio kompleksnog HACCP sustava (Slika 1.).



Slika 1. Položaj HACCP sustava u logističkom lancu (Kilibarada, Manojlović i Andrić, 2007) .

Izuzetno je važno izvršiti analizu procjene rizika koja se provodi na temelju ocjene vjerojatnosti pojavljivanja (mala, srednja ili velika) rizičnog događaja i ozbiljnosti posljedica za zdravlje kupaca odnosno reputaciju proizvođača (velika, srednja ili mala). Proces skladištenja robe prate fizičke, kemijske i mikrobiološke opasnosti.

Kao bitne komponente HACCP-a u logističkom sustavu izdvajaju se karakteristike proizvoda koje se odnose na fizička, kemijska, mikrobiološka i sezonska svojstva bitna za sigurnost prehrambenih proizvoda. Svaki proizvod koji se pojavljuje u logističkom lancu mora sadržavati specifikaciju i opis osjetljivosti proizvoda i potencijalne opasnosti za sigurnost.

Zahtjevi koji se postavljaju u sklopu svakog logističkog procesa prema Cliver i Tajkarimi (2007) odnose se na sljedeće:

- 1) Primarno pakiranje, podrazumijeva ambalažu koja je u neposrednom kontaktu s proizvodom i koja treba biti od odobrenih materijala za pakiranje prehrambenih proizvoda kao i sam proces i uvjete pakiranja proizvoda. Višekratno pakiranje mora biti otporno, jednostavno za pranje i dezinfekciju.
- 2) Transportno pakiranje uključuje utovarno manipulativne jedinice i ambalažu u koju se slažu i pakiraju primarna pakiranja odnosno procese formiranja i rasformiranja različitih utovarnih jedinica i pojava oblika robe u pojedinim fazama logističkog lanca.
- 3) Manipulacija robom koja obuhvaća načine, postupke i procedure vezane za tehnologiju utovara, pretovara i istovara robe. Potrebno je definirati načine podizanja, premještanja i odlaganja proizvoda koji će omogućiti očuvanje svih zdravstvenih i sigurnosnih svojstava.
- 4) Uvjeti skladištenja, potrebno je poznavati sve uvjete vezane za skladištenje određenog proizvoda kao što su temperatura, vlaga, provjetravanje i ostala specifična svojstva.
- 5) Uvjeti transporta, definiranje procesa distribucije, na koji način i kojim sredstvima i kako robu dopremiti na određeno mjesto.
- 6) Označavanje i obilježavanje proizvoda uključuje deklaracije proizvoda. Svaki proizvod mora biti jasno označen i s istaknutom deklaracijom posebno ako postoje zahtjevi za posebnim tretmanom u bilo kojem segmentu logističkog lanca.

Svaki logistički podsistem mora osigurati uvjete nužne za zaštitu hrane dok je ona u njihovoj nadležnosti. To se osigurava primjenom „dobre proizvođačke prakse“ GMP – *Good Manufacture Practices* ili „dobre higijenske prakse“ GHP – *Good Higiyenick Practices*. Time se ispunjavaju preduvjeti za uspostavljanje i primjenu HACCP sistema i izradu HACCP planova. HACCP plan pisani je dokument koji je temeljen na HACCP principima i opisuje procedure koje se primjenjuju tijekom primjene HACCP sustava. Kompleksnost logističkih aktivnosti znatno usložnjava proces izrade HACCP plana.

5. Specifičnosti distribucije prehrambenih proizvoda

Lanac stvaranja vrijednosti u gospodarskom sektoru prehrambenih proizvoda počinje ondje gdje završava poljoprivreda, a završava tamo gdje konačni potrošač preuzima prehrambene proizvode. Prehrambeni proizvodi koji su proizvedeni u prehrambenoj industriji ili prehrambenom obrtu mogu se do potrošača kretati posredstvom trgovine na veliko, trgovine na malo, preko centralnog skladišta ili izravno (Schubert, 2007).

Centralna su skladišta uobičajena kod prehrambenih proizvoda koji nisu lako pokvarljivi, npr. smrznuta hrana. Izravna prodaja je česta kod prehrambenih proizvoda koje proizvodi obrtnik npr. mesnica, pekara, mliječni proizvodi, dok veliki potrošači nabavljaju robu izravno od proizvođača, trgovine na malo ili centralnih skladišta.

Opskrbni lanac za prehrambene proizvode je od izuzetne važnosti kako za ukupni gospodarski sektor prehrambenih proizvoda tako i za poljoprivredu. Logistički je koncept odlučujući za izbor novih lokacija prehrambene industrije i centralnih skladišta. Često se svježi poljoprivredni proizvodi proizvode na način da primatelj kontrolira i preuzima proizvodnju npr. sjetva žitarica, berba voća, koja se dalje upućuje na preradu u prehrambenu industriju jer se na taj način smanjuju gubici vrijednosnih sadržaja hrane. Što su kraći putevi distribucije, to je kvaliteta prehrambenih proizvoda veća.

Odgovarajućom se distribucijom utječe na kvalitetu, a time i na konačnu prodajnu cijenu pa se zbog toga postavljaju i odgovarajući zahtjevi na distribucijski lanac. Za održivost svježih prehrambenih proizvoda bitna je i tehnologija npr. hlađenje voća ili povrća.

U trgovni na malo prehrambenim proizvodima danas se razvija sve manje manjih i sve više većih prodavaonica prehrambenih proizvoda. Razlog tomu je što veća trgovniska poduzeća i grupacije imaju veliku tržišnu snagu i međusobno se nalaze u odnosnima konkurentske borbe, što utječe na skraćivanje distribucijskih kanala, što ujedno utječe na njihovu kvalitetu i sigurnost. U skladu s navedenim tendencijama, mora se voditi računa o okruženju u kojem se sami procesi odvijaju, ali isto tako i o unutrašnjim faktorima koji često mogu dovesti do nekog rizika. Kako bi identificirali mjesta rizika te osigurali kvalitetu prehrambenih proizvoda, potrebno je prethodno definirati standarde i mjere kojima će biti obuhvaćeni svi logistički procesi (Segetlija, 2010).

5. Zaključak

Na području logistike, prehrambeni proizvodi su konstantno izloženi utjecaju različitih opasnosti koje mogu dovesti do značajnih problema vezanih za sigurnost hrane i ugrožavanje zdravlja potrošača. S druge strane, procesi distribucije koji uključuju skladištenje i transport proizvoda često su kritična karika u prehrambenom lancu. Jedan od razloga je dinamičnost tih procesa gdje je proizvod potrebno dostaviti s jedne lokacije na drugu u što kraćem vremenu.

U distributivni lanac prehrambnih proizvoda često je uključen velik broj sudionika koji mogu biti, ali vrlo često nisu, zaposlenici tvrtke proizvođača. Zato sudionici u distribucijskom lancu moraju međusobno surađivati te imati uvid u praksu prethodnih i budućih sudionika, što uključuje dokumentiranje postupaka skladištenja i distribucije, propisivanje uvjeta te zahtjeva vezanih uz uređenje skladišnih prostora. Iz tih razloga, svi logistički sustavi koji se bave

distribucijom i isporukom hrane moraju razvijati i uvoditi HACCP sustav i standarde sigurnosti hrane.

U kontekstu navednog možemo istaknuti važnost ne samo nastavka implementacije sustava o sigurnosti hrane u svim fazama procesa proizvodnje do distribucije hrane, već i njegovog unaprjeđenja i razvijanja.

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The impact of logistics on retailing and physical distribution in food industry

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Abstract. Market globalization and food trade growth have been posing ever more complex problems for producers. The aim is to deliver as much food possible in the shortest possible period, and by doing so, satisfy demanding consumers. On the other hand, distribution processes that include packing, storing, transport, manipulative operations, and other services, are often the weakest link in the supply chain. A quality system of food distribution requires the application of certain standards and procedures in the complete logistics chain. A fresh food appearance increases sales, and buyers often identify the quality of the product with the quality of the retail store. Therefore, the quality and the health safety of products have to be the aims shared by every part of the food chain, from producers, to distributors, to retailers that deliver the products to the end consumer. Producers have become aware that they cannot be certain that the safety and quality products will reach their buyers without an efficient storage and transport control system. In this study we deal with new technologies in the field of logistics and market trends that have effect on the specificity of food delivery, its quality and safety.

Key words: *logistic, physical distribution, retailing, food*

Veza klime i sezonalnosti turističkog poslovanja priobalnih odmorišnih destinacija

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Sažetak. Veza klime i turizma na prvi pogled predstavlja jasne korelacijske odnose. No, paradoksnu detaljnim razmatranjem razvidne su brojne nelogičnosti. Poznato je da je klima jedan od ključnih turističkih resursa na kojem brojne destinacije, posebno one orijentirane odmorišnom priobalnom turizmu, grade svoju atrakcijsku osnovu. Klima, kao prirodni resurs, izdvojena je komponenta atrakcijske osnove, posebice u destinacijama priobalnog odmorišnog turizma, koje svoje poslovanje temelje na pogodnim klimatskim uvjetima. Paradoksnu, ovaj pokretač turističkih aktivnosti ujedno je i ograničavajući faktor turističkog razvoja. Naime, na klimu se gleda kao na glavnog uzročnika sezonalnosti turizma. Pogodni klimatski uvjeti čine destinaciju popularnu u jednom dijelu godine i zaboravljenu u drugom. Sezonska koncentracija turističke potražnje implicira brojne negativne učinke na turističku destinaciju. Svođenjem turističkih aktivnosti u kratko razdoblje godine, odnosno ljetnu turističku sezonu, s velikim diferencijama razine iskorištenosti kapaciteta između ljeta i zime, implicira ekonomsku, ekološku i sociokulturnu neodrživost poslovanja. Navedena kontradiktornost zahtijeva detaljnu analizu što je cilj ovog rada.

Ključne riječi: klima, atraktivnost, sezonalnost, priobalna odmorišna destinacija

1. Uvod

Varijacije u klimatskim uvjetima stvaraju različite sezonske potencijale i resurse turističkih odredišta, za koje se percipira da imaju određene sezonske kvalitete (Lee i dr. 2008.). Iz ovog fenomena nastaju sezonski turistički prostori koji su popularni tijekom turističke sezone i zaboravljeni u vansezonskom razdoblju, time su same turističke destinacije korelirane sa sezonskim krajolikom koji izravno ili neizravno proizvodi najveće turističke atrakcije (Haas i dr., 2007.). Turističke destinacije orijentirane odmorišnom kupališnom turizmu profitiraju zbog značaja ovoga vida turizma u ukupnim turističkim tokovima. Kupališne destinacije, kao što je hrvatsko priobalje, dodatnu prednost ostvaruju na činjenici da se njemu bitna emitivna tržišta, zemlje srednje i sjeverne Europe, nalaze blizu, a obilježena su nepovoljnim klimatskim uvjetima što ih dodatno motivira na putovanje. No, kupališni turizam nosi obilježje sezonalnosti. Sezonalnost turizma je nezaobilazna sastavnica turizma koja prvenstveno uz sebe vezuje negativne implikacije koje zahtijevaju pažnju. Negativne implikacije rezultat su izuzetno visoke koncentracije turističke potražnje na uskom obalnom pojasu u kratkom periodu u godini. Prema navedenom se klimatski resursi javljaju kao pokretači turizma, ali i ograničavajući faktori turističkog razvoja (Higham i Hinch, 2002.). Turistička destinacija generirat će potražnju na

osnovi klimatskih uvjeta kao faktora atraktivnosti, ali ujedno će ovaj atrakcijski resurs ograničiti poslovanje turističke destinacije na određenu sezonu, odnosno dio godine.

Svrha ovoga je rada prezentirati vezu klime i turizma u priobalnim odmorišnim destinacijama. Prvi dio rada posvećen je prezentaciji klime kao faktora atraktivnosti turističke destinacije na temelju kojeg brojne destinacije, a posebice priobalne odmorišne, grade svoju turističku osnovu. U drugom dijelu rada analiziran je utjecaj klime na sezonsku koncentraciju turističke potražnje, stvarajući najznačajniju karakteristiku turizma. Na kraju slijedi zaključak sa smjernicama za buduća istraživanja.

2. Klima kao atrakcijski faktor turističke destinacije

Resursi koji imaju sposobnost privlačenja turista su brojni i raznovrsni te u različitim su stadijima tržišne razvijenosti (Formica i Uysal, 2011.). Resursi postaju turističke atrakcije tek onda kada ih destinacijski menadžment svrsta u turističku ponudu i stavi na raspolaganje posjetiteljima te pretvori u turistička dobra koja imaju sposobnost zadovoljavanja turističkih potreba. Sukladno navedenom turistički resursi imaju važnu ulogu u turističkom sustavu, ali nemaju pravu vrijednost ukoliko nisu adekvatno osmišljeni i izgrađeni te ukoliko se njima uspješno ne upravlja (Gunn, 2002.).

Turistički djelatnici i znanstvenici suglasni su oko značaja atrakcija kao krucijalnih elemenata postojanja i razvoja turizma (Page i Connel, 2009.; Vanhove, 2005.; Crouch i Ritchie, 1999.; Gunn, 1994.; Ferrario, 1979.). Hu i Ritchie (1993.) smatraju da atraktivnost turističke destinacije odražava osjećaje, vjerovanja, i stavove koje pojedinac ima o mogućnostima destinacije da zadovolji specifične turističke potrebe.

Klima se uvrštava u prirodne ili naslijeđene atrakcije, atrakcije koje ljudi nisu stvorili s ciljem turističke eksploatacije nego su nastale djelovanjem prirodnih sila ili u različitim povijesnim okolnostima za ne turističke svrhe, ali su djelovanjem konverzijske funkcije turizma izgubile svoju prvobitnu namjenu te su postali vrijedni privredni turistički resursi. Elementi prirodne ili naslijeđene atraktivnosti su uporište komparativnih prednosti turističkih destinacija, one predstavljaju skupinu destinacijskih atributa koji su u potpunosti izvan kontrole destinacijskog menadžmenta. Klima kao prirodna ili naslijeđena destinacijska atraktivnost temelj je razvoja turizma određene regije. Upravo na ovome elementu formira se specifičnost destinacije u odnosu na druge turističke destinacije na danas izrazito konkurentnom turističkom tržištu. Iz navedenog proizlazi da klima ima sposobnost privlačenja turističke potražnje sukladno čemu se javlja kao generator turističkih dolazaka u receptivno turističko odredište.

Naime, klima je jedan od ključnih faktora koja omogućuje brojne turističke aktivnosti na otvorenome čime klimu svrstavamo u jedan od preduvjeta razvoja turizma u određenoj regiji (Kim, 1998.). Klimatske uvjete kao faktore destinacijske atraktivnosti istraživali su među ostalom Amelung et al., 2007., Bigano, Hamilton i Tol, 2007. te Gomez, 2005. Radi boljeg razumijevanja klime kao faktora atraktivnosti potrebno je spomenuti rad Mieczkowskog (1985.) u kojemu je autor prezentirao turistički klimatski indeks (TCI) koji se sastoji od pet komponenti: dnevne toplinske ugodnosti, svakodnevne toplinske ugodnosti, oborina, broja sunčanih sati i brzine vjetra. Glavni kriteriji klimatskog indeksa su temperatura i oborine jer, primjerice, broj sunčanih sati i vjetar nisu značajni turistu koji posjećuje destinaciju radi razgledavanja i kulturne baštine. Turistička potražnja koja bira destinaciju zbog klime ima veći prosperitet putovanja i konzumiranja tražene usluge u željenoj turističkoj destinaciji. Prema istraživanju Nicolaua i Masa (2006.) turisti u potrazi za ugodnom klimom voljni su putovati velike udaljenosti kako bi

zadovoljili svoje potrebe za turističkim uslugama u destinaciji koja ima klimatske uvjete sukladno njihovoj potražnji.

Klima kao faktor atraktivnosti turističke destinacije, a time i generator turističkih dolazaka od izuzetnog je značaja u destinacijama priobalnog odmorišnog kupališnog turizma koje svoj turistički proizvod upravo grade na povoljnim klimatskim uvjetima. Gunn (2002.) opisuje atrakcije turističke destinacije kao elemente sastavljene od tri zone vezane za prostorni ili fizički raspored atrakcije, pri čemu navodi središnju zonu s ključnom atrakcijom, tampon zonu u kojoj se nalaze pomoćni sadržaji i usluge povezane s ključnom atrakcijom, koja zajedno s dvije unutarnje zone formira prošireni turistički proizvod. Pozivajući se na ovu klasifikaciju atrakcija u destinacijama priobalnog turizma klima čini ključnu turističku atrakciju zajedno s kvalitetom mora i plaža. Turistička potražnja u potrazi za ovom vrstom turističkog proizvoda ciljano traži odredište koje će im osigurati nesmetanu konzumaciju i zadovoljenje njihovih potreba za klimatski pogodnim okruženjem. Shodno tome, klimatski pogodna turistička destinacija generirat će veći udio tržišnog segmenta.

Hrvatsko priobalje temelji svoju komparativnu prednost na podobnim klimatskim uvjetima. Naime, klima predstavlja konstantnu varijablu turističke ponude hrvatskog proizvoda sunce i more koja omogućava potražnju željene aktivnosti na otvorenome. Usprkos bogatstvu ostalih prirodnih resursa, ali i iznimnom nasljeđu kulturnih resursa, klima je dominantna odrednica hrvatskog turističkog proizvoda.

3. Klima kao uzročnik sezonalnosti turizma

Govoreći o sezonalnosti u turizmu govorimo o pojmu koji povezujemo s vremenskim (vrijeme odlaska na turističko putovanje) i prostornim problemom (destinacija odabira turističkog putovanja) (Jang, 2004.), pri čemu je potrebno naglasiti da sezonalnost turizma ne predstavlja povremene nepravilnosti u turizmu, nego je obilježje turizma koje je stabilno i dobro utemeljeno (Witt i Moutinho, 1995.).

Kao glavni uzročnik sezonalnosti turizma uz institucionalne faktore ubrajaju se prirodni faktori (BarOn, 1975.; Hyllerberg, 1992.; Hartmann, 1986.; Butler, 1994.; Frechtling, 2001.; Kolomiets, 2010.). Pod prirodnim uzrocima sezonalnosti u receptivnoj zemlji podrazumijevamo klimatske faktore kao što su prirodne varijacije temperature zraka i vode, razina kišnih i snježnih padalina, ledeni pokrivači, vlažnost, sunčeva svjetlost, vjetrovi, oblačnost i sl. Klima u emitivnom području predstavlja faktor poticaja osobe na putovanje u klimatski pogodnije krajeve. Kišovito, hladno i nestabilno vrijeme daju poticaj odluci odlaska na odmor u klimatski pogodna područja (Butler, 1994.). Navedeni uzroci sezonalnosti su izvan kontrole donositelja odluke turističke potražnje. Prirodna sezonalnost prati godišnja doba, a posebno je izražena u perifernim i udaljenim odredištima s izrazitim temperaturnim razlikama između godišnjih doba (Kolomiets, 2010.). Prirodna sezonalnost utječe na pojedince u različitim intenzitetima dok udaljavanjem od ekvatora raste i stupanj sezonalnosti (Lundtrop, Rassing i Wanhill, 1999.; Butler, 1994.). Odredišta s toplom i hladnom klimom izložena su sezonskim promjenama ovisno o klimi i godišnjem dobu. S obzirom na činjenicu da se većina turističkih aktivnosti odvija na otvorenom, u prirodnom okruženju, nedvojbeno je ovisnost istih aktivnosti o vremenskim i klimatskim prilikama što predstavlja ograničenje razvoju turizma (Koenig i Bischoff, 2005.). Kreutzwiser (1989.), prema Highamu i Hinchu (2002.), tvrdi da klimatski i vremenski uvjeti utječu na zadovoljstvo osobito rekreativnih izleta. Hartman (1986.) i Allcock (1989.) smatraju da su sezonske varijacije uzrokovane prirodnim čimbenicima predvidljive te da su one stabilne u određenim mjestima te se ponavljaju s relativno malim izmjenama. Varijacije su značajnije u

vansezonskom razdoblju obilježenim kraćim odmorima koji su ovisniji o oscilacijama u klimi i vremenskim pogodama.

Na koncept sezonalnosti turizma može se gledati kao na poznati i jasni koncept, no paradoksnu ne postoji jedinstvena i precizna definicija. Pojam sezonalnosti može biti razmatran s više aspekata te sezonalnost može imati različita značenja pripisana različitim područjima. U definicijama sezonalnosti prevladava naglasak da je sezonalnost sistematični pokret unutar godine, ujedno se sezonalnost opisuje kao vrsta pokretača posjetitelja na posjet koji se ponavlja svake godine. Većina definicija i opći pojmovi sezonalnosti opisuju taj fenomen samo u općim uvjetima ili se odnose na njegove uzroke. Sukladno tome, vlada nedostatak kvantitativnih definicija kada sezonalnost turizma nastupi, kako se turističke sezone mogu razlikovati te kako sezonalnost može biti uspoređena između različitih regija ili godina (Koenig i Bischoff, 2005.).

U nastavku slijedi kronološki pregled najcitiranijih definicija i razmatranja pojma sezonalnosti turizma:

- Sezonalnost predstavlja fluktuacije potražnje ili ponude u turizmu zbog čimbenika kao što su vremenske prilike i državni i školski praznici (BarOn, 1972.).
- Sezonalnost je efekt koji se javlja svake godine u skoro jednako vrijeme sa skoro jednakim intenzitetom, a proizlazi iz klimatskih uvjeta, ograničenja državnih i školskih praznika, posebnih atrakcija (npr. festivala) ili osobnog načina života (BarOn, 1975.).
- Sezonalnost predstavlja neravnomjernu raspodjelu korištenja resursa tijekom vremena (s godišnjim vrhom) što je jedan od najizraženijih problema turizma, jer uzrokuje neučinkovito korištenje resursa, gubitak potencijalnog profita, pritisak na socijalne i ekološke kapacitete kao i administrativne poteškoće (Manning i Powers, 1984.).
- Sezonalnost je prirodno obilježje turizma koje se temelji na pouzdanom i predvidivom povratu turista čime se stvara ekonomski okvir za razvoj turističke industrije (Hartmann, 1986.).
- Sezonalnost turizma predstavlja tendenciju turističkih tokova da se koncentriraju u relativno kratkim razdobljima u godini (Allcock, 1989.).
- Sezonalnost je sustavni, iako ne nužno redoviti, pokret unutar godine, uzrokovan klimatskim promjenama, učincima kalendara i vremena odluke, izravno ili neizravno kroz proizvodne i potrošne odluke donesene od agenata ekonomije. Ove odluke su pod utjecajem očekivanja i želja agenata kao i produkcijske tehnike dostupne u ekonomiji (Hylleberger, 1992.).
- Pojam sezonalnosti turizma može se definirati kao vremenska neravnoteža u fenomenu turizma, izražena u broju posjetitelja, njihovoj potrošnji, prometu različitih oblika prijevoza, zaposlenosti i dostupnosti atrakcija. Stoga se podrazumijeva da sezonalnost turizma utječe na sve aspekte aktivnosti ponude potražnje, uključujući cijene, popunjenost kapaciteta, ljudske resurse, stupanj ponude, ponuđene aktivnosti i dostupnost atrakcija itd. (Butler, 1994.).
- Sezonalnost je globalni turistički fenomen uzrokovan privremenim kretanjem ljudi (Butler, 1994.).
- Sezonalnost turističke potražnje je univerzalni prepoznat fenomen koji rezultira fluktuacijama turističkog obujma tijekom kalendarske godine te treba biti diferenciran od dugoročnih poslovnih ciklusa i kratkoročnih promjena koje se odnose na tjedna i dnevna putovanja (Baum i Lundtrop 2001.).

- Sezonalnost je nerazdvojivo obilježje turizma jer su turistički tokovi određeni s prolaznošću i prirodnim sezonskim faktorima (Commons i Page, 2001.).

Sezonalnost turizma nije karakteristika pojedinačne destinacije, nego se skoro svaka destinacija u svijetu susreće s vrstom sezonalnosti u poslovanju (BarOn, 1973.; Yacoumis, 1980.; Higham i Hinch, 2002.; Jang 2004.). No, negativne implikacije najizraženije su u destinacijama masovnog odmorišnog turizma (Allcock, 1996.). Pristupom problemu sezonalnosti nailazimo na odrednice koje se javljaju kao faktori utjecaja na formiranje sezonalnosti. Među navedene odrednice ubrajamo organizirani masovni turizam s komponentama sunce, more, pijesak koji se, sukladno motivima, odvija u klimatski atraktivnom razdoblju godine, nadalje, formiranje ponude na otočnim i obalnim destinacijama tako da funkcionalno i teritorijalno zadovoljavaju potražnju za vrijeme ljetnih praznika te društveni okvir u pogledu plaćenog godišnjeg odmora koji je formiran da se odobrava u ljetnim mjesecima. Izrazito naglašenu sezonalnu strukturu potražnje imaju mediteranske zemlje, zemlje obilježene kupališnim turizmom s dominacijom potražnje motiviranom ugodnom klimom. U ovu skupinu pripada i hrvatski priobalni turizam koji je međunarodno etabliran u odmorišnom proizvodu sunce i more. Turistički kapaciteti unutar destinacije suočavaju se s koncentracijom potražnje u jednom vrhu godine, i to u ljetnim mjesecima, s velikim diferencijama razine iskorištenosti kapaciteta između ljeta i zime (Karamusafa i Ulama, 2010.; Spotts i Mahoney, 1993.). Allock (1994.) ističe da je najznačajniji aspekt sezonalnosti taj da uključuje koncentraciju turističkih tokova u relativno kratkom razdoblju godine. Njeni godišnji vrhovi u turističkim aktivnostima kroz par hektičnih tjedana ili mjeseci s vjerojatnošću rezultira s neučinkovitosti industrije, kao i velikim teretom na fizičke i socijalne resurse destinacijskog područja (Koenig i Bischoff, 2005.). Opće je suglasje kako sezonski karakter turizma implicira brojne negativne učinke na gospodarstvo, ekološko i sociokulturno okruženje turističke destinacije pa i na turističku potražnju (Cellini i Rizzo, 2010.; Cooper et al., 2005.; Goulding, Bauman i Morrison, 2004.; Jang, 2004.; Goeldener i Ritchie, 2003.; Commons i Page, 2001.; Butler, 2001.; Krakover, 2000.; Butler, 1994.; Hartmann, 1986.; BarOn, 1975.).

Sezonalnost turizma je nekontrolirana situacija (Allcock, 1989.), a njezine implikacije rastu paralelno s rastom masovnosti turizma (Wall i Yan, 2003.). Butler (1994.) ukazuje da razvojem masovnog turizma dolazi do sve većih sezonskih raspona. Rastom standarda, rast će i turistička potražnja, a time će se sve veći broj poduzeća okrenuti turističkoj djelatnosti, povećavajući svoje kapacitete reducirat će svoju fleksibilnost i sposobnost prilagodbe promjenama na strani potražnje (Koenig i Bischoff, 2005.). U turističkoj industriji na sezonalnost se gleda kao na izazov i problem koji utječe na mnoga područja djelovanja, što ne izaziva reakcije samo kod vlade i turističkih institucija, nego i znanstvenika i akademičara koji su u potrazi za uzrocima sezonalnosti turističke potražnje, kao i strategijama za suzbijanje sezonskog karaktera poslovanja turističkih aktera. Problem sezonalnosti turizma stvaran je i njegovi razmjeri postaju sve veći, što uvjetuje da svi akteri i sudionici u sektoru turizma budu aktivirani i mobilizirani na zajedničku suradnju s namjerom širenja turističke sezone i formiranja pretpostavki za turizam u svim godišnjim dobima (Dritsakis, 2008.).

Relevantnost tematike sezonalnosti poslovanja u destinacijama priobalnog odmorišnog turizma obrađena je u istraživanju Ćorluke i Matošević Radić (2014.). Rezultati navedenog istraživanja ukazuju na ekstremnu sezonalnost u cijeloj priobalnoj Hrvatskoj u 2012. godini. Županija Dubrovačko-neretvanska ima najnižu vrijednost sezonskog omjera među sedam promatranih županija hrvatskog priobalja, ali s omjerom sezonalnosti od 2,72 u dolascima i 3,33 u noćenjima, što znači da je mjesec s najvećim brojem dolazaka i noćenja ima 2,72 puta više dolazaka i 3,33

puta više noćenja od godišnjeg prosjeka županije, tako da i ova turistička regija pati od ekstremne sezone koncentracije turističke potražnje. Omjeri sezonalnosti za ostale županije su dramatičniji te iznose: Istarska županija 3,20 u dolascima i 3,93 u noćenjima, Primorsko-goranska županija 3,34 u dolascima i 4,16 u noćenjima, Ličko-senjska županija 3,55 u dolascima i 4,62 u noćenjima, Zadarska županija 3,77 u dolascima i 4,61 u noćenjima, Šibensko-kninska županija 3,61 u dolascima i 4,44 u noćenjima, Splitsko-dalmatinska županija 3,39 u dolascima i 4,14 u noćenjima. O koncentraciji turističke potražnje u glavnoj turističkoj sezoni govore podaci dobiveni Lorenzovom krivuljom prema kojoj županija Dubrovačko-neretvanska ima najnižu sezonsku koncentraciju s udjelom turističkih dolazaka u najboljem godišnjem tromjesečju oko 65 %, odnosno noćenja s udjelom više od 75 %. Najveću koncentraciju u glavnoj turističkoj sezoni glede turističkih dolazaka i noćenja imaju Zadarska i Šibensko-kninska županija, koncentrirajući oko 85 % njihovih ukupnih dolazaka i više od 90 % noćenja u glavnom turističkom tromjesečju dok ostale županije bilježe koncentraciju turističkih dolazaka u glavnom turističkom tromjesečju od oko 70 % i turističkih noćenja oko 80 %.

4. Zaključak

Veza klime i turizma na prvi pogled predstavlja jasne korelacijske odnose. Poznato je da je klima jedan od ključnih turističkih resursa na kojem brojne destinacije, posebno one orijentirane odmorišnom priobalnom turizmu pa tako i Hrvatska, grade svoju atrakcijsku osnovu. Naime, priobalne odmorišne destinacije temelje svoju tržišnu komparativnu prednost upravo na klimatskim resursima, pri čemu se na klimatske uvjete gleda kao na konstantu koja u određeno doba godine omogućuje brojne aktivnosti na otvorenome te stvaraju preduvjete razvoja odmorišnog kupališnog turizma. Paradoksn, glavni atrakcijski čimbenik je ujedno glavni ograničavajući čimbenik poslovanja priobalnih odmorišnih destinacija, svođenjem turističkih aktivnosti u kratko razdoblje godine, odnosno ljetnu turističku sezonu. Klima je uzročnik sezonalnosti poslovanja priobalnih odmorišnih destinacija, ograničavajući poslovanje na ljetne mjeseci s velikim diferencijama razine iskorištenosti kapaciteta između ljeta i zime, pri tome implicira ekonomsku, ekološku i sociokulturnu neodrživost poslovanja. Destinacijski menadžment u priobalju trebao bi valorizirati pogodne klimatske uvjete izvan same špice turističke sezone te uz kupališni turizam razvijati ostale oblike odmorišnog turizma. Neophodno je probuditi svijest turističke potražnje o prednostima dolaska u priobalne turističke destinacije izvan razdoblja kupališne sezone kada su klimatski uvjeti izuzetno povoljni te omogućuju brojne turističke aktivnosti na otvorenome. Buduća istraživanja se trebaju usmjeriti na ispitivanje atributa turističke ponude priobalnih odmorišnih destinacija koji imaju snagu privlačenja turističke potražnje u pred i posezonskom turističkom razdoblju.

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The relationship between climate and seasonality of business in coastal tourist destinations

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Abstract. At first glance, the relationship between climate and tourism seems to have clear correlations. However, a detailed examination reveals many counter-intuitive notions. It is known that climate is one of key tourist resources. Many destinations, especially those oriented towards coastal tourism, base their core appeal on climatic resources. Climate, as a natural resource, is an outstanding attractiveness component, especially in coastal tourism destinations, whose business operations are based on favourable climate conditions. Paradoxically, this driver of tourism activities is also a limiting factor for tourism development. In fact, climate is seen as the main cause of tourism seasonality. Favourable weather makes destinations popular in one part of the year, and forgotten otherwise. The seasonal concentration of tourist demands implies a number of negative effects on the tourist destination. The concentration of tourism activities over a short period of time each year - in the summer season, with noticeable discrepancies in the utilization of capacities between summer and winter - implies economic, environmental and socio-cultural unsustainability. This contradiction requires detailed analysis and that is the objective of this paper.

Key words: *climate, attractiveness, seasonality, coastal destination*

Kreiranje održivog marketinškog spleta u ruralnom turizmu

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Sažetak: Ruralni turizam, kao značajan element održivog turističkog, ekonomskog i socijalnog razvoja ruralnih područja, nailazi na sve veće razvojne, marketinške, menadžerske i ekonomske poteškoće. Istovremeno se na strani turističke potražnje iskazuje sve značajniji interes za ovakvim oblikom turizma. Za razvoj ruralnog turizma važni su dobri prirodni i kulturni preduvjeti poput klime, tla, povoljnih mogućnosti za razvoj poljoprivredne proizvodnje i očuvana kulturna baština. U radu se analizira postojeće stanje i ponuda ruralnog turizma na području submediteranske Dalmacije, odnosno marketinški splet gospodarstava na području submediteranske Dalmacije.

Ključne riječi: ruralni turizam, marketinški splet, održivi razvoj.

1. Uvod

Najveći dio hrvatskoga ruralnog prostora je turistički vrlo atraktivan, ali i turistički slabo razvijen. Uključivanje ruralnog prostora u turističko korištenje, s jedne strane, izravno može obogatiti cjelokupnu hrvatsku turističku ponudu i povećati ukupan prihod od turizma, a s druge strane, može seljacima osigurati dodatne prihode, čime bi se, između ostaloga, spriječila i depopulacija ovoga prostora. Demografske promjene dovele su do slabijeg iskorištavanja travnjačkih površina te se u posljednje vrijeme predlaže model ekstenzifikacije poljoprivredne proizvodnje u cilju poboljšanja bioraznolikosti. Također se posljednjih desetljeća povećava interes za uvođenje autohtonih ukrasnih, ljekovitih i aromatičnih vrsta u uređenje javnih i privatnih prostora gdje bi se, kroz agroturizam, mogle izvrsno valorizirati. Ruralni turizam, kao značajan element održivog turističkog, ekonomskog i socijalnog razvoja ruralnih područja, nailazi na sve veće razvojne, marketinške, menadžerske i ekonomske poteškoće u svom razvoju, dok se istovremeno na strani turističke potražnje iskazuje sve značajniji interes za ovakvim oblikom turizma. Pri tome je nužno umrežavanje, kako gospodarskih subjekata, prvenstveno agroturističkih domaćinstava međusobno, tako i s

drugim segmentima i interesnim skupinama u segmentu ruralnog turizma i općenito ruralnog razvoja regionalne zajednice.

1.1. Pojam ruralnog turizma

U znanstvenim raspravama i praksi često se brkaju ili poistovjećuju pojmovi "ruralni turizam" i "agroturizam". Agroturizam je osnovni segment razvoja ruralnog turizma, i daje mu "osnovnu boju", konotaciju, te predstavlja osnovni čimbenik razvoja ruralnog turizma (Krajnović, 2011.). Ruralni turizam je uvjetovan turističkim atrakcijama koje se nalaze u ruralnom području (Damonja, 2010.). Važnost ruralnog turizma ogleda se u interakciji poljoprivredne proizvodnje tradicionalnih proizvoda, prezentiranja tradicije, tradicijske gastronomije i turističkih usluga, te korištenju već postojećih resursa. Poljoprivreda kao jedina gospodarska djelatnost koja se bavi proizvodnjom hrane za ljude i životinje također ima ulogu čuvanja biološke raznolikosti, nastanjenosti seoskog prostora, kulture krajolika i drugih prirodnih bogatstava (Volk et al., 2006.).

Da bi mogli definirati ruralno područje, ono u osnovi mora sadržavati prostor izvan gradskih i urbanih središta, te imati mali broj stanovnika, do 150 stanovnika/km². Također, potrebno je dominantno korištenje zemlje i šuma za opstanak ljudi te prevladavajuća društvena struktura, običaji i seoski identitet (Damonja i Ružić, 2010.). Ruralna baština je temelj ruralnog turizam, prije svega uključuje krajolik kao što je očuvana priroda, posebnosti flore i faune te materijalna i nematerijalna baština (Damonja i Baćac, 2012.). U Republici Hrvatskoj, ruralni prostor zauzima 91,6 % ukupne površine što je vrlo veliki potencijal za razvoj ruralnog turizma (Damonja i Ružić, 2010.).

1.2. Pretpostavke za razvoj ruralnog turizma

Pretpostavke razvoja ruralnog turizma u Hrvatskoj su brojne, a od veće važnosti su čisti zrak, čista voda, zdrava klima, očuvana okolina (prirodno i kulturno nasljeđe). Važna je mogućnost slobodnog kretanja u prirodi radi rekreacije i razgledavanja zanimljivosti u okolici (Damonja, 2010.). Turisti vrlo često traže i mogućnost stjecanja praktičnih znanja pa im je vrlo zanimljiva okolica u kojoj se mogu upoznati sa starim obrtima kao što su, kovanje, tesarstvo, klesarstvo i drugo (Ružić, 2005.).

Osim prirodnih obilježja također je bitan i čovjekov utjecaj na: oblikovanje prirodnog ambijenta, izgled i veličinu seoskih gospodarstava, širinu seoskih putova i staza, veličinu poljoprivrednih parcela, vrstu i uzgojene oblike trajnih nasada, vrste i raspored zaštitnog i simboličnog drveća te razmještaj zajedničkih objekata u prostoru kao što su crkve, škole, sajmišta i drugi. Kao primjer možemo navesti ruralnu kuću u Istri za odmor "Arbalovija" gdje je okućnica uređena kao travnjak. Prostor između puteljaka, vrta, povrtnjaka i začinskog vrta također se može urediti kao travnjak (Damonja i Baćac, 2012.). Također se povećava interes za uvođenje autohtonih ukrasnih, ljekovitih i aromatičnih vrsta u uređenje javnih i privatnih prostora posljednjih desetljeća (Vršek i Kurtela, 1995; Dorbić i ostali, 2012.).

Hrvatska ima značajnu i brojnu prirodno i socio-kulturnu resursnu osnovu za razvoj turizma u svim njenim područjima, a ne samo u maritimnom. Međutim, da bi ta resursna osnova bila upotrebljiva i na pravi način iskorištena, potrebno je oblikovati i primijeniti takav marketinški miks koji će omogućiti održivi razvoj ruralnog prostora u Hrvatskoj.

2. Uloga marketinga u razvoju ruralnog turizma

Marketing u turizmu predstavlja primjenu poznatih strategija i metoda marketinškog djelovanja na specifične uvjete u kojima se formiraju odnosi među subjektima tržišta, koji međusobno konkuriraju na temelju obilježja turističkih proizvoda. Prilikom primjene marketinga u turizmu valja poći od specifičnosti odnosa koji vladaju na turističkom tržištu, specifičnosti turističkog dobra ili proizvoda te specifičnosti turista kao potrošača i njegova ponašanja na turističkom tržištu. Marketing u turizmu predstavlja sustavno prilagođavanje politike turističkih poduzeća i turističke politike na lokalnom, regionalnom, nacionalnom i međunarodnom nivou da bi se zadovoljile potrebe turista i na taj način ostvario profit (Senčić i Vukanović, 1997.).

Suvremeno turističko tržište traga za novim oblicima provođenja slobodnog vremena. Masovni turizam u kojem se traži sunce i more došao je do točke zasićenja, kako na strani turističke potražnje, tako i na strani ponude. Adekvatan odgovor na ovaj tržišni izazov je ruralni turizam pa bi svaka zemlja koja ima za cilj povećati svoju konkurentnost nužno trebala sagledati vlastite potencijale za razvoj ovakvog oblika turizma te iznaći načine njegove kvalitetne valorizacije (Krajinović i ostali, 2011.).

Primjer Hrvatske, kao zemlje sa značajnim potencijalima za razvoj ruralnog turizma u praktički svim njenim područjima ukazuje na probleme i poteškoće na koje nailazi receptivna zajednica pokušavajući razviti ruralni turizam. Takvi se problemi i poteškoće odnose prije svega na slabu ekonomsku snagu obiteljskih poljoprivrednih gospodarstava, kojima je vrlo teško postići pozitivan financijski učinak. Nadalje, pojavljuje se problem nedovoljnih i/ili neadekvatnih financijskih poticaja od strane javnog sektora, neprepoznavanje ruralnog turizma kao oblika turizma koji dodaje vrijednost turističkoj destinaciji, nepostojanje ekspertize u malim obiteljskim gospodarstvima, neadekvatni zakoni koji tretiraju problematiku ruralnog turizma, vrlo loša ili neadekvatna marketinška aktivnost objedinjenih poslovnih jedinica (obiteljskih seoskih gospodarstava u ruralnom turizmu) i slično. Temelj čitavog problema nalazi se u neadekvatnom načinu upravljanja razvojem ruralnog turizma kao mehanizmom koji bi umanjio ili ublažio prikazane probleme, a neke i uklonio.

3. Pojmovno određenje marketinga i marketinškog miksa

S razvojem teorije marketinga i njegovom primjenom u praksi pojavljuje se veći broj definicija. Iako postoji opća suglasnost o tome da razmjena čini bit marketinga, autori definiranju marketinga pristupaju iz različitih perspektiva te ga promatraju kao proces, znanost, način izvođenja poslovne aktivnosti, umijeće, ljudsku aktivnost, skup aktivnosti, skup funkcija i dr. (Previšić i Ozretić Došen, 2007.).

Među definicijama najšire prihvaćena je definicija koju je potvrdila Američka udruga za marketing (AMA) 1985. godine, a ona glasi: "Marketing predstavlja proces planiranja i provođenja stvaranja ideja, proizvoda i usluga, određivanja njihovih cijena, promocije i distribucije kako bi se obavila razmjena koja zadovoljava ciljeve pojedinca i organizacije". Od 2004. godine Upravni odbor AMA-e redefinirao je definiciju marketinga koja glasi: "Marketing je organizacijska funkcija i skup procesa kojima se stvaraju, komuniciraju i

isporučuju vrijednosti potrošačima i kojima se upravlja odnosima s potrošačima s ciljem ostvarivanja koristi za organizaciju i sve uključene strane". (Previšić i Ozretić Došen, 2007.).

Marketinški miks, često nazivan 4P, predstavlja specifičnu kombinaciju elemenata koji se koriste za istovremeno postizanje ciljeva poduzeća i zadovoljenje potreba i želja ciljnih tržišta. Najčešće se izražava u obliku konceptualnog obrasca koji obuhvaća određeni broj elemenata marketinga kao što su: proizvod, cijena, promocija i distribucija. Ovi elementi predstavljaju varijable marketinga koje poduzeće može kontrolirati. Pored osnovna četiri elementa marketing miksa (4P), neki teoretičari navode da bi on trebalo biti proširen s dodatnim elementima, ovisno o svrsi za koju se koristi.

Marketing miks uključuje aspekte i strategije marketinga koje menadžment koristi za stjecanje konkurentske prednosti. Da bi marketing miks bio učinkovit mora biti prilagođen potrebama kupaca, kreirati određenu konkurentsku prednost, imati dobro uravnotežene elemente te biti usklađen sa raspoloživim resursima poduzeća. S obzirom na to da se kupci na pojedinim tržištima razlikuju prema iskazanim potrebama, upravljanje marketinškim miksom za različite kupce nudi različita rješenja (Kotler i ostali, 2006.).

4. Održivi marketinški splet

Pitanje održivosti se često navodi kao cilj poslovanja različitih tipova organizacija. Poznato je da je marketing poslovna funkcija usmjerena prvenstveno na ostvarivanje ekonomskih efekata, odnosno maksimizaciju profita kroz zadovoljenje potreba potrošača. Međutim, danas maksimizacija profita više nije primarni fokus poslovanja. Primjena koncepta održivog razvoja u turizmu dovela je do izvjesnog proširenja ciljeva marketinga. Pored poznatih ciljeva zadovoljenja potreba tržišta i ostvarenja profita, marketing koncepcija u turizmu devedesetih godina uvela je još jedan cilj, a to je poštivanje i očuvanje osnovnih vrijednosti na kojima se temelji turistički proizvod (Ahmetović-Tomka, 1995.). Takva održivost predstavlja presudan element upravljanja svim aspektima turističkog djelovanja. Stručnjaci za marketing u turizmu danas imaju na raspolaganju različite mogućnosti koje dopuštaju istovremeno ostvarivanje ciljeva održivosti i profitabilnosti pa se u najkraćim okvirima može reći da su danas uspješne organizacije one koje ne odvajaju etičnost od profitabilnosti (Bajić, 2011.).

Tradicionalni marketing miks (4P) čine četiri elementa koja se koriste pri izboru ciljnog tržišta. To su: proizvod (*product*), cijena (*price*), promocija (*promotion*) i distribucija (*place*). Kada su u pitanju uslužne djelatnosti, kao što je slučaj sa turizmom, Bums i Bitner (Booms & Bitner, 1981.) uvode tri dodatna elementa. To su: ljudi (*people*), fizičko okruženje (*physical evidence*) i procesi (*process*).

Mnogi autori su razmatrali pitanje marketing miksa u turizmu i na tradicionalni 4P miks dodavali različite elemente koji bi bolje iskazali jedinstvene karakteristike turističkih proizvoda. Najprihvatljivijim se čini model koji je u području marketinga u turizmu dao Morison (Morrison, 1989). Ovaj autor na osnovni miks od 4P dodaje četiri elementa: ljude (*people*), partnerstvo (*partnership*), pakiranje (*packaging*) i programiranje (*programming*) pozivajući se na ključne aktivnosti koje stručnjaci za marketing u turizmu čine u cilju kreiranja inovativnog i uzbudljivog iskustva za potrošače. Sintezom navedenih elemenata došlo se do unapređenog turističkog marketing miksa od 10 ključnih faktora, koji pored četiri

tradicionalna, sadrži tri dodatna P za marketing usluge koja su predložili Bums i Bitner i tri turistička P koja je predložio Morison. U tom slučaju turistički marketinški miks čine: proizvod, cijena, promocija, distribucija, ljudi, fizičko okruženje, procesi, partnerstvo, pakiranje i programiranje.

Sukladno ključnim načelima održivog turizma, utvrđenim od strane UNEP – UNWTO (2005.), marketing u turizmu treba koristiti holistički i strateški pristup, u kojima podržava ekološke procese, štiti kulturno nasljeđe i biodiverzitet i pomaže dugoročni razvoj. Stoga marketinški miks održivog turizma, koji predlažu Pomering i suradnici (Pomering, Johnson i Noble, 2009.), uključuje tri dodatna elementa; zajednica, ekosustav i profit. Ova tri elementa zapravo predstavljaju tri koncepta održivosti te ih treba uzeti u obzir pri donošenju marketinških odluka kako bi one imale održive ishode (slika 1.)

	Proizvod	Cijena	Promocija	Distribucija	Ljudi	Fizičko okruženje	Procesi	Pakiranje	Iskustvo	Partnerstvo
Zajednica										
Ekosustav										
Profit										

Slika 1. Suvremeni marketinški miks za održivi turizam

Izvor: Pomering et al., 2009, p. 6.

4. Uzorak, metodologija i rezultati istraživanja

Istraživanje marketinškog spleta u ruralnom turizmu realizirano je u siječnju 2016. na uzorku osam (8) obiteljsko-poljoprivrednih gospodarstava (OPG) u Šibensko-kninskoj županiji.

Cilj istraživanja je pronaći odgovor na pitanje:

- Je li marketing-menadžment sastavni dio poslovanja obiteljsko-poljoprivrednih gospodarstava u Šibensko-kninskoj županiji?

Kvalitativno istraživanje realizirano je metodom intervjua s vlasnicima koji su odgovorni za planiranje i realizaciju marketinških aktivnosti u OPG-u u Šibensko-kninskoj županiji. Uzorak od osam (8) OPG-a izabran je nakon preliminarnih mailova i razgovora s vlasnicima OPG-ova koji su bili spremni odgovarati na pitanja o marketing menadžmentu koji primjenjuju u poslovanju vlastitih OPG-ova.

Rezultati istraživanja kratko su navedeni u tablicama 1. i 2. U ukupnoj strukturi uzorka zastupljeni su OPG-ovi koji primjenjuju različite marketinške strategije i taktike te manje ili više precizno definiraju ciljno tržište i njegove potrebe. Premda je vlasnik samo jednog (1) OPG-a kao ciljno tržište definirao isključivo strane goste u dobi iznad šezdeset (60) godina, iz rezultata intervjua vidljivo je da i ostali vlasnici razmatraju pojam ciljnog tržišta i prema njemu nastoje prilagođavati i osmišljavati tržišnu ponudu. Dva (2) vlasnika OPG-a (25 %) smatraju da su u njihovoj ciljnoj populaciji podjednako zastupljeni domaći i strani gosti dok

ostalnih pet (5) vlasnika OPG-ova (62,5 %) svoju tržišnu ponudu usmjerava isključivo prema obilježjima i zahtjevima stranih gostiju.

Jedan (1) OPG (12,5 % uzorka) opisuje svoju ciljnu skupinu kao osobe starije od šezdeset (60) godina dok tri (3) OPG-a (37,5 % uzorka) smatraju da su njihovi ciljni kupci stariji od trideset (30) godina. Četiri (4) vlasnika OPG-a (62,5 %) opisuju strukturu svojih potencijalnih korisnika kao „goste svih dobnih skupina“. Rezultati intervjua pri tome indiciraju da OPG-ovi, uz izuzetak OPG-a „E“, koji su u okviru ciljnih korisnika prepoznali sve dobne skupine, ne prilagođavaju turističku ponudu u odnosu na dobnu skupinu, odnosno oblikuju jedinstveni marketinški miks za sve dobne skupine. OPG „E“, naime, u ponudi sadržaja nudi i dječje igralište što na neki način implicira oblikovanje ponude prilagođene ciljnom segmentu (u ovom slučaju populaciji djece).

Rezultati istraživanja indiciraju da OPG-ovi iz uzorka razvijaju specifičan asortiman proizvoda/usluga. Temeljni sadržaj ponude OPG-ova u pravilu uključuje ponudu autohtone prehrane i domaćih specijaliteta (8 OPG-ova ili 100 % uzorka) i prodaju autohtonih proizvoda (7 OPG-ova ili 87,5 % uzorka) koje gosti mogu kupiti tijekom boravka na OPG-u i ponijeti u svoje domicilne destinacije. Nadalje, samo tri (3) od ukupno osam (8) OPG-ova (37,5 %) iz uzorka svojim gostima nudi mogućnost smještaja na OPG-u, a samo dva (2) OPG-a (25 %) neke dodatne aktivnosti kao što su primjerice obilazak područja i upoznavanje s kulturnim vrijednostima u pratnji vodiča, branje maslina ili proizvodnju vina.

U području promocije, rezultati istraživanja ukazuju da su OPG-ovi u Šibensko-kninskoj županiji prvenstveno usmjereni na oglašavanje i komuniciranje s potencijalnim gostima posredstvom turističkih agencija (svih osam (8) OPG-ova ili 100 % uzorka). Turističke agencije imaju ulogu posredničkog kanala i omogućavaju OPG-ovima dolazak većih skupina stranih gostiju treće životne dobi koje su spremne izdvojiti više novca za svoj boravak na OPG-u u odnosu na prosječnog turističkog potrošača. Nadalje, OPG-ovi nastoje komunicirati s potencijalnim potrošačima posredstvom vlastitih web stranica i društvenih mreža (pet (5) OPG-ova ili 62,5 % uzorka). Premda rezultati istraživanja pokazuju da komuniciranje posredstvom društvenih mreža još uvijek ne prakticiraju svi OPG-ovi, jasno je da se njihov broj, prvenstveno zbog izrazito visokog povrata u odnosu na uložena sredstva, kontinuirano povećava. Vrlo važnu ulogu u privlačenju novih gostiju na OPG-ove ima usmena predaja, odnosno preporuke onih koji su jednom posjetili neki OPG i nakon toga isti preporučili članovima obitelji i prijateljima. U konačnici, možemo kazati da su i same oznake obilježavanja OPG-ova na određenoj mikrolokaciji povremeno poticaj slučajnom posjetitelju koji obilazi određeno područje da posjeti OPG.

Rezultati istraživanja lokacije OPG-ova, kao jednog od elemenata marketinškog miksa, ukazuje da OPG-ovi u pravilu djeluju na pristupačnim, lako dostupnim lokacijama u okviru kojih se nude raznovrsni autohtoni sadržaji oblikovani u skladu s tradicijom i poviješću specifičnog lokaliteta. Primjerice OPG „A“ nudi posebne sadržaje kao što su raznovrsna događanja u amfiteatru i etnografska zbirka. Nadalje, dva (2) OPG-a (25 % uzorka) posjeduju auto kamp, a jedan (1) OPG (12,5 % uzorka) boćalište i dječje igralište.

Unatoč činjenici da ulogu marketing-menadžera preuzimaju vlasnici s vrlo niskom razinom marketinškog obrazovanja, OPG-ovi iz uzorka se vrlo profesionalno ponašaju u području formiranja cijena. Kroz intervju s vlasnicima, primjetno je da se najveći broj OPG-ova, pri

formiranju cijene, ne fokusira na troškove već na konkurente i tržište što je potvrda marketinškog načina promišljanja. Udio OPG-ova koji mijenja cijene s promjenama potražnje vrlo je značajan (šest OPG-ova ili 75 % uzorka). Cijene se mijenjaju u ovisnosti o kretanju potražnje, veličini grupe, vrsti menija te vremenskom kalendaru. Dio OPG-ova, koristi raznovrsne akcijske cijene koje uključuju akcijske ponude za blagdane i tematske događaje (Valentinovo, „Proljeće na selu“, „Berba grožđa“).

Rezultati istraživanja ukazuju da OPG-ovi iz uzorka najčešće kao konkurentsku prednost ističu sastavni dio usluge OPG-a - razgledavanje OPG-a i autohtonih sadržaja koje OPG nudi. Nadalje, neki od njih kao konkurentsku prednost ističu kulturnu baštinu koju prezentiraju i mogućnost sudjelovanja turističkih posjetitelja u tradicijskim aktivnostima (branje maslina). Nekolicina onih koji su resursno ograničeni i ne raspolažu dovoljnom količinom autohtonih sadržaja kao prednost ističu originalnost, inovativnost i kreativnost.

Rezultati istraživanja također indiciraju da OPG-ovi iz uzorka nemaju uvijek primjereno usklađene marketinške aktivnosti. Primjerice, OPG-ovi „A“ i „B“ koji raspolažu zaštićenom kulturnom baštinom, koja je upisana u registar kulturne baštine ili zaštićena od strane UNESCO-a, vrlo su inertne u području promocije oslanjajući se isključivo na turističke agencije kao posrednike. Nadalje, OPG „B“ razvija i nudi vrlo uzak prodajni asortiman (isključivo autohtona prehrana i domaći specijaliteti), a OPG „A“ formirajući cijene neovisno o potražnji riskira da, unatoč kvalitetnoj ponudi i imidžu posebice u razdoblju izvan sezone, izgubi značajan dio turističkih posjetitelja.

Tablica 1. Rezultati istraživanja marketing menadžmenta u OPG-ovima Šibensko-kninske županije

OPG	A	B	C	D
Ciljno tržište	Strani gosti, starosna struktura 60+	Strani gosti, starosna struktura 35+	Strani gosti, starosna struktura 35+	Strani gosti, sve dobne skupine
Asortiman proizvoda/usluga	Autohtona prehrana i domaći specijaliteti, prodaja autohtonih proizvoda, aktivnosti: obilazak područja i upoznavanje s kulturnim vrijednostima u pratnji vodiča.	Autohtona prehrana i domaći specijaliteti.	Autohtona prehrana, klasična jela, prodaja autohtonih proizvoda-delicija.	Autohtona prehrana i domaći specijaliteti, prodaja autohtonih proizvoda, aktivnosti: branje maslina, proizvodnja vina, smještajni kapaciteti.
Oblici promocije	Promocija posredstvom turističke agencije, usmena predaja (preporuka prijatelja).	Promocija posredstvom turističke agencije, oznake za OPG na mikrolokaciji.	Promocija posredstvom turističke agencije, web stranica OPG-a, usmena predaja (preporuka prijatelja).	Promocija posredstvom turističke agencije, web stranica OPG-a, oglašavanje na društvenih mrežama, oznake za OPG na mikrolokaciji.
Obilježja lokacije	Pristupačna lokacija, posebni sadržaji: amfiteatar, etnografska zbirka.	Pristupačna lokacija, autohtoni izgled prostornih sadržaja.	Pristupačna lokacija, OPG posjeduje auto kamp.	Pristupačna lokacija.

Formiranje cijene	Cijene na razini konkurentskih, cijene se ne mijenjaju s potražnjom, nema akcijskih cijena.	Cijene na razini konkurentskih, cijene se mijenjaju ovisno o potražnji, veličini grupe, vrsti menija te vremenskom kalendaru.	Cijene na razini konkurentskih, akcijske i promotivne cijene bazirane na dogovoru.	Cijene na razini konkurencije, cijene su niže u rano proljeće i kasnu jesen, akcijske ponude za blagdan i tematske događaje (Valentinovo, Proljeće na selu, Berba grožđa).
Konkurentska prednost OPG-a	Mogućnost razgledavanja OPG-a, zbirka upisana u registar kulturne baštine, učenje na iskustvu, priče i doživljaj.	Mogućnost razgledavanja OPG-a, zaštićena kulturna baština od strane UNESCO-a.	Originalnost, inovativnost, kreativnost.	Mogućnost razgledavanja OPG-a, sudjelovanje u tradicijskim aktivnostima (berba voća).

Tablica 2. Rezultati istraživanja marketing menadžmenta u OPG-ovima Šibensko-kninske županije

OPG	E	F	G	H
Ciljno tržište	Strani i domaći gosti, sve dobne skupine	Strani gosti, starosna struktura 35+	Strani gosti, sve dobne skupine	Strani i domaći gosti, sve dobne skupine
Asortiman proizvoda/usluga	Autohtona prehrana i domaći specijaliteti, prodaja autohtonih proizvoda, klasična jela, smještajni kapaciteti.	Autohtona prehrana i domaći specijaliteti, prodaja autohtonih proizvoda.	Autohtona prehrana i domaći specijaliteti, prodaja autohtonih proizvoda.	Autohtona prehrana i domaći specijaliteti, smještajni kapaciteti.
Ključni kanali promocije	Promocija posredstvom turističke agencije, web stranica OPG-a, usmena predaja (preporuka prijatelja).	Promocija posredstvom turističke agencije, oznake za OPG na mikrolokaciji.	Promocija posredstvom turističke agencije, web stranica OPG-a, OPG-a, usmena predaja (preporuka prijatelja).	Promocija posredstvom turističke agencije, web stranica OPG-a, oglašavanje na društvenih mrežama.
Obilježja lokacije	Pristupačna lokacija, posebni sadržaji: prostor za boćanje i dječje igralište.	Pristupačna lokacija, OPG posjeduje auto kamp.	Pristupačna lokacija.	Pristupačna lokacija, autohtoni izgled prostornih sadržaja.
Formiranje cijene	Cijene su na razini konkurentskih, akcijske i promotivne cijene ovise o potražnji.	Cijene na razini konkurentskih, akcijske i promotivne cijene tijekom godine.	Cijene na razini konkurentskih, ne mijenjaju se s potražnjom.	Cijene na razini konkurentskih, akcijske i promotivne cijene tijekom godine.
Konkurentska prednost OPG-a	Atraktivnosti, inovativnost, širina ponude.	Mogućnost razgledavanja OPG-a.	Mogućnost razgledavanja OPG-a.	Mogućnost razgledavanja OPG-a, sudjelovanje u tradicijskim aktivnostima (branje maslina).

5. Zaključak

Najveći izazov vezan za koncept održivog ruralnog turizma predstavlja njegova operacionalizacija i sagledavanje ruralnog turizma kao procesa koji se primjenjuje kroz razvojne planove i projekte i tekuće aktivnosti turističkih subjekata. Tradicionalni pristup marketingu, koji je fokusiran na ograničenu ideju maksimizacije profita poslovnih subjekata, nije bio u mogućnosti odgovoriti na brojne društvene i ekološke zahtjeve koje nameće koncept održivog razvoja.

Koncept marketing miksa je dobra polazna točka za istraživanje načina na koji stručnjaci za marketing u turizmu mogu zadovoljiti povećane društvene i ekološke zahtjeve. Elementi marketing miksa oblikuju viziju, misiju, strategiju i vrijednosti organizacije i umnogome određuju njen identitet.

Rezultati istraživanja indiciraju da su OPG-ovi na području Šibensko-kninske županije prepoznali ulogu marketinga u poslovanju i da uspješnim kombiniranjem elemenata marketinškog miksa izgrađuju pretpostavke za profitabilno poslovanje i izgradnju konkurentne pozicije na tržištu. Marketinška orijentacija OPG-ova vidljiva je kroz njihovo nastojanje da prilagode ponudu specifičnim dobnim skupinama, izgrade komunikaciju s posrednicima (turističke agencije) i krajnjim korisnicima te kroz stalno usklađivanje cijene s promjenama potražnje potaknu potencijalne korisnike na kupnju i konzumiranje vlastitih proizvoda i usluga. Pri tome, jasno je da OPG-ovi iz uzorka još uvijek ne koriste sve raspoložive potencijale, kao što je primjerice kulturna baština koju posjeduju, u izgradnji imidža i uspješnijem pozicioniranju na tržištu. Vlasnici OPG-ova više su fokusirani na potencijalne posjetitelje i asortiman proizvoda/usluga koje nude, a manje na koncept održivog razvoja ruralnog turizma koji bi im trebao osigurati dugoročni uspjeh i tržišni rast. Međutim, za davanje kvalitetnijih preporuka, nužno je provesti kvantitativno istraživanje na primjerenom broju OPG-ova u svim hrvatskim regijama.

Marketing u održivom ruralnom turizmu mora biti okrenut prema prirodnom i socio-kulturnom okruženju, društveno odgovornom poslovanju te etičnom ponašanju. Na budućnost održivog ruralnog turizma veliki pozitivan utjecaj može imati implementacija proširenog marketing miksa. Kod donošenja marketinških odluka, marketing miks se treba zasnivati na tri područja održivosti (ekološkim, socijalnim i ekonomskim).

Ako ruralni turizam želi biti održiv, sve aktivnosti na kojima se on zasniva moraju biti održive. Marketing može odigrati značajnu ulogu u ovom procesu, budući da održivi marketing nastoji zadovoljiti ukupne ekološke troškove u proizvodnji i potrošnji radi stvaranja održive ekonomije.

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Creating a sustainable marketing mix in rural tourism

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Abstract: Rural tourism, as an important element of both sustainable tourism and economic and social development of rural areas, faces all the major development, marketing, and economic challenges. At the same time, an interest in this form of tourism has been increasing significantly. Good natural and cultural conditions, such as climate, soil, beneficial

possibilities for the development of agricultural production, and well-preserved cultural heritage are important for the development of rural tourism. This study deals with the present condition of rural tourism in sub-Mediterranean Dalmatia with respect to what it can offer to tourists, and the marketing mix of the family farms in the area of sub-Mediterranean Dalmatia.

Key words: *rural tourism, marketing mix, sustainable development, family farm*

Implikacije klimatskih promjena na sezonalnost turističkog poslovanja priobalnih odmorišnih destinacija

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Sažetak. Autori su suglasni oko senzibilnosti turističke potražnje na promjene u klimi. Predviđa se da će rast temperature prouzrokovati prostornu i vremensku redistribuciju turističke potražnje. Klimatske promjene promijeniti će standardiziranu sliku sezonskog poslovanja priobalnog kupališnog turizma te učiniti će popularne ljetne destinacije manje privlačnim. Očekuje se da će stabilniji vremenski uvjeti u emitivnom području sa pogodnom klimom utjecati na razvoj domaćeg turizma, čime će potreba za putovanjem u inozemna područja opadati. Nadalje, očekuje se da će se klimatske promjene odraziti različitim intenzitetom među regijama. Navedene implikacije klimatskih promjena jasno projiciraju promjene u ustaljenoj slici turističkih aktivnosti. Pod direktnim utjecajem su priobalne odmorišne destinacije sa formiranom ljetnom turističkom sezonom i sezonskim poslovanjem. Zbog navedenih implikacija klimatskih promjena planiranje u turizmu neće biti zamislivo bez njihovog uvažavanja, posebice u segmentu kupališnog turizma koji je pod najvećom prijetnjom klimatskih promjena. Navedeno će izazvati nove odnose na konkurentnom turističkom tržištu.

Ključne riječi: klima, klimatske promjene, turistička potražnja, sezonalnost poslovanja, priobalna odmorišna destinacija

1. Uvod

Turistička industrija doživjela je ubrzani razvoj protekla tri desetljeća, ostvarujući korist prvenstveno od razvoja ekonomije, povećanja kupovne moći te smanjenja transportnih cijena (Pestana et al., 2011.). Turizmu se predviđa, uz informacijsku tehnologiju i telekomunikacije, uloga jedne od tri vodeće industrije dvadeset prvog stoljeća (Rachman et al., 2000.). Pri tome, kroz ubrzani rast ima značajan doprinos BDP-u, zaposlenosti, ekonomskom rastu, deviznom priljevu, generiranju prihoda, kao i regionalnom i društvenom razvoju zemlje (Volo, 2010.). Obalni odmorišni turizam kao najveća komponenta globalne turističke industrije s udjelom većim od 60 % u ukupnim putovanjima Europljana i više od 80 % ukupnih turističkih prihoda SAD-a predstavlja ključni turistički proizvod. Dominaciju ovog vida turizma u ukupnim turističkim tokovima Republike Hrvatske potvrđuje podatak da je 92,5 % turističkih noćenja u 2014. godini ostvareno u županijama priobalnog pojasa (Institut za turizam, 2014.).

Turizam kao sastavni dio globalnog poslovanja ovisan je o promjenama klimatskih uvjeta, ekonomskih aktivnosti, kao i ljudskog ponašanja i društva u cjelini (Baum i Lundtrop, 2001). Navedene promjene uzrokuju fluktuacije turističkih aktivnosti iz čega proizlaze sezonske oscilacije u razini poslovanja u globalnoj turističkoj industriji (Kolomiets, 2010). Varijacije u

klimatskim uvjetima stvaraju različite sezonske potencijale i resurse turističkih odredišta, za koje se percipira da imaju određene sezonske kvalitete (Lee i dr. 2008.). No, klimatske promjene mogle bi poremetiti uhodane turističke tokove. Rastom temperature trenutno popularne odmorišne destinacije mogle bi postati prevruće, dok bi drugim destinacijama klimatske promjene optimizirale temperaturu i učinile ih privlačnim odredištem turističkih aktivnosti (Berrettella i dr., 2006.). Prema navedenom obalni odmorišni turizam upravo je pod najvećom prijetnjom klimatskih promjena.

Svrha rada prikazati je potencijalne razmjere klimatskih promjena na sezonsko poslovanje priobalnih odmorišnih destinacija.

2. Klimatske promjene i njihove implikacije na turistička kretanja

Provedena istraživanja suglasno potvrđuju da je došlo do promjene u globalnoj klimi te da će se klima i dalje mijenjati. Prema podacima Međuvladinog panela o klimatskim promjenama (IPCC) zagrijavanje klimatskog sustava nedvojbeno je te se projicira da će do kraja 21. stoljeća globalna prosječna temperatura porasti za 1,8°C do 4°C. Kao glavni uzročnik globalnog zagrijavanja izdvaja se prekomjerna emisija stakleničkih plinova koji uzrokuju efekt staklenika u planetarnoj atmosferi. Čak, i ako se atmosferske koncentracije stakleničkih plinova stabiliziraju na sadašnjim razinama, Zemlja će se i dalje zagrijavati kao rezultat prošlih emisija stakleničkih plinova i toplinskih inercija mora (UNWTO i UNEP, 2009.). Posljedice klimatskih promjena bit će povećanje maksimalne temperature, veći broj vrućih dana, veći intenzitet tropskih oluja i snažnih vjetrova, veće količine oborina u jednim krajevima i duga sušna razdoblja u drugim krajevima.

Implikacije klimatskih promjena manifestirat će se na mnogim aspektima društva, pri čemu ni turistička industrija nije isključena, posebice zbog izrazito bliske veze klime, okoliša i turizma. Prethodno je već naglašen atrakcijski faktor klime te uloga klime kao regulatora prostorne i vremenske distribucije turističke potražnje. Paradoksn, doprinos turizma emisiji stakleničkih plinova je u porastu. Izračuni ukazuju da turizam na globalnoj razini doprinosi emisiji ugljičnog dioksida (CO₂) u rasponu od 3,9 % do 6 % ukupnih ljudskih emisija. No, s obzirom na predviđeni rast turizma očekuje se porast od 130 % emisije sektora turizma u razdoblju od 2005. do 2035. Shodno tome, međunarodni turizam se smatra jednim od glavnih doprinositelja globalnog zagrijavanja (Korstanje i George, 2012.). Prema navedenom, može se konstatirati da turizam postepeno sam narušava svoju održivost. Veza turizma i klime je dvosmjerna veza s kompleksnim interakcijama, naime, turizam svojim aktivnostima doprinosi klimatskim promjenama dok nastale klimatske promjene značajno utječu na turističku industriju, posebno na atraktivnost turističkih destinacija i na turističke tokove (Hernandez i Ryan, 2011.).

Klimatske promjene imat će direktne i indirektne implikacije na turizam (UNWTO i UNEP, 2009.). S obzirom na to da su klima, okoliš i osobna sigurnost tri primarna čimbenika za izbor destinacija od strane turističke potražnje, globalnim klimatskim promjenama predviđa se značajan utjecaj na ova tri čimbenika na regionalnoj razini.

Direktni utjecaji odrazit će se redistribucijom turističkih putovanja, prostorno i vremenski. Turistička potražnja, suprotno ponudi, ima mogućnost da se prilagodi klimatskim promjenama izbjegavanjem odredišta pod utjecajem klimatskih promjena ili pomicanjem vremena putovanja kako bi se izbjegli nepovoljni klimatski uvjeti (UNWTO i UNEP, 2009.). Klimatske promjene promijenit će standardiziranu sliku sezonskog poslovanja priobalnog kupališnog turizma te će popularne ljetne destinacije, primjerice hrvatsko priobalje, učiniti manje privlačnim. Suprotno tome, potražnja će se vremenski redistribuirati u druge dijelove godine ili pak prostorno u druge

destinacije s ugodnim klimatskim uvjetima. Navedeno će izazvati nove odnose na konkurentnom turističkom tržištu. Intenzitet klimatskih utjecaja manifestirat će se različito među regijama. Novonastale promjene stvarat će tržišne prijetnje, ali i prilike. Navedene promjene odrazit će se na sezonalnost u turizmu mijenjajući kvalitetu, razdoblje i duljinu trajanja sezone (UNWTO, 2009.). Spoznaje iz provedenih istraživanja utjecaja promjene klimatskih uvjeta na turističku potražnju sugeriraju da će se sredinom i krajem 21. stoljeća dogoditi geografska i sezonska preraspodjela turističke potražnje, a da će razmjeri ovoga utjecaja varirati među pojedinim destinacijama. Predviđeni utjecaji uključuju postupnu selidbu potražnje u destinacije na višim geografskim razinama i na višim nadmorskim visinama u planinskim područjima. Turisti iz emitivnih zemalja koji trenutno dominiraju u međunarodnim turističkim tokovima (npr. sjeverna Europa) očekuje se da će provesti godišnji odmor u svojoj domovini ili u blizini, prilagođavajući svoje putne obrasce novim klimatskim prilikama u svom životnom okruženju. Koncentracija turističke potražnje u sezoni će se smanjiti, pri čemu će, eventualno, više turista putovati u predsezoni i posezoni, ili zimi jer će im klimatski uvjeti to omogućiti. Izravni učinak klimatskih promjena mogao bi biti dovoljno značajan da promijeni sliku glavnih turističkih regija, posebice onih gdje je klima ključni atrakcijski faktor pa tako i hrvatskog priobalja. Međutim, spoznaje ne upućuju na potencijalne promjene u obujmu turističkih putovanja na globalnoj razini. Naime, nema dokaza da će promjene u klimi izravno dovesti do značajnog smanjenja globalnog volumena turizma (UNWTO i UNEP, 2009.).

Indirektni utjecaji klimatskih promjena rezultat su klimatski izazvanog narušavanja okoliša. Utjecaji uključuju promjene u dostupnosti vode, gubitku bioraznolikosti, smanjenju estetike krajolika, mogućnostima poljoprivredne proizvodnje, povećanje prirodnih nepogoda, obalne erozije i poplava, oštećenja infrastrukture i povećanju učestalost zaraznih bolesti koje će se odraziti na turizam u različitim intenzitetima (UNWTO i UNEP, 2009.).

Prema istraživanju UNWTO (2009.) turističke destinacije i turistički operatori podliježu utjecajima klimatskih varijacija u sljedećim područjima:

- Klima definira duljinu i kvalitetu turističkih sezona (npr. kupališne sezone) različito među regijama. Pojedine turističke destinacije su klimatski ovisne destinacije, jer klima predstavlja glavni destinacijski resurs na kojem se temelji turizam.
- Klima izravno utječe na različite aspekte turističke operative (npr. opskrbu vodom i kvalitetu vode, troškovi grijanja i hlađenja, potrebe za navodnjavanjem, upravljanje štetočinama, evakuaciju i privremeno zatvaranje) koji utječu na profitabilnost poslovanja.
- Širok raspon ekoloških resursa koji čine krucijalne turističke atrakcije u mnogim destinacijama su osjetljivi na klimatske varijabilnosti, kao što su biljni i životinjski svijet i biološka raznolikost, vodostaj i kvaliteta mora.
- Klima, također, utječe na okolišne uvjete koji mogu odbiti turiste u njihovoj namjeri posjete, uključujući zarazne bolesti, požare, cvjetanje mora, insekte ili vodne nametnike (npr. meduze) i ekstremne događaje kao što su uragani, poplave i toplotni udari.
- Klima je ključna odrednica turističkog odlučivanja. Sezonske klimatske fluktuacije u turističkim destinacijama i u glavnim emitivnim tržištima su ključni pokretači turističke potražnje na globalnim i regionalnim razmjerima. Vrijeme je sastavna komponenta iskustva putovanja koje utječe na turističku potrošnju i zadovoljstvo odmorom.

Turizam je sektor karakteriziran raznolikošću, a time postoje značajne razlike u klimatskoj osjetljivosti i sposobnosti prilagodbe turističkih operatora i odredišta. Nadalje, posljedice klimatskih promjena za turističke operatore ili sama odredišta djelomično će ovisiti o utjecaju

klimatskih promjena na konkurente. Naime, negativan utjecaj u jednom dijelu turističkog sustava stvara prilike negdje drugdje (UNWTO, 2009.).¹

Ispitivanje utjecaja klimatskih promjena na turizam nije pridobilo adekvatnu pažnju među istraživačima (Hernandez i Ryan, 2011.; Hamilton i Tol, 2007.). Dosadašnja istraživanja koja su ispitivala tematiku odabira turističke destinacije nisu bila značajno orijentirana na faktor klime, razlog tomu je činjenica da su autori na klimu gledali kao na konstantnu varijablu (Eugenio-Martina i Campos-Soria, 2010.; Berrittella i dr., 2006.; Lise i Tol, 2002.). No, klima nije konstantna te se očekuje da će se mijenjati ubrzanim korakom (Lise i Tol, 2002.).

Neophodno je pristupiti detaljnom istraživanju utjecaja klimatskih promjena na turističke aktivnosti s fokusom na stjecanje konkretnih spoznaja o razmjerima utjecaja na pojedina područja (Hernandez i Ryan, 2011.). U nastavku slijedi pregled istraživanja kojima je cilj bio analizirati utjecaj klimatskih promjena na turističke aktivnosti.

Prema istraživanju Berrittella i dr. (2006.) klimatske promjene će utjecati na mnoge aspekte ljudskog života. Navike odlaska na odmor su među onim najosjetljivijim varijablama na varijacije u klimi. Shodno tome, vrlo važni uslužni sektor, turizam, bit će pod izravnim utjecajem što može imati važne gospodarske posljedice. Autori smatraju da će klimatske promjene moderirati turističke tokove, pri čemu će doći do prostorne i vremenske redistribucije turističkih aktivnosti, paralelno tome će iste izazvati redistribuciju turističke potrošnje. Navedeno će se negativno odraziti na turističke destinacije prepoznatljive po odmorišnom kupališnom turizmu koje su ekonomski izrazito ovisne o turizmu. Shodno tome, na globalnoj razini, klimatske promjene će u konačnici dovesti do gubitka blagostanja, nejednako rasprostranjenog među regijama. Istraživanje Prema Eugenia-Martina i Campos-Soria (2010.) pokazuje da će turistička potražnja, inače osjetljiva na klimatske uvjete, reagirati elastično na klimatske promjene i modificirat će svoje navike putovanja prema novonastalim klimatskim uvjetima. Autori naglašavaju snagu klime u mjestu stanovanja kao determinante odabira odredišta odmora, stanovnici u regijama s boljim klimatskim indeksom imaju veću vjerojatnost domicilnog putovanja i nižu vjerojatnost putovanja u inozemstvo. Nadalje, autori ističu da su stanovnici klimatski nepogodnijih područja manje osjetljivi na varijacije u klimi te su spremni prihvatiti „prosječne“ klimatske uvjete, suprotno stanovnicima naviknutim na izrazito pogodne klimatske uvjete koji će reagirati izrazito elastično na klimatske promjene. Bigano, Hamilton i Tol (2006.), također, ističu da turisti iz toplijih sredina imaju više naglašene preferencije putovanja. Stajališta su da će klimatske promjene implicirati promjene na turističkoj karti, potražnja će se pomicati prema sjeveru, ujedno reducirat će se broj putovanja u srpnju i kolovozu. Lise i Tol (2002.) izdvajaju klimu kao značajni faktor odabira turističke destinacije, ističući prosječnu godišnju temperaturu oko 21°C kao optimalnu, no ujedno konstatiraju da će klimatske promjene utjecati na popularnost trenutno poželjnih destinacija odmorišnog turizma, ali će zasigurno na tržište ući novi konkurenti što će povećati konkurentnost na turističkom tržištu. Hamilton i Tol (2007.) u svome istraživanju potvrđuju tezu o utjecaju klimatskih promjena na redistribuciju turističke potražnje prema polovima, no oni preciziraju smjernice budućih turističkih tokova naglašavajući da će se klimatske promjene različito odraziti među regijama te samim time doći i do različitih međuregionalnih promjena u ponašanju potražnje. Bigano, Hamilton i Tol (2007.) konkretiziraju

¹ Detaljna analiza direktnih i indirektnih razmjera klimatskih promjena na turizma prikazana je u UNWTO i UNEP (2008), *Climate Change and Tourism, Responding to Global Challenges*, World Tourism Organization and the United Nations Environment Programme, Madrid, Spain.

spoznaje te ističu da će se klimatske promjene odraziti na domaći i međunarodni turizam. Predviđa se dupliranje domaćeg turizma u hladnijim zemljama te smanjenje domaćeg turizma za 20 % u toplijim zemljama. Međunarodni turizam će se u pojedinim zemljama utrostručiti dok će se u drugim prepoloviti. Navedene promjene u volumenu putovanja odrazit će se i na turističku potrošnju te u konačnici na ekonomsko blagostanje receptivnih područja.

3. Rasprava

Predviđene klimatske promjene izazvat će prostornu i vremensku redistribuciju turističke potražnje te time utjecati na sezonalnost poslovanja priobalnih odmorišnih destinacija. S obzirom na izrazitu elastičnost turističke potražnje, navedene promjene izazvat će prijetnje i prilike te potrebe prilagodbe na turističkom tržištu.

Prijetnje proizlaze iz prostorne i vremenske redistribucije turističke potražnje. Konkretno za hrvatski turizam, ako se potražnja prostorno redistribuira na područja s pogodnijim klimatskim uvjetima i ujedno glavna emitivna tržišta hrvatskog turizma povećaju broj domaćih putovanja, ugrožit će se poslovanje hrvatskog priobalnog turizma kojeg čini oko 90 % međunarodnih turističkih dolazaka. Vremenska redistribucija turističke potražnje, također, bi ugrozila poslovanje hrvatskog priobalnog turizma zbog njegove izrazite tržišne prepoznatljivosti kao destinacije popularne u ljetnom kupališnom tromjesečju.

Klimatske promjene izazvat će tržišne prilike u priobalnom odmorišnom turizmu. Brojne negativne ekonomske, ekološke i sociokulturne implikacije koje proizlaze iz sezone koncentracije turističke potražnje mogle bi se prebroditi pravilnom vremenskom redistribucijom turističke potražnje. Predviđeni rast temperature mogao bi reducirati razinu potražnje u glavnom ljetnom tromjesečju u kojem bi dominirala potražnja željna izlaganju iznimno visokim temperaturama dok bi se kupališna sezona proširila u mjesec pred i posezone. Navedenim bi se redistribuirao višak turističke potražnje iz trenutnog vrhunca sezone u vansezonsko razdoblje te generirala bi se nova potražnja.

Shodno iznesenom prilike koje bi proizašle iz klimatskih promjena nadmašuju prijetnje. No, priča zasigurno nije tako jednolična. Naime, činjenica da je turizam jedan od glavnih doprinositelja klimatskim promjenama te da će klimatske promjene, uz sami rast temperature, imati brojne indirektno negativne implikacije kao što su promjene u dostupnosti vode, gubitak bioraznolikosti, povećanje prirodnih nepogoda, obalne erozije i poplate te druge implikacije, uvjetuje određene promjene u budućim turističkim aktivnostima. Turističko poslovanje u priobalju trebat će se prilagoditi novim regulativama poslovanja. Na tržištu će opstati samo one destinacije koje svoje poslovanje usklade s novonastalim tržišnim uvjetima te marketinškim aktivnostima repositioniraju svoju ponudu na međunarodnom turističkom tržištu. Navedeno je kompleksna tematika koja zahtijeva zasebno istraživanje.

4. Zaključak

Autori su suglasni oko senzibilnosti turističke potražnje na promjene u klimi. Spoznaje da će stabilniji vremenski uvjeti u emitivnom području s pogodnom klimom utjecati na razvoj domaćeg turizma, da će potreba za putovanjem u inozemna područja opadati te da će doći do vremenske i prostorne redistribucije turističke potražnje i da će se klimatske promjene odraziti različitim intenzitetom među regijama, jasno projiciraju promjene u ustaljenoj slici turističkih aktivnosti. Pod direktnim utjecajem su priobalne odmorišne destinacije s formiranom ljetnom turističkom sezonom i sezonskim poslovanjem. Zbog navedenih implikacija klimatskih

promjena, planiranje u turizmu neće biti zamislivo bez njihovog uvažavanja, posebice u segmentu kupališnog turizma koji je pod najvećom prijetnjom klimatskih promjena.

Klimatske promjene su stvarne, iako trenutno nisu ozbiljno shvaćene. Njihove implikacije se postepeno odražavaju na turističke aktivnosti te će budući razmjeri izazvati značajne promjene u poslovanju turističkih destinacija priobalja. Buduća istraživanja veze klime i turizma trebaju biti detaljno usmjerena u dva pravca. Prvo regionalno ispitati utjecaj klimatskih faktora na sezonalnost turizma. Drugo, također regionalno, analizirati potencijalne razmjere klimatskih promjena i njihove implikacije, negativne i pozitivne, na sezonalnost poslovanja priobalnog turizma. Pravovremena anticipacija osnovni je preduvjet upravljanja nadolazećim situacijama.

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The implications of climate change on seasonal business in coastal tourism destinations

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Abstract. Authors agree that tourist demands are sensitive to climate changes. It is anticipated that the temperature increase will cause spatial and temporal redistribution of tourist demand. Climate change will change the standardized image of seasonal business in coastal tourism and will make popular summer destinations less attractive. It is expected that stable weather conditions in areas with favourable climate will affect the development of domestic tourism, which will reduce the need for vacationing abroad. Furthermore, it is expected that climate change will differ in intensity between regions. These implications of climate change will clearly project changes in the established image of tourist activities. Coastal destinations with established summer season and seasonal business will be directly affected. Because of these implications of climate change, planning in tourism will not be conceivable without heeding the changes in climate, especially in costal tourism areas, which are under the greatest threat of climate change. This will lead to new relationships on the competitive tourist market.

Key words: *climate, climate change, tourist demand, seasonality, costal tourism*

Značaj strateškog menadžmenta ljudskih potencijala za ostvarenje dugoročne održivosti poslovnih organizacija

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Sažetak. Strateški menadžment ljudskih potencijala uključuje prihvaćanje sustava i politika upravljanja ljudskim potencijalima koji pomažu poslovnim organizacijama ostvariti viziju i strateške ciljeve osiguravajući im održivu konkurentsku prednost. Kako suština dugoročne konkurentске prednosti leži u osiguranju njene održivosti, koncept održivog razvoja neminovno je vezan uz ovu problematiku. Održivi razvoj na razini poslovnih organizacija definira se na različite načine te uključuje ekonomsku, okolišnu i društvenu dimenziju održivosti. Brojna istraživanja pokazuju kako su značajan izvor dugoročne održivosti, na nacionalnoj razini, kao i na razini poslovnih subjekata, upravo ljudski potencijali, odnosno ljudski kapital. U ovom radu, kroz analizu dosadašnjih istraživanja, ukazat ćemo na značaj koji strateški menadžment ljudskih potencijala ima za ostvarenje dugoročne održivosti poslovnih organizacija.

Ključne riječi: *održivi razvoj, strateški menadžment ljudskih potencijala, društveno odgovorno poslovanje*

1. Uvod

Kao odgovor na sve izraženiju svijest i osjetljivost svjetske javnosti na ekološke, društvene i ekonomske probleme koji su posljedica poslovnih aktivnosti mnogih organizacija, sve je izraženija spremnost vodećih svjetskih kompanija da dokažu svoju opredijeljenost k održivom poslovanju. U suvremenom svijetu sve više postaje jasno kako organizacije pri donošenju poslovnih odluka moraju uzeti u obzir i mogući učinak tih odluka na okolinu u kojoj posluju. One tako doprinose vlastitom razvoju i rastu, ali i razvoju i rastu društva u cjelini. Dugoročan poslovni uspjeh temelji se na odlukama koje donosimo danas, a koje ne smiju ugroziti poslovanje u budućnosti. To je temelj koncepta održivog razvoja.

U ovom radu, analizom dosadašnjih istraživanja, dovode se u vezu pojmovi održivog razvoja, strateškog upravljanja i upravljanja ljudskim potencijalima.

U skladu s opće prihvaćenim konceptom održivog razvoja, moguće je promatrati održivi razvoj gospodarskih subjekata kao pokušaj prilagodbe tog koncepta na korporativnoj razini, usklađivanjem ciljeva stvaranja vrijednosti s okolišnim i društvenim pitanjima. Drugim riječima, to je sposobnost organizacija da stvaraju i održavaju ekonomski uspjeh u kontekstu odgovornosti prema okruženju.

U skladu s postojećim trendovima možemo tvrditi da će korijen strategije i konkurentskih prednosti u godinama koje dolaze biti sposobnosti organizacija da svoje ekonomske aktivnosti provode na održiv način koji ne ugrožava okoliš i tako sebi dugoročno osiguravaju resursnu bazu potrebnu kako za kratkoročan, tako i za dugoročan uspjeh.

Znanstvenici su gotovo jedinstveni u stavu da su ljudski potencijali jedan od značajnijih izvora konkurentskih prednosti organizacija, te na takav način dolaze u samo srce strateškog usmjerenja organizacija. Na njima se temelji konkurentska prednost, a stvaranje vrijednosti i vrijednost gospodarskih subjekata rezultat su strateške upotrebe ljudskih potencijala.

2. Koncept održivog razvoja

Održivi razvoj postao je općeprihvaćena paradigma 21. stoljeća. Ekonomski rast, društvena jednakost i briga za održivim kapacitetom prirodnih sustava čine okosnicu te paradigme. Iako se svaki od ovih elemenata održivog razvoja odavno izučava zasebno, tek je 1992. godine na konferenciji Ujedinjenih naroda o okolišu i razvitku (engl. *United Nations Conference on Environment and Development* – UNCED) u Rio de Janeiru došlo do konsenzusa političara, nevladinih organizacija i poslovnih vođa kako se niti jedan od ta tri problema ne mogu riješiti bez uzimanja u obzir ostala dva (Keating, 1993.).

Od tada do danas koncept održivog razvoja razvijao se na različite načine. U praksi je istovremeno nailazio na podršku, kao i na cijeli niz problema koji ozbiljno dovode u pitanje njegov uspjeh na svjetskoj razini. Kao primjere možemo izdvojiti zastoj međunarodnih ugovora o bioraznolikosti i klimatskim promjenama, antiglobalizacijske proteste protiv slobodne trgovine koja je smatrana osnovnim alatom ekonomske održivosti i brojne druge. Ipak, mnoge su vlade inicirale programe nacionalne održivosti u različitim područjima djelovanja, slično kao i vlasti na lokalnim razinama. U rujnu 2015. godine, Ujedinjeni narodi donijeli su Program za održivi razvoj 2030. Programom je utvrđen globalni okvir u svrhu iskorjenjivanja siromaštva i postizanja održivog razvoja do 2030. Kao prvi globalni sporazum u povijesti kojim se utvrđuje univerzalni, sveobuhvatni program za djelovanje, Programom 2030. obuhvaćen je ambiciozan skup od 17 ciljeva održivog razvoja i 169 povezanih ciljeva, uz mobiliziranje svih zemalja i dionika da ostvare te ciljeve i utjecaje na nacionalne politike (Europska komisija, 2015).

Podizanje razine svijesti o važnosti problema održivog razvoja ključ je njegova uspjeha. Ta razina nikada nije bila viša, posebno potaknuta sasvim evidentnim svjetskim problemima održivosti. No, sama svijest o problemu nije dovoljna. Još uvijek nemamo dovoljno znanja o mogućim načinima rješavanja problema. U tom smislu znanost ima ključnu ulogu. Teorijski okvir značajno je evoluirao u navedenom razdoblju. Veliki broj znanstvenika ozbiljno je istraživao navedenu problematiku te su teorijski principi u značajnoj mjeri razvijeni i prilagođeni izmijenjenim svjetskim prilikama.

Koncept održivosti i iz njega izvedena sintagma održivi razvoj prvi put su službeno definirani u tzv. Brundtlandovom izvještaju koji je 1987. godine objavila Svjetska komisija o okolišu i razvoju (Brundtland, 1987.). U Brundtlandovom izvještaju održivi se razvoj definira kao proces koji zadovoljava potrebe sadašnjih generacija bez ugrožavanja mogućnosti budućih generacija da zadovolje svoje potrebe. „Tri stupa“ na kojima počiva ovako definiran održivi razvoj uključuju ekonomska, društvena i okolišna pitanja. Ovako široko definiran koncept omogućio je da svi njegovi elementi budu zastupljeni na jednak način i u jednakoj mjeri. U kratkom roku ti se elementi mogu promatrati zasebno, kao individualno ključni i hitni problemi, no kako bi se dostigao cilj održivosti u dugom roku, svi se moraju istovremeno uzimati u obzir. Štoviše, oni su duboko međusobno povezani i mogu utjecati i poticati jedan drugog.

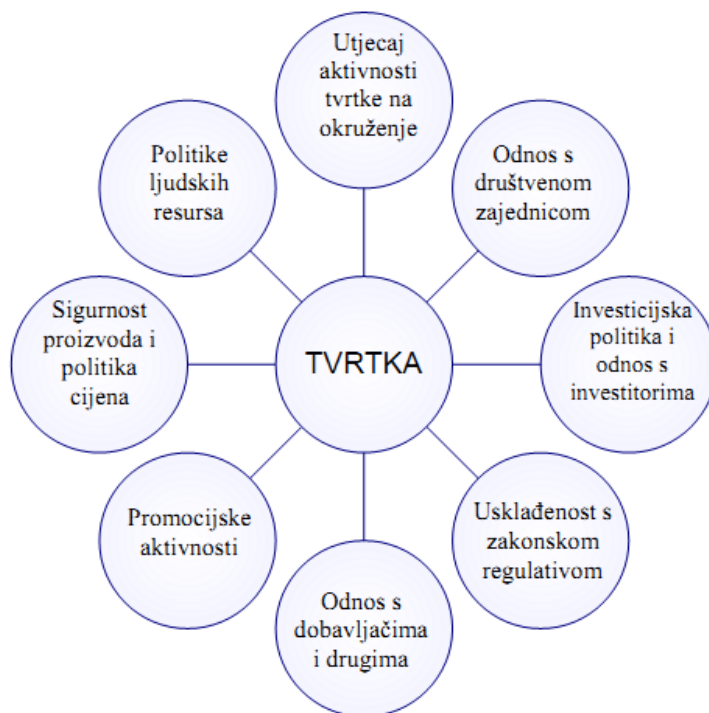
Tijekom vremena javile su se neke kritike ove definicije kako na teorijskoj, tako i na praktičnoj razini (Sneddon, 2006.). Kao posljedica tih kritika, tijekom godina pojavio se niz novih, više preskriptivnih definicija održivog razvoja. Vjerojatno jedna od najpopularnijih govori da je: „Održivost odnos između dinamičnih ljudskih ekonomskih sustava i većih, dinamičnih, ali uobičajeno sporije promjenjivih ekoloških sustava, u kojemu: 1) se opstanak

čovječanstva može beskonačno nastaviti, 2) ljudi mogu napredovati i 3) ljudska kultura se može razvijati; ali u kojemu učinak ljudskih aktivnosti ostaje unutar granica koje će omogućiti da se ne uništi raznolikost, složenost i djelovanje ekoloških sustava“ (Costanza, Daly & Bartholomew, 1991.).

2.1 Održivi razvoj gospodarskih subjekata

Uspjeh koncepta održivog razvoja posebno je vidljiv na razini gospodarskih subjekata gdje je opće prihvaćen kao temeljni preduvjet poslovanja (Holliday, 2001.). Mnogi od njih zapošljavaju posebne djelatnike koji se bave problemima održivog poslovanja, objavljuju godišnja izvješća o održivosti te uključuju održivi razvoj u svoje strategije, izjave o viziji i misiji. Mnogi gospodarski subjekti pokreću inovativne programe fokusirane na razvoj tzv. zelenih tehnologija (Hall & Vredenburg, 2003.) te usvajaju standarde očuvanja okoliša (ISO, 2005). Skupina osviještenih menadžera, nakon samita u Riu osnovala je Svjetski poslovni savjet za održivi razvoj (eng. *World Business Council for Sustainable Development – WBCSD*) s ciljem da olakšaju dijalog s političarima o mogućim načinima doseganja održivosti. Deset godina poslije savjet je brojao oko 150 međunarodnih kompanija, a danas je ta brojka višestruko uvećana te savjet ima predstavništva na svim kontinentima i ogranke u većini zemalja svijeta. Ipak, potrebno je naglasiti, da je većina aktivnosti gospodarskih subjekata u smislu održivog razvoja usmjerena isključivo na poboljšanje ekološke učinkovitosti poslovanja, dok su ostali elementi uvelike zanemareni. Iako je ekološka efikasnost vrijedan dio poslovnih strategija, kao samostalan koncept nije dovoljna (Welford, 1997.).

Od osamdesetih godina 20. stoljeća raste i interes za etičke standarde poslovnih subjekata, a kao odgovor na brojne skandale proizišle iz neetičkih ili neodgovornih akcija nekih kompanija. Rastu društveni i politički pritisci na tvrtke da se ponašaju etički u pogledu velikog broja pitanja od kojih su neka prikazana na slici 1.



Slika 1 Etički aspekti i pitanja društvene odgovornosti gospodarskih subjekata

U ovaj se trend uklopio i koncept održiva razvitka, potičući privredne subjekte da ozbiljno prihvate svoju odgovornost prema okruženju iz sljedećih razloga (Swarbrooke, 1999.):

- ako unište resurse na kojima njihovo poslovanje počiva, ugrozit će budućnost svojega poslovanja
- ako po svojoj želji to ne učine, zakonodavci će biti prisiljeni regulirati njihove aktivnosti
- imaju široku odgovornost prema društvenoj zajednici da se ponašaju kao dobri susjedi.

Kao posljedica, sve više privrednih subjekata pokušava svoje aktivnosti uskladiti s načelima održivog razvoja mjerama smanjivanja zagađenja i otpada, mjerama očuvanja energije, korištenjem recikliranih materijala te usmjerenim zapošljavanjem i osposobljavanjem ljudskih resursa. Na taj način i gospodarski subjekti dokazuju da u pogledu očuvanja okoline mogu biti rješenje problema, a ne njegov izvor. Za mnoge od njih, ovakvo ponašanje predstavlja dio sustavnog odnosa s javnošću, smatrajući etičko ponašanje jednim od mogućih izvora dugoročno održive konkurentske prednosti.

Znanost menadžmenta razvila je teorijski okvir koji podržava uključenje okolišnih i društvenih pitanja u praksu menadžmenta, a održivi razvoj gospodarskih subjekata prihvaćen je kao pozitivan doprinos globalnim problemima kao što su siromaštvo, društvena isključenost, poboljšanje uvjeta rada i negativni utjecaji na prirodni okoliš.

U skladu s opće prihvaćenim konceptom održivog razvoja, moguće je promatrati održivi razvoj gospodarskih subjekata kao pokušaj prilagodbe tog koncepta na korporativnoj razini, usklađivanjem ciljeva stvaranja vrijednosti s okolišnim i društvenim pitanjima. Drugim riječima, to je sposobnost organizacija da stvaraju i održavaju ekonomski uspjeh u kontekstu odgovornosti prema okruženju. Teorija i praksa menadžmenta dovela je do niza različitih definicija ovog pojma. Vrlo jednostavno, održivost gospodarskih subjekata može se definirati kao dugoročna sposobnost organizacije da stvara vrijednost proizvodnjom proizvoda i usluga (Pogutz. 2007). U tom kontekstu moguće je održivost organizacija promatrati i kao sposobnost kreiranja dugoročne održive konkurentske prednosti.

Prema Dow Jones-ovom indeksu održivosti, 'Korporativna održivost je pristup poslovanju koji stvara dugoročnu vrijednost vlasnicima iskorištavanjem prilika i upravljanjem rizicima koji nastaju promjenama u ekonomskoj, društvenoj i prirodnoj okolini'.

Još je jedan zanimljiv pristup koji konceptualizira održivost organizacija uključivanjem različitih oblika kapitala. Ovdje se govori da je korporativna održivost 'sposobnost organizacije da beskonačno nastavlja svoje aktivnosti, vodeći računa o utjecaju na prirodni, društveni i ljudski kapital' (AccountAbility. 1999). Ovdje se utvrđuju tri temeljna oblika kapitala: ekonomski, prirodni i društveni, a održivo poslovanje je ono koje osigurava u dugom roku postojanje svih oblika kapitala u dovoljnim količinama i strukturi. Unutar ovog pristupa, u teoriji također postoje razilaženja u mišljenjima. Postoji naime skupina autora koji smatraju da je moguće nedostatak jednog oblika kapitala zamijeniti nekim drugim oblikom (kao primjer navode se brojni slučajevi supstitucije oskudnih prirodnih resursa umjetno proizvedenim nadomjescima). Drugi pristup tvrdi kako ne postoje supstituti za sve oblike (posebno prirodnog) kapitala te se takvi oblici kapitala moraju sačuvati netaknutima neovisno o drugim oblicima (samo jedan od primjera je uloga šuma i njen utjecaj na sve ostale oblike kapitala).

Tijekom godina javio se i skepticizam u odnosu neodređenost i nejasnoću pojma održivog razvoja čime se dovodi u pitanje i mogućnost njegove primjene i praćenja u poslovanju. Kao odgovor na te kritike društveno odgovorno poslovanje formalizirano je kao koncept koji uključuje ekonomska, pravna, etička i filantropska očekivanja koje je društvo stavilo pred organizacije u određenom vremenskom trenutku (Carroll & Buchholtz. 2003). Drugim riječima, organizacije pored svoje temeljne i pravne odgovornosti (tj. cilja ostvarenja profitabilnosti i pridržavanja zakona) imaju i druga očekivanja koje je pred njih stavilo

društvo. Ta očekivanja odnose se na dobrovoljan doprinos zajednici u kojoj posluju u smislu odgovaranja na društvene norme i druge oblike odgovornog poslovanja.

Slično je i s tzv. stakeholder pristupom teoriji, koji govori da organizacije nemaju odgovornost samo prema vlasnicima, već i prema svim ostalim dionicima svog poslovanja. Ovaj pristup razvio je teorijsku osnovu istraživanjem normativnih, instrumentalnih i deskriptivnih aspekata teorije.

Posljednjih godina koncept održivog razvoja gospodarskih subjekata razvijen je u još nekoliko različitih pravaca ili pristupa, te je stvoren okvir unutar teorije menadžmenta kojim se istražuju odnosi između poslovanja i društva. Na tim temeljima razvijene su definicije koje ćemo na ovom mjestu objediniti kroz onu koju je Europska Unija institucionalizirala svojim Okvirom za društveno odgovorno poslovanje, gdje stoji da je to koncept kojim kompanije integriraju društvena i okolišna pitanja u svoje poslovanje te u interakciji s njihovim dionicima, na dobrovoljnoj bazi (CEC. 2001).

2.2 Strateški pristup održivom poslovanju

Održiva konkurentska prednost je primarni zadatak strateškog djelovanja organizacija prema različitim teorijskim pristupima strateškom menadžmentu: strukturalističkom pristupu, resursnom pristupu, pristupu temeljenom na dinamičkim sposobnostima i mnogim drugima. Perspektiva održivog razvoja dovodi u pitanje da li konkurentska prednost može biti održana tijekom dugog vremenskog perioda. Mnogi autori prihvatili su Porterovo mišljenje prema kojemu su glavni neprijatelji održivosti, pa prema tome i strateškog djelovanja usmjerenost na kratki rok i fokus na uzak prostor djelovanja organizacija. Do promjene paradigme došlo je uslijed promjena okruženja koje su se posebno manifestirale posljednjih godina tijekom izraženo dugog perioda globalne recesije. Istraživanja su pokazala da četiri od pet istraženih organizacija svjesno žrtvuju dugoročno stvaranje vrijednosti kako bi u kratkom roku ostvarili zadane profitne ciljeve (Graham i dr. 2005).

Usmjerenost na kratki rok je način donošenja odluka i operativnog djelovanja organizacija koji je u kratkom roku optimalan, ali pri tom u dugom roku ostvaruje rezultate ispod razine optimalnih. Ovakav način razmišljanja i djelovanja posebno je izražen u uvjetima neizvjesnosti i nesigurnosti, kada zahtjevi za sadašnjim koristima znatno nadmašuju one za budućim. Usmjerenost na kratki rok dovodi do suboptimalnih rezultata kako za organizacije tako i za društvo u cjelini. Strateški pristup poslovanju, jednako kao i pristup održivosti pokušavaju naći ravnotežu između kratkoročnih i dugoročnih koristi. Iako postoje autori u području strateškog menadžmenta koji naglašavaju kratkoročni pristup donošenju odluka, brojni su mišljenja da to može biti potencijalno opasno za budućnost organizacija te da strategije moraju uključivati održivost kako u teorijskom tako i u praktičnom smislu.

Veza između strateškog pristupa poslovanju i pristupa temeljenog na principa održivosti možda je najbolje vidljiva analizom resursnog pristupa. Sam termin 'resursi' u svom sadržajnom smislu može označavati niz različitih koncepata ovisno o teorijskom okviru unutar kojega se promatra (biologija, ekologija, ekonomija ili sociologija).

Unutar koncepta održivog razvoja resursi se promatraju kao sredstva dostupna za razvoj čovječanstva, te uključuju prirodne resurse (prirodni kapital i njegovi izvori), ekonomske resurse (različite oblike ekonomskog kapitala, primjerice financijski, materijalni...) te ljudske resurse (ljudski kapital predstavlja različita znanja, vještine, sposobnosti i iskustvo zaposlenih kojima se oni koriste u poslovnom procesu, te se u kontekstu intelektualnog kapitala javlja zajedno s organizacijskim kapitalom i kapitalom odnosa s klijentima). Prirodni resursi se razlikuju od ostalih što ih čini nezamjenjivima. Često se klasificiraju kao obnovljivi i neobnovljivi prema njihovoj sposobnosti regeneriranja i beskonačnog korištenja. Kada se resursi koriste brže nego što se nadomještaju, odnosno obnavljaju, zalihe se troše i s

vremenom nestaju. Ključ teorije održivog razvoja je upravo u ravnoteži trošenja i obnavljanja resursa.

Znanost menadžmenta promatra resurse na nešto drugačiji način. Resursna teorija je danas najutjecajniji teorijski okvir u znanosti menadžmenta koja pokušava objasniti kako razlike u resursima poduzeća mogu stvoriti konkurentsku prednost. Dvije temeljne pretpostavke ove teorije su: heterogenost resursa (različita poduzeća imaju različite resurse i sposobnosti iz čega proizlazi i njihov različit uspjeh unutar industrije) i njihova imobilnost (razlike u resursima mogu dugo potrajati zbog neprenosivosti i rijetkosti pojedinih resursa ili poteškoća njihova pribavljanja ili imitiranja). Dakle, resursi samo po sebi nisu dovoljni. Oni ne stvaraju vrijednost već su povezani sa sposobnostima organizacija u njihovoj efikasnoj uporabi u dobro osmišljenoj i provedenoj strategiji. Te sposobnosti uključuju sposobnost menadžmenta, organizacijske procese i postupke, organizacijsko znanje i informacije, te znanje, sposobnosti i razinu motiviranosti djelatnika.

Jasno je da nedostatak prirodnih resursa može predstavljati ozbiljno ograničenje i za buduće poslovanje organizacija. Čini se neminovnim da će tržišta i gospodarski subjekti u budućnosti biti visoko ovisni o ekosustavu (prirodi). Drugim riječima, vjerojatno je da će korijen strategije i konkurentskih prednosti u godinama koje dolaze biti sposobnosti organizacija da svoje ekonomske aktivnosti provode na održiv način koji ne ugrožava okoliš (Hart. 1995, 2003).

3. Značaj strateškog upravljanja ljudskim potencijalima za ostvarenje dugoročne održivosti poslovnih organizacija

Sve je veći broj autora koji smatraju da je u suvremenom svijetu glavno sredstvo, a po nekima i jedino održivo sredstvo postizanja dugoročne organizacijske konkurentnosti ili konkurentске prednosti upravo značajno unaprjeđenje aktivnosti upravljanja ljudskim resursima. Kao što Pfeffer (1994., str. 6) navodi: 'Tradicionalni izvori uspjeha – proizvodna i procesna tehnologija, zaštićena ili regulirana tržišta, dostupnost financijskih resursa i ekonomija obujma – još uvijek mogu osigurati povećanje konkurentnosti, ali danas u manjoj mjeri nego u prošlosti, dok su organizacijska kultura i sposobnosti, kao rezultat upravljanja ljudskim potencijalima od relativno većeg značaja.' Pitanje danas više nije što neka organizacija posjeduje, već što ona zna i može učiniti. Inteliktualni kapital danas stvara gotovo 80% ekonomske vrijednosti. Na njemu se temelji konkurentska prednost a stvaranje vrijednosti i vrijednost gospodarskih subjekata rezultat su strateške upotrebe ljudskih potencijala.

Za razliku od tradicionalnih teorija poduzeća u kojima su dominantni resursi bili materijalni: kapital (zemlja, tvornice i oprema), fizički rad (manualnih radnika) i financijski kapital (novac), poslovanje suvremenih organizacija većinom se bazira na neopipljivoj imovini. Dodana vrijednost koju subjekti u poslovnom procesu danas stvaraju proizlazi prvenstveno iz znanja, sposobnosti i vještina ljudi koji su zaposleni u organizaciji ili s njom surađuju kao poslovni partneri ili vanjski suradnici. Kapitalna imovina danas potrebna za kreiranje bogatstva nije više zemlja, niti fizički rad, strojevi, alati ili tvornice – umjesto njih to je intelektualna imovina, odnosno intelektualni kapital.

Ljudskim se potencijalima daje sve veće značenje zbog toga što će oni u budućnosti biti odlučujuća konkurentska snaga. To se može uočiti i u promjenama u terminologiji: pojmovi kadrovi, radnici i radna snaga zamjenjuju se pojmovima suradnici, ljudski resursi, ljudski potencijal i ljudski kapital. Zamjena pojmova nije formalnog karaktera, već ona proizlazi iz shvaćanja važnosti čovjeka i njegova potencijala kao nositelja poslovnog uspjeha i razvoja (Avelini Holjevac. 1998).

Dakle, upravljanje ljudskim potencijalima postaje ne samo najznačajnija poslovna funkcija, nego i specifična filozofija i pristup upravljanju koja ljude smatra najvažnijim potencijalom te

ključnom strategijskom i konkurentskom prednošću. Strateški menadžment ljudskih potencijala definira namjere organizacije o tome kako svoje poslovne ciljeve postići ljudima (Bahtijarević Šiber. 1998).

Kao posljedica svega navedenog, a posebno temeljeno na principima resursnog pristupa strateškom menadžmentu, koncepcija strateškog menadžmenta povezana je s klasičnom koncepcijom menadžmenta ljudskih potencijala unutar nove razvojne faze u razvoju upravljanja ljudskim potencijalima – strateškog menadžmenta ljudskih potencijala (SMLJP). Strateška uloga menadžmenta ljudskih potencijala u organizaciji podrazumijeva integriranje ljudskog čimbenika sa strateškim poslovnim ciljevima radi stvaranja nove vrijednosti i unaprjeđenja konkurentске prednosti organizacije.

Resursni se pristup temelji na uvjerenju da se konkurentska prednost osigurava ako organizacija može dobiti i razviti ljudske potencijale koji omogućuju da uči brže i primjenjuje naučeno djelotvornije nego njezini konkurenti. Ulaganje u ljudske potencijale povećava organizacijsku vrijednost budući ljudski kapital posjeduje najveći potencijal za to da bude izvor održive konkurentске prednosti, odnosno održivog strateškog uspjeha. Ljudski potencijali su strateški vrijedni kao mogući izvor konkurentске prednosti budući posjeduju posebne osobine koje ih čine vrijednima, rijetkima, teškim za imitirati, dinamičnim, itd.

Sve do sada navedeno dovodi do pitanja kako organizacije upravljaju svojim najvrjednijim resursom te što treba učiniti kako bi se dugoročno održala ta resursna baza. Mnoge organizacije u svojim izvješćima naglašavaju predanost održivom načinu poslovanja, iako uvijek nije sasvim jasno da li je to njihovo stvarno opredjeljenje ili samo jedna od izjava usmjerena na dobre odnose s javnošću. Čak i među onima čije je održivi razvoj stvarno opredjeljenje, veliki je broj organizacija koje su usmjerene isključivo na prirodni kapital, odnosno na očuvanje okoliša. Rijetke se one koje imaju odgovore na pitanja što to znači upravljati ljudskim potencijalima na održiv način.

Ozbiljno prihvaćajući održivost ili održivi razvoj kao svoju strategiju organizacije direktno utječu i na svoju buduću praksu upravljanja ljudskim potencijalima, odnosno svoj SMLJP (Cohen i dr. 2012). Rezultati istraživanja pokazali su da mnoge organizacije značaj održivosti za SMLJP vide kao način ostvarivanja jednog ili više navedenih ciljeva (Ehnert, 2009):

- privlačenje i zadržavanje talenata, stvarajući imidž poželjnog poslodavca,
- briga za zdravlje i sigurnost zaposlenih,
- investiranje u znanja i vještine zaposlenih na dugoročnim temeljima razvijanjem ključnih kompetencija i cjeloživotnog učenja,
- podrška zaposlenima u stvaranju ravnoteže između poslovnog i privatnog života ili poslovnog života i obitelji,
- stvaranje povjerenja zaposlenih i dobrih interpersonalnih odnosa,
- društveno odgovorno poslovanje prema zaposlenima i sredini u kojoj posluju,
- ostvarivanje visoke razine kvalitete života za zaposlene i zajednicu u cjelini.

Dokazi o povezanosti održivog razvoja i SMLJR dolaze i od strane konzultantskih kuća. Njihova izvješća govore kako će buduće organizacije koje želi privući talente morati imati snažan fokus na održivi razvoj, zeleni menadžment i društvenu odgovornost. Iako sve organizacije neće postati održive, biti će sve veći broj onih čije će strateško opredjeljenje postati održivi razvoj. Naglašavajući značaj upravljanja ljudskim potencijalima konzultantske kuće preporučuju povezivanje kvalitetne i transparentne strategije održivog razvoja s adekvatnom praksom upravljanja ljudskim potencijalima.

Povezujući sve ove koncepte u teoriji se u posljednje vrijeme sve više počeo prihvaćati i termin 'održivo upravljanje ljudskim potencijalima' koji se tumači kao sve ono što

organizacije trebaju raditi kako bi osigurale dugoročno pribavljanje talentiranih, vještih i motiviranih ljudi (Ehnert, 2009). Radi se dakle o dugoročno orijentiranom pristupu i aktivnostima usmjerenim na društveno odgovorno i ekonomski prihvatljivo privlačenje i odabir, razvijanje, usmjeravanje i održavanje učinkovite radne snage.

Moguće je zaključiti da je strateški uspjeh neminovno vezan uz dugoročno održivi razvoj, a jedan od temeljnih preduvjeta je ostvarivanje sklada sa strateškim upravljanjem ljudskim potencijalima kojim će se osigurati nužno potrebna resursna baza za stvaranje izvora dugoročno održive konkurentske prednosti.

4. Zaključak

Promjena je temeljna značajka suvremenog svijeta. Za ostvarivanje poslovnog uspjeha organizacije trebaju aktivno odgovarati na te promjene, znajući kako iskoristiti prilike i suzbiti prijetnje koje dolaze iz tako dinamične, heterogene i neizvjesne okoline. Strateški pristup upravljanju poslovnim organizacijama čini upravo to – pokušava osigurati dugoročan uspjeh organizacija usklađujući njihovo djelovanje s uvjetima okoline u kojoj posluju, pokušavajući osigurati dugoročno održivu konkurentsku prednost.

Temeljni doprinos koncepta održivog razvoja je u prepoznavanju međusobnog utjecaja koji prirodno, društveno i ekonomsko okruženje imaju jedno na drugo. Ukoliko želimo osigurati zadovoljenje potreba kako sadašnjih generacija, tako i onih budućih neminovno moramo prihvatiti održivi razvoj kao način promišljanja prilikom donošenja odluka. Kratkoročni pristup donošenju odluka kojemu je većina privrednih subjekata danas sklona ima cijeli niz negativnih posljedica na njihovo buduće djelovanje.

Brojna istraživanja pokazuju kako su značajan izvor dugoročne održivosti, na nacionalnoj razini kao i na razini poslovnih subjekata, upravo ljudski potencijali, odnosno ljudski kapital. Ljudski potencijali su također jedan od značajnih izvora dugoročno održive konkurentske prednosti. Svojim specifičnostima osiguravaju ključne sposobnosti koje su dugoročne i teške za imitirati. U tom smislu potrebno je uskladiti strateško djelovanje organizacija s njihovim praksama upravljanja ljudskim potencijalima kako bi se u dugom roku osiguralo ostvarivanje strateških ciljeva.

Na taj način strateški menadžment ljudskih potencijala, kroz prizmu strategije, postaje jedan od temeljnih preduvjeta ostvarenja dugoročne održivosti gospodarskih subjekata.

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The importance of Strategic Human Resource Management for long term sustainability of business organisations

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Abstract. Strategic human resources management includes acceptance of human resources management practices and systems that help business organisations gain their vision and strategic goals, simultaneously ensuring their competitive advantage. As the essence of the long-term

competitive advantage lies in its sustainability, this issue also relates to the concept of sustainable development. Corporate sustainable development is defined in various ways and includes economic, environmental, and societal dimension. Numerous studies have shown that human resources or human capital are a very important source of long-term sustainability, both on a corporate level as well as at the national level. In this paper, through the analysis of previous studies, we point out the importance of strategic human resource management for the long-term business sustainability.

Key words: *sustainable development, Strategic Human Resources Management, social responsibility*

Primjena načela space managementa u prodajnoj praksi

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Sažetak. Space management predstavlja dio *category managementa* koji se bavi upravljanjem kategorijama proizvoda kao poslovnih jedinica s jasnim ciljevima. Ciljevi su implementirati i postaviti strukturirane procese za upravljanje kategorijama proizvoda unutar zadane strategije poduzeća. Trgovine sa suvremenim konceptom poslovanja nastoje prilagoditi svoj prodajni prostor potrebama kupaca u cilju njegove što veće funkcionalnosti. Pravilnim pozicioniranjem proizvoda unutar trgovine osigurava se bolji poslovni rezultat i lakše snalaženje kupaca unutar prodajnog prostora. Osnovni način implementacije space managementa u praksi je definiranje asortimana proizvoda, izgleda prodajnog prostora, rasporeda polica unutar prodajnog prostora te raspored proizvoda na policama s ciljem privlačenja pažnje kupaca. Sam način izlaganja proizvoda ima veliki utjecaj na odluku o kupnji. Ako želi ispuniti svoje ciljeve, trgovac mora učinkovito provoditi strategiju za odabranu kategoriju proizvoda. To znači određeno taktiziranje s pozicioniranjem kategorije na polici, dodatna izlaganja, promociju cijene itd. U radu je provedeno istraživanje u prodajnim prostorima s ciljem uvida koliko se u praksi implementiraju načela space managementa.

Ključne riječi: *space management, category management, kategorije proizvoda, prodajni prostor, pozicioniranje proizvoda*

1. Uvod

Lokacija, ponuda, unutarnje uređenje prostora, cjenovna politika, mjerenja i planiranje bitni su čimbenici prodajnog poslovanja poduzeća, stoga je važno uspostaviti sistem specijaliziran za upravljanje i kontrolu tih čimbenika. Space management (upravljanje prostorom) dio je *category managementa* čija je osnovna vizija dobro opremljen i funkcionalan prodajni prostor uređen suvremenim dizajnerskim karakteristikama što u konačnici rezultira privlačenjem pažnje kupaca i povećanjem prodaje.

Sam način izlaganja proizvoda ima veliki utjecaj na odluku o kupnji što znači da trgovci moraju učinkovito provoditi strategiju za odabrane kategorije proizvoda i taktizirati s pozicioniranjem proizvoda i kategorija na polici, dodatna izlaganja, promociju cijene itd.

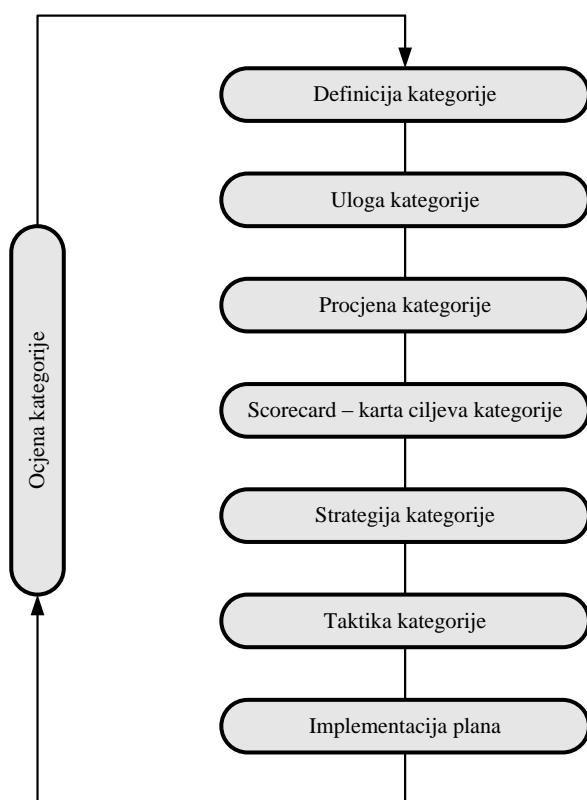
Kao primjeri poduzeća pomoću kojih će se prikazati implementacija space managementa u prodajnoj praksi u radu se analiziraju: Plodine, Takko Fashion, Kaufland, Dm - drogerie markt.

2. Pojam space managementa

Space management (upravljanje prostorom) predstavlja važan segment *category managementa*. Budući da su mnoga istraživanja pokazala da je preko 60 % kupovine tzv.

impulzivna kupovina, uloga space managementa utjecati je svojom poslovnom politikom na odluke kupca. Space management ima za cilj funkcionalno uređenje prodajnog mjesta, optimizaciju zaliha i kao posljedicu maksimiziranje profita.

Category management razvio se na maloprodajnim tržištima krajem osamdesetih godina prošlog stoljeća kao posljedica razvoja tržišta prodaje. *Category* management sastoji se od poslovnih procesa: razvoja i praćenja poslovnih planova za određene kategorije proizvoda. Osnova svega je definiranje proizvoda koji čine određene kategorije i dodjeljivanje uloge kategoriji. Nadalje, potrebno je razraditi potencijalne mogućnosti prodaje i razviti strategiju potražnje. Slijedi određivanje cijena, promocije proizvoda, odgovarajući razmještaj u poslovnom prostoru i na policama te kao rezultat svega pratiti prodajne rezultate određene kategorije proizvoda.



Slika 1. Poslovni proces Category managementa (Izvor: Muller, Singh, 2006: Category Management, Zagreb: Internacionalni centar za profesionalnu edukaciju., str. 196.)

Glavni zadaci *category* managementa su (Segetlija, 2006.; 324.):

- optimiziranje asortimana
- optimiziranje polica
- planiranje i kontrola akcijskih prodaja
- izravna rentabilnost proizvoda
- analiza potrošačke košare.

Kao glavna ograničenja prilikom djelovanja *category* managementa nameću se (Muller, Singh, 2006.): organizacija, ljudi, informacijski sustavi, oslanjanje na proizvođače, nedostatak kreativnosti, vrlo ograničeno poznavanje potrošača, nedostatak znanja o pokretačima kategorije i loša izvedba.

Primjena *category* managementa ima osam koraka (Basuroy, 2001.):

- definiranje kategorije

- uloga kategorije gdje se analiziraju navike kupca
- procjenjivanje kategorije
- strategije kategorije
- taktike kategorije
- implementacija plana
- praćenje rezultata.

Space management ima zadatak: definirati kategorije proizvoda, organizirati bazu podataka o proizvodima i njihovoj prodaji (u kojoj količini i kad), kreirati police, uočiti mogućnosti za bolju prodaju te izradu planograma, tj. novo pozicioniranje proizvoda unutar prodajnog prostora. Kao krajnji cilj space managementa nameće se detaljna analiza novonastalih prodajnih količina, tj. koji proizvodi su najviše prodani, koji proizvodi su najmanje prodani, na kojem mjestu su se nalazili, u koje vrijeme su kupljeni itd.

Svi naponi za ostvarivanje postavljenih ciljeva bit će usmjereni na zadovoljavanje potreba kupaca tako da se postigne konkurentska prednost u odnosu na konkurenciju. Poduzeće može kreirati svoju konkurentsku prednost na strani ponude - gdje poduzeće mora biti svjesno svojih resursa i sposobnosti kroz koje može kreirati svoju jedinstvenost i na strani potražnje - gdje je ključ uspjeha razumijevanje želja i potreba kupaca. U oblikovanju i provedbi strategije diferencijacije potrebno je:

- odrediti tko je stvarni kupac
- odrediti lanac vrijednosti kupca i utjecaj poduzeća na njega
- odrediti kriterije kupnje i njihove rangove
- procijeniti postojeće i potencijalne izvore jedinstvenosti u lancu vrijednosti poduzeća
- identificirati troškove postojećih i potencijalnih izvora diferencijacije
- odabrati konfiguraciju vrijednosnih aktivnosti koja stvara „najvrjedniju“ diferencijaciju za kupca u odnosu na troškove diferencijacije
- provjeriti i testirati održivost diferencijacije i smanjiti troškove u aktivnostima koje utječu na izabrani oblik diferencijacije (Muller, Singh, 2006.).

3. Učinkovito upravljanje prostorom u trgovini

Vanjskim i unutarnjim uređenjem prodavaonice može se stvoriti takva prodajna atmosfera koja će kupca privući, omogućiti mu da kupuje sa zadovoljstvom, motivirati ga da ostane duže, potroši više novca nego što je to prethodno namjeravao, i što je najvažnije, da se u prodavaonicu opet vrati (Mihić, 2006.; 920.).

Trgovine s modernom koncepcijom poslovanja sve veću pažnju pridodaju izgledu prodajnog prostora i izlaganju proizvoda. Neke trgovine i trgovački centri postali su zbog toga i prave turističke destinacije npr. Harrods u Londonu, Laffayet u Parizu, The Mall at Bay Plaza u New Yorku. S obzirom na postojanje većeg broja trgovačkih centara u svjetskim metropolama, teži se individualnosti koja će osiguravati prepoznatljivost što će u konačnici rezultirati povećanjem broja kupaca i povećanjem prihoda.

Osnovni elementi stvaranja atmosfere u prodajnom prostoru su: rasvjeta, glazba, mirisi i uređenje. Svojstva rasvjete kojima se stvara ugođaj su koloritet i osvjetljenje. Miris kod kupca stvara osjećaj elegancije i kupci rado ulaze u trgovine privučeni mirisom. Glazba sporijeg tempa usporava kretanje kupca kroz prodajni prostor, a istraživanja su pokazala kako trgovine sa sporijim tempom glazbe ostvaruju najbolje efekte u prodaji. Izbor glazbe u trgovini mora se prilagoditi segmentu kupaca koji u njoj kupuje i brendu koji prodaje. Boje imaju posebnu ulogu u uređenju izloga i prodajnih prostora; tople boje su pogodne za uređenje izloga u

impulzivnoj kupovini, a hladne boje se koriste u slučajevima duljeg zadržavanja kupaca na jednom mjestu (Muller, Singh, 2006.).

Sama boja, sklad boja i kombinacije boja su bitni za izazivanje i skretanje pažnje potrošača na prodavaonicu ili određeni proizvod. Isto tako boja potpomaže nastajanju odgovarajućih pozitivnih asocijacija kod kupaca pri stvaranju njihove odluke o kupnji. Tako na primjer, crvena i žuta boja mogu pojačati osjećaj za apetit i dobro ih je kombinirati u prodavaonicama hrane (Gutić, Barbir, 2009.; 379.).

Prodavaonica mora biti tako dizajnirana da olakša kretanje kupaca, omogućiti prezentiranje proizvoda i stvoriti ugođaj procesa kupovine na mjestu prodaje. Izgled prodavaonice utječe na opće raspoloženje kupca i povećava opseg kupovine. Postavljanje izložbenih policama i tok kretanja kroz prodavaonicu mogu znatno povećati prodaju. Prostor koji je namijenjen pojedinim proizvodima na policama te mikrolokacija proizvoda na polici također povećava ili umanjuje obim prodaje. Gdje su smješteni proizvodi za djecu, žene, muškarce? Gdje su smješteni proizvodi u okviru makrolokacije – da li na frekventnim putevima prolaska ili na rijetko posjećenim mjestima? (Kesić, 2006.; 129.)

Neka od pravila uređenja prodajnih prostora su (Muller, Singh, 2006.):

- hodnici kojima hodaju kupci moraju biti dovoljno široki
- trgovinu organizirati u smjeru kretanja desno, radi urođenog nagona prema kretanju tijela u desno
- u prodajnom prostoru stvoriti nekoliko fokusnih točaka, kako bi se kupca navelo da prođe cijelom trgovinom
- stvoriti zanimljive kutke u kojima se mogu ponuditi sezonski ili prigodni proizvodi
- odjele formirati u skladu s potrebama kupaca, tzv. tematski odjeli
- ne stavljati previše natpisa i plakata s natpisom akcija jer kupci gube povjerenje u istinitost
- na ulazu u hipermarkete postavlja se odjel voća, povrća i cvijeća radi dojma svježeg
- proizvodi ciljane kupovine (kruh, mlijeko, meso) smješteni su na kraju hipermarketa kako bi kupac prošao veći dio trgovine da bi došao do njih
- najprodavanije proizvode postaviti u sredinu odjela kako bi kupci prošli i pored ostalih proizvoda kako bi došli do traženog proizvoda
- organizacija police prema težini; veći i glomazniji proizvodi pozicioniraju se na dnu police, a manji i lakši na vrhu
- proizvode za djecu pozicionirati niže kako bi ih djeca uočila
- proizvode na promociji postaviti u visini očiju
- dizajn etikete za cijenu mora biti jednostavan
- oko blagajne pozicionirati proizvode impulzivne kupovine.

Uređenost pojedinih odjela u prodavaonici, širina prolaza, općenito prolaznost ili zakrčenost (zatrpanost) prolaza, grupiranje proizvoda po vrstama i namjenama, pozicija proizvoda na policama, natrpanost robe itd. mogu biti bitni elementi u privlačenju i odvlačenju pažnje kod kupaca (Gutić, Barbir, 2009.; 381.).

Vrlo je važno proizvodima koji su najprodavaniji unutar svoje kategorije dati i najveći prostor, ali i najbolju poziciju što se može vidjeti na slici 2. Najprodavanije proizvode potrebno je pozicionirati u području vidokruga potencijalnog kupca u njihovoj razini očiju.

Temeljni cilj planiranja prostora u trgovini je uskladiti opseg pojedine kategorije proizvoda, prodajni asortiman, prostor namijenjen pojedinom artiklu, lokaciju na polici, broj artikala na polici s podacima o prodaji proizvoda. S obzirom na neprestani razvoj informacijske tehnologije, postoje softverska rješenja pomoću kojih se bez premještanja proizvoda može jednostavnije uskladiti prodajni prostor, smještaj proizvoda unutar njega i potencijalna

MORAM SE ISTEGNUTI 5th

VIDIM 4th

MOGU DOHVATITI 3rd

MORAM SE SAGNUTI 2nd

VEĆA PAKIRANJA 1st

34%

78%

http://web.efzg.hr/dok/OIM/OIMprester_MP_Space%20management%20%20Apollo%20software.pdf)

Na temelju rezultata istraživanja o segmentaciji kupaca u supermarketima na osnovi njihova zadovoljstva prodajnim osobljem (Mihić, 2006.; 932.) i njihovog zadovoljstva pojedinim faktorima izdvojenima na osnovi stavova o ponašanju i izgledu prodajnog osoblja i na osnovi uređenja prodajnog mjesta, vlasnicima analiziranih supermarketa i njihovom prodajnom osoblju sugerira se sljedeće:

- Uređenje prostora prodavaonica u cjelini ima značajne efekte na ponašanje potrošača. Ovi se efekti mogu sumirati u sljedećem (Markin et al. 1976.):

- prostor modificira i oblikuje ponašanje potrošača
- prostorni aspekt prodavaonice utječe na potrošača posredstvom osjetila
- maloprodajne prodavaonice slično kao i ostali stimulansi utječe na potrošača posredstvom percepcije, stavova i imidža
- prodavaonice projiciranim dizajnom mogu izazvati kao i ostali stimulansi u procesu komunikacije željene reakcije potrošača.

Pojedinci dolaze u prodavaonicu (prodajni centar) često iz drugih razloga pored kupovnih. To su fizičke aktivnosti, društveni kontakti ili poticanje osjetila kao što su užitak, zadovoljstvo, odmor i sl. Prodajni centar je najbolji primjer za to. Stoga prodavaonica treba svoj imidž uskladiti s imidžom cjelokupnog centra, a sve zajedno uskladiti sa stilom života ciljnog segmenta kojemu je kupovni centar usmjeren (Kesić, 2006.; 130.).

4. Implementacija načela space managementa u odabranim trgovinskim poduzećima

4.1. Hipermarketi Plodine

Plodine d.d. posjeduju 75 prodajnih centara u svim većim gradovima u Republici Hrvatskoj, sa sjedištem i upravom u Rijeci. Plodine stoga imaju značajnu ulogu na tržištu prodaje hipermarketa. Što se tiče uređenja prodajnih prostora, u svim centrima jednaka je kategorija proizvoda, iako prema teritorijalnom načelu poslovanja različiti asortiman sukladno potrebama kupaca na određenom području ima drugačiju poziciju i ulogu. Na ulazu u prodajni prostor nalazi se odjel voća, povrća i cvijeća, a smjer kretanja je u desno. Glazba je sporijeg tempa i odgovara segmentu kupaca koji kupuju u Plodinama. Proizvodi široke potrošnje (brašno, šećer, pelene ...) u pravilu se nalaze uvijek na istom mjestu. Proizvodi namjenske kupovine (brašno, mlijeko, meso ...) nalaze se na kraju trgovine, a neki proizvodi impulzivne kupovine nalaze se oko blagajne. Proizvodi na akciji nalaze se u centralnom dijelu prodajnog prostora jer je tamo najveća koncentracija kupaca.

4.2. Takko Fashion

Takko je s 1 900 poslovnica zastupljen u 16 europskih zemalja te u Rusiji. 17 000 djelatnika u prodaji, odjelu logistike i središnjici u Telgteu, nedaleko od atraktivne vestfalske metropole Münster, brine o željama kupaca. Takkov kupac je obiteljska žena koja uživa u svom aktivnom životu između posla i obitelji (Takko, 2016.).

Sve Takkove trgovine su četvrtastog oblika, veličine do 400 m². Ulaz se nalazi na sredini trgovine, a unutrašnjost prodajnog prostora podijeljena je na ženski, muški i dječji odjel s pododjelima. Svaki od ovih odjela ima svoju stražnju stijenu ispred koje se nalaze tematski stalci kojima su odjeli odvojeni. Trgovine Takka su svijetle i jasno strukturirane. U trgovinama se koristi LED rasvjetni sustav. Prevladavaju svijetlo siva i krem nijansa boje. Budući da su žene najveći segment kupaca, smjer kretanja u desno namijenjen je ženskom odjelu. Na ženskom odjelu nalazi se i stol namijenjen izlaganju proizvoda povoljnih cijena i proizvoda na akciji. Odjeća je pozicionirana na stalcima, vješalicama i stepenastim stolovima što poboljšava dinamiku u pozicioniranju proizvoda. Na tematskim stalcima pozicioniraju se proizvodi zadane teme i povoljnih cijena. Cijene su jasno istaknute, a ispred blagajne nalaze se proizvodi namijenjeni impulzivnoj trgovini npr. čarape.

4.3. Kaufland k.d.

Kaufland grupacija osnovana je u Njemačkoj, gdje su i danas među vodećim trgovinama prehrambenih proizvoda i robe široke potrošnje. 2001. godine Kaufland je otvorio svoju prvu poslovnicu u Hrvatskoj. Poslovnice Kauflanda postoje i u Češkoj, Slovačkoj, Poljskoj,

Rumunjskoj te Bugarskoj. Ponuda Kauflanda sastoji se od 20 000 proizvoda (Kaufland, 2016.).

Ponuda proizvoda u Kauflandu proteže se od vlastitih robnih marki do poznatih brendova. Svi Kaufland centri su sličnog oblika i identično uređeni kako bi se postigla standardiziranost. Prodajni centri dobro su osvijetljeni, s glazbom koja odgovara širem segmentu kupaca. Unutarnje elemente prostora čine police s proizvodima, rashladne vitrine, hladnjaci, police s kruhom i odjel s mesom. Kretanje kupaca i položaj odjela navodi na desno. Kupci imaju prostora za kretanje i razgledavanje. Na ulazu u trgovinu nalazi se odjel voća i povrća. Proizvodi planske kupovine (kruh, mlijeko, meso) nalaze se na kraju trgovine. Novi proizvodi i proizvodi na akciji pozicioniraju se na privremenim mjestima izlaganja kao što su promotivni štandovi. Proizvodi koji su na akciji pozicionirani su u sredini prodajnog prostora, na posebnim policama. Sezonski proizvodi su dodatno istaknuti, a oko blagajne nalaze se proizvodi impulzivne kupovine.

4.4. Dm – drogerie markt

1973. otvorena je prva dm prodavaonica u Njemačkoj (Karlsruhe), 1976. prva dm prodavaonica u Austriji (Linz), a 1996. prva dm prodavaonica u Hrvatskoj (Zagreb). Danas je dm s 154 filijale zastupljen po cijeloj Hrvatskoj. Upravno-distributivni centar u Zagrebu središte je za cijelu Hrvatsku, kao i poveznica za susjedne zemlje u jugoistočnoj Europi. Asortiman dm-a obuhvaća više od 15 500 proizvoda iz područja zdravlja, ljepote, dječje njege i hrane, domaćinstva, fotousluga i dodatnog asortimana. Asortiman je upotpunjen i s 22 dm marke (DM, 2016.).

Najveći dio prodajnog prostora u dm-u zauzimaju police s proizvodima koje su raspoređene po odjeljcima i kategorijama proizvoda. U svakom odjeljku proizvodi su pozicionirani prema visini cijene, od najskupljih na najvišim policama do jeftinijih na nižim policama.

U dm-u se za pozicioniranje proizvoda na akciji i promotivne ponude koriste gondole (samostojeće konstrukcije za izlaganje robe), a smještene su na početku polica i u prolazima. Istu namjenu imaju i škarasti stolovi, no oni su smješteni isključivo na početku police. Proizvodi na akciji koji su većih dimenzija (npr. pelene, wc papir) uglavnom se izlažu na paletama koje su raspoređene za to na predviđenim lokacijama. Neposredno u blizini blagajne smještene su samostojeće police na kojima su izloženi proizvodi različitih kategorija. Njihove cijene su pretežno redovne, a cilj im je potaknuti kupce na impulzivnu kupovinu. Na samoj blagajni nalaze se police s proizvodima namijenjenim impulzivnoj kupovini. Kupci na blagajni dobiju i preporuku za proizvode od samih djelatnica što dodatno potiče njihovu odluku na kupnju. Osim pozicioniranja proizvoda, velika pažnja u prodajnim prostorima dm-a poklanja se i isticanju cijene artikala. Kartice s cijenama, osim same cijene, sadržavaju informacije i pogodnosti vezane uz samu kupnju.

5. Zaključak

Sam Walton, osnivač Wal-Marta rekao je: „Postoji samo jedan boss: kupac. On može najuriti svakog iz kompanije – od predsjednika pa nadalje i to jednostavno ako odluči potrošiti svoj novac negdje drugdje.“

Prodajni prostor može biti glavni razlog dolaska kupaca u određeno prodajno mjesto u kojem će se on osjećati ugodno, a da sam prostor bude funkcionalno uređen. Koncept space managementa pruža i mogućnost individualnog pristupa uređenju prostora svojom estetikom što može dominirati kupovnim doživljajem. Osnovna pitanja kojima se bavi space management su: treba li povećati ili smanjiti asortiman, treba li alocirati pojedini proizvod, kako pozicionirati proizvode unutar kategorije i odjela. Pozicioniranje proizvoda se odnosi i

na odluke i aktivnosti čija je namjera stvaranje određene koncepcije o proizvodu u svijesti kupaca. Primjenom informacijske tehnologije i uporabom planograma postiže se optimizacija zaliha, povećanje profita i zadovoljenje potreba kupaca.

Uvidom u neke od prodajnih prostora (Plodine, Takko, Kaufland, dm) može se analizom doći do zaključka kako oni u svojim prodajnim prostorima uspješno implementiraju načela space managementa.

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Application of space management principles in sales practice

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Abstract. Space management is the part of category management focused on the category management of products as units with clearly defined goals. The goal is to implement and

establish structured processes for product category management within the company's strategy.

Stores with a modern business concept strive to adapt their retail space to customers' needs in order to make it as functional as possible. The right product positioning within a store guarantees better business results and allows the customer to navigate the retail space more easily.

In practice, space management is primarily implemented by defining the product range, retail space appearance, shelf layout within the store, and the placement of products on the shelves in order to draw customers' attention. The very manner in which products are placed can strongly impact the buying decision process. If merchants want to achieve their goals, they need to ensure that the strategy for a specific category of products is efficiently implemented. This implies certain tactical decisions regarding the positioning of a product category on the shelf, additional displays, promotional pricing, etc.

This paper provides an analysis of research conducted in various stores in order to determine the extent to which the principles of space management are implemented in practice.

Key words: *space management, category management, product categories, retail space, product positioning*

CIET
2016

Track 3

Information Technology,
Electrical Engineering and
Mechanical Engineering

Transformator s jezgrom od amorfnog materijala u distribucijskoj mreži

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Sažetak. U radu je napravljena analiza transformatora s jezgrom od amorfnog materijala u usporedbi sa klasičnim transformatorom. Prednosti transformatora s jezgrom od amorfnog materijala su mali gubici u jezgri, mala struja magnetiziranja, veća energetska učinkovitost i duži životni vijek. Procjenjuje se da gubici u jezgri čine više od 70 % ukupnih gubitaka u transformatoru te oko 25% svih tehničkih gubitaka u mreži. Smanjenjem gubitaka doprinijelo bi većoj energetske učinkovitosti te samim time povećala bi se ekonomičnost pogona. Transformator s jezgrom od amorfnog materijala ima oko 50 % niže gubitke u jezgri u odnosu na najbolje klasične transformatore

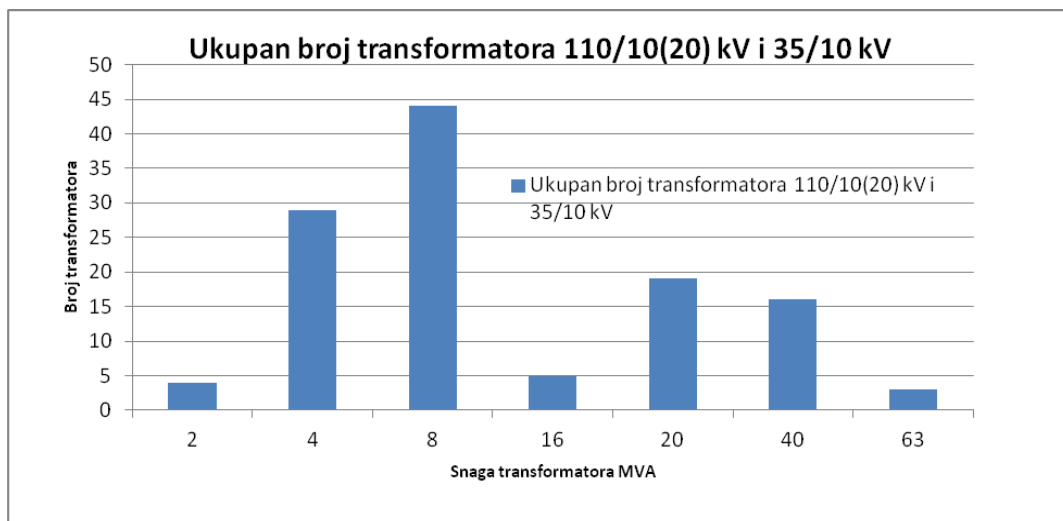
Ključne riječi: Distribucijski transformator, amorfnja jezgra, gubici u jezgri, energetska učinkovitost

1. Uvod

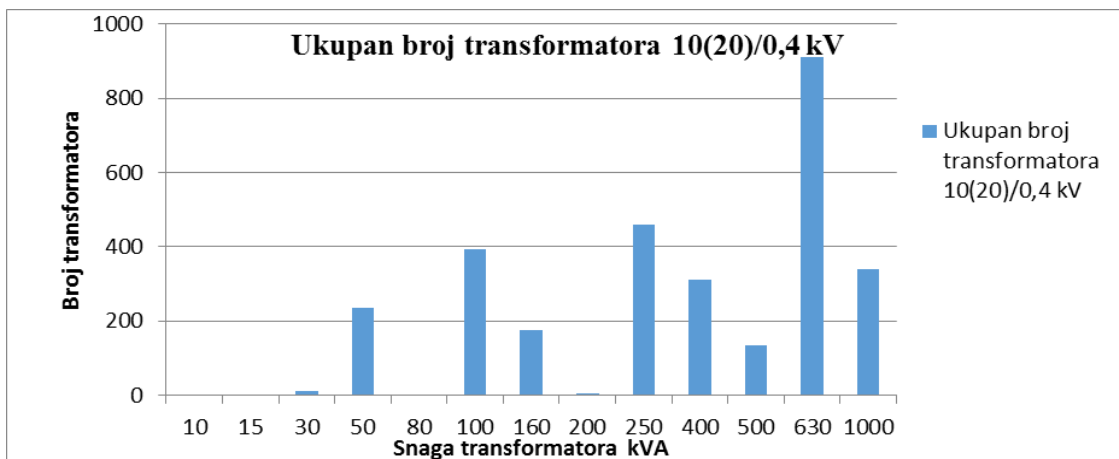
U radu su prikazana mjerenja i proračuni čiji je cilj prikazati učinak zamjene klasičnog transformatora sa energetske učinkovitijim transformatorom. Energetske učinkovitiji transformatori imaju različit sklop i sastav jezgre od klasičnog transformatora i njihova svrha je ušteda u gubicima kako u ekonomskom tako i tehničkom segmentu. Razmatrana je trafostanica Dugopolje - 4 snage 250 kVA u kojoj je ugrađen transformator s jezgrom od amorfnog materijala. Prikazat će se rezultati mjerenja električnih i magnetskih polja te buke, odnosno utjecaj trafostanice Dugopolje - 4 na okoliš. Provest će se i proračun isplativosti zamjene klasičnog transformatora sa transformatorom s jezgrom od amorfnog materijala.

2. Postojeće stanje

Gubici električne energije predstavljaju znatan udio u ukupnim gubicima u elektroenergetskom sustavu. Prema procjenama gubici u jezgri čine više od 70 % ukupnih gubitaka u transformatoru te oko 25 % svih tehničkih gubitaka u mreži. Smanjenju gubitaka doprinosi primjena energetske učinkovitijih transformatora. Broj distribucijskih transformatora na području Elektrodalmacije Split iznosi oko 3100, a njihova razdioba prikazana je na slikama 1 i 2.

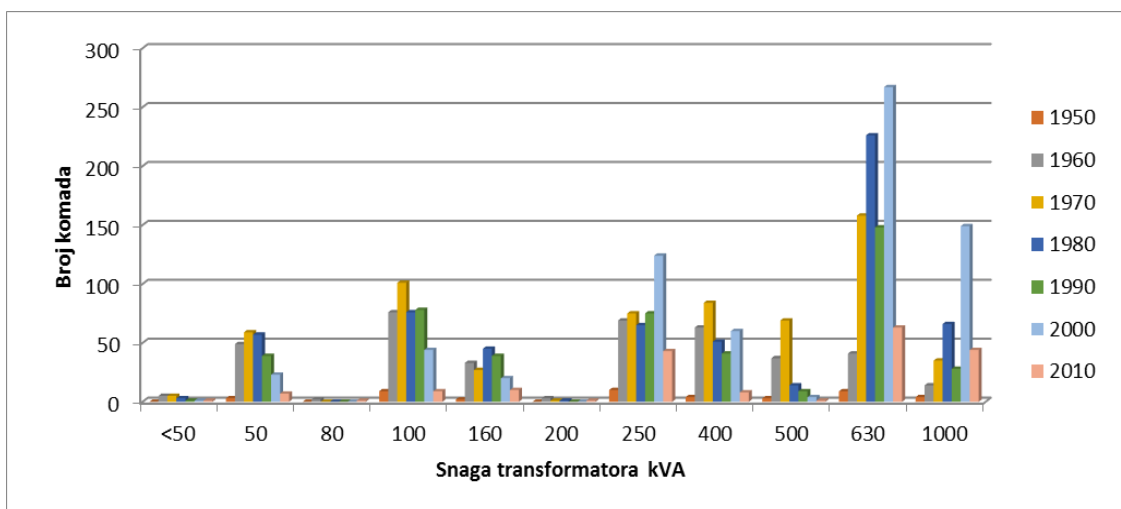


Slika 1 Ukupan broj transformatora napona 110/10(20) i 35/10 kV



Slika 2 Ukupan broj transformatora napona 10(20)/0,4 kV

Broj transformatora snage 250 kVA iznosi 460 jedinica što čini 15 % instalirane snage distribucijskog područja, dok transformator snage 630 kVA iznosi 912 jedinica što čini 31 % instalirane snage distribucijskog područja. Velik broj transformatora je podopterećen što dodatno pridonosi gubicima. Na slici 3 prikazana je starosna dob transformatora.



Slika 3 Starosna dob transformatora napona 10(20)/0,4 kV

Najstariji transformator je iz 1951. godine snage 400 kVA, napona 10/0,4 kV.

3. Transformator s jezgrom od amorfnog materijala

Sama proizvodnja transformatora s jezgrom od amorfnog materijala događa se u posebnim uvjetima i na poseban način. Magnetska jezgra ovog transformatora napravljena je od feromagnetskih amorfnih materijala i debljina limova iznosi oko 25 μm . Amorfne slitine razlikuju se od kristalnih slitina u svojim magnetskim i mehaničkim svojstvima (čvrstoća i tvrdoća). Gubici u transformatorima s jezgrom od amorfnog materijala mogu biti podjeljene u dvije komponente:

- gubici u histerezi
- gubici uzrokovani vrtložnim strujama.

Amorfni materijal omogućuje lakšu magnetizaciju materijala što u konačnici dovodi do smanjenja gubitaka histereze.

Gubici vrtložnih struja također su manji kod amorfnog materijala zbog kombinacije tanje debljine lima i visokog električnog otpora od 130 $\mu\Omega\text{cm}$ u odnosu na klasični transformator čiji električni otpor iznosi 51 $\mu\Omega\text{cm}$.

Prednosti ovakvog transformatora su mali gubici u jezgri, mala struja magnetiziranja, veća energetska učinkovitost i duži životni vijek. Ono što odlikuje transformator s jezgrom od amorfnog materijala je to što imaju 50 % niže gubitke praznog hoda u odnosu na najbolje klasične transformatore, a iz perspektive troškova proizvodnje imaju jednaku ili nešto veću cijenu kao i visokoučinski transformatori.

3.1 Transformatorska stanica Dugopolje - 4

TS Dugopolje - 4 izvedena je kao samostojeći objekt tipa „tornjić“. Sadrži transformator s jezgrom od amorfnog materijala tipa AMT250-24X nazivne snage 250 kVA s regulacijom $\pm 2 \times 2.5 \%$ proizveden 2014. g. Novi postojeći transformator s jezgrom od amorfnog materijala prikazan je na slici 4.



Slika 4 Transformator s jezgrom od amorfnog materijala u TS Dugopolje-4

Prema ispitnoj listi dani su podaci transformatora AMT 250-24X koji su prikazani u tablici 1 i ispitani su prema IEC 60076.

Tablica 1 Tehnički podaci transformatora sa amorfnom jezgrom

Snaga	250 kVA	
Oznaka spoja	Dyn5	
Frekvencija	50 Hz	
Razred izolacije	A	
Naponi	VN=10kV± 2x2.5 %	NN= 420V
Ukupna masa	1258 kg	
Gubici i struja praznog hoda	V _{ef} =420 V, I=0,72A, W _g =126 W	
Gubici praznog hoda	150 W	
Gubici opterećenja	2750	
Ukupni gubici	2900 W	

U tablici 2 prikazana je ispitna lista klasičnog transformatora 8EuTBN ispitano prema IEC 76.

Tablica 2 Tehnički podaci klasičnog transformatora

Snaga	250 kVA	
Oznaka spoja	Dyn5	
Frekvencija	50 Hz	
Razred izolacije	A	
Naponi	VN=10kV± 2x2.5 %	NN= 420V
Ukupna masa	1050 kg	
Gubici i struja praznog hoda	V _{ef} =420 V, I=1,34A, W _g =440 W	
Gubici praznog hoda	425 W	
Gubici opterećenja pri 75 C	3250 W	
Ukupni gubici	3675 W	

Prema podacima iz tablice 1 i 2 uočava se da klasični transformator ima gubitke jezgre 425 W, dok transformator s jezgrom od amorfnog materijala ima gubitke jezgre koji iznose 150 W. Zaključuje se i da transformator s jezgrom od amorfnog materijala tipa AMT 250-24X ima 35 % niže gubitke jezgre u odnosu na transformator sa klasičnom jezgrom tipa 8EuTBN.

3.2 Utjecaj transformatora s jezgrom od amorfnog materijala na okolinu

Utjecaj TS Dugopolje - 4 na okolinu ispitana je kroz analizu električnih i magnetskih polja te buke.

Magnetsko polje (B), izraženo u μT , svojom indukcijom djeluje na okolinu te se stvara u području oko vodiča kada teče struja. Magnetsko polje ovisi o jakosti struje i raste s opterećenjem trafostanice koje je tijekom mjerenja bilo manje od nazivnog.

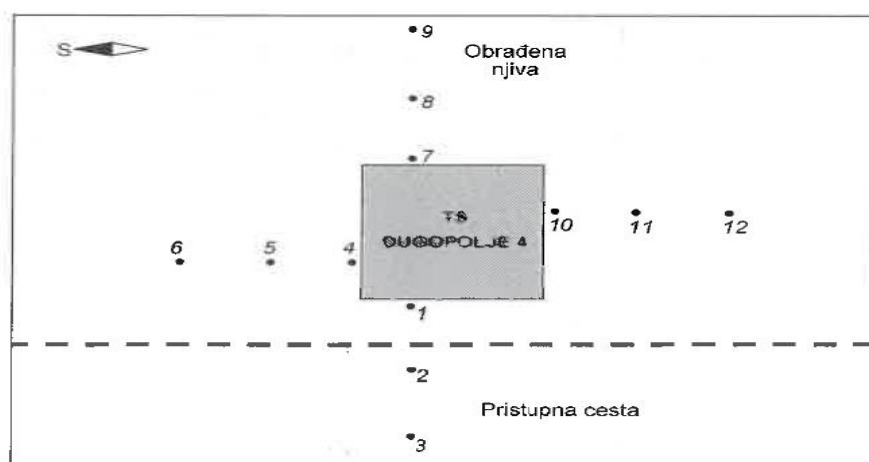
Jakost električnog polja (E), izraženo u V/m, direktno je ovisna o iznosu napona koji uzrokuje električno polje. Prema međunarodnoj organizaciji za zaštitu od neionizirajućih zračenja-ICNIRP izdana je preporuka za granične vrijednosti magnetskog polja. U tablici 3 prikazane su granične vrijednosti razine jakosti električnih polja i magnetskih polja.

Tablica 3 Granične razine jakosti električnih polja i gustoća magnetskog toka

Područje zaštite	Jakost el. polja E (V/m)	Magnetsko polje B (μT)
Područje profesionalne izloženosti	5000	100
Područje povećane osjetljivosti	2000	40

Trafostanica Dugopolje - 4 nalazi se na javnom području, a najbliže područje profesionalne izloženosti (obrađena njiva) udaljena je 1 m od trafostanice, dok su područja povećane osjetljivosti toliko udaljena da se u njima elektromagnetska (EM) polja trafostanice ne mogu izdvojiti od polja ostalih izvora EM polja mrežne frekvencije. Zbog toga su EM polja mjerena na 12 lokacija u neposrednom okolišu trafostanice i to na 3 lokacije sa svake strane trafostanice gdje su preglednim mjerenjima utvrđene najviše razine magnetskog polja.

Mjerne lokacije smještene su na udaljenostima 0,2 m, 1 m i 2 m od trafostanice prema slici 5. Na svakoj lokaciji mjereno je na tri mjerna mjesta postavljena na visinama 0,5 m, 1m i 1,5 m iznad tla.

**Slika 5** Skica smještaja trafostanice s 12 označenih mjernih lokacija

Izmjerene vrijednosti djelovanja magnetskog i električnog polja na okolinu prikazani su u tablici 4.

Tablica 4 Rezultati mjerenja

Rezultati mjerenja							
Lokacija	Visina	B(μT)	E(kV/m)	Lokacija	Visina	B(μT)	E(kV/m)
1	0,5m	1,296	0,002	7	0,5m	1,000	0,002
	1m	0,998	0,006		1m	1,086	0,007
	1,5m	1,054	0,012		1,5m	1,364	0,012
2	0,5m	0,335	0,004	8	0,5m	0,119	0,006
	1m	0,287	0,005		1m	0,148	0,014
	1,5m	0,303	0,010		1,5m	0,194	0,010
3	0,5m	0,147	0,005	9	0,5m	0,071	0,013
	1m	0,157	0,007		1m	0,075	0,018
	1,5m	0,158	0,012		1,5m	0,091	0,000

4	0,5m	0,859	0,001	10	0,5m	0,275	0,000
	1m	0,991	0,003		1m	0,506	0,000
	1,5m	0,822	0,006		1,5m	0,824	0,000
5	0,5m	0,148	0,005	11	0,5m	0,064	0,000
	1m	0,142	0,008		1m	0,067	0,000
	1,5m	0,141	0,018		1,5m	0,082	0,001
6	0,5m	0,072	0,011	12	0,5m	0,036	0,000
	1m	0,072	0,015		1m	0,035	0,000
	1,5m	0,063	0,028		1,5m	0,036	0,000
Mjera nesigurnosti ±10%							
Granične razine B= 40/100/1000 (μT) E= 2/5/10 kV/m							

Najviša razina magnetskog polja od $1,364 \mu\text{T}$ izmjerena je na lokaciji 7 uz samu trafostanicu, na visini 1,5 m iznad tla gdje se s visinom polje mijenja pa bi prostornim usrednjavanjem dobivena razina izloženosti ljudi homogenom polju na toj lokaciji bila nešto niža od ove vrijednosti. Iz rezultata mjerenja vidi se da magnetsko polje trafostanice slabi sa udaljenošću od trafostanice, tako da na ostalim područjima tijekom mjerenja polja trafostanice nije premašilo ovu razinu.

Izmjerene vrijednosti jakosti električnih polja, od kojih je najveća $0,028 \text{ kV/m}$, dolaze prvenstveno od priključnih vodova trafostanice.

Prema dobivenim rezultatima mjerenja očigledno je da su izmjerene vrijednosti EM polja znatno niže od propisanih te udovoljavaju zahtjevima Pravilnika o zaštiti od elektromagnetskih polja.

3.3 Buka transformatora

Buka transformatora najviše ovisi o indukciji i vrsti lima. Veća indukcija izaziva veću buku. U tablici 5 definirane su najveće dozvoljene vrijednosti zvučne snage koje su usko povezane s razinama gubitaka jezgre te ih definira ista oznaka (E_0 , D_0 , C_0 , B_0 i A_0).

Tablica 5 Gubici jezgre i nivo zvučne snage $L_{WA}(\text{dB(A)})$

Nazivna snaga	E_0		D_0		C_0		B_0		A_0		Napon kratkog spoja
kVA	P_0	L_{WA} W dB(A)	P_0	L_{WA} W dB(A)	P_0	L_{WA} W dB(A)	P_0	L_{WA} W dB(A)	P_0	L_{WA} W dB(A)	%
50	190	55	145	50	125	47	110	42	90	39	4
100	320	59	260	54	210	49	180	44	145	41	
160	460	62	375	57	300	52	260	47	210	44	
250	650	65	530	60	425	55	360	50	300	47	
315	770	67	630	61	520	57	440	52	360	49	
400	930	68	750	63	610	58	520	53	430	50	
500	1100	69	880	64	720	59	610	54	510	51	
630	1300	70	1030	65	860	60	730	55	600	52	
630	1200	70	940	65	800	60	680	55	560	52	6
800	1400	71	1150	66	930	61	800	56	650	53	
1000	1700	73	1400	68	1100	63	940	58	770	55	
1250	2100	74	1750	69	1350	64	1150	59	950	56	
1600	2600	76	2200	71	1700	66	1450	61	1200	58	
2000	3100	78	2700	73	2100	68	1800	63	1450	60	
2500	3500	81	3200	76	2500	71	2150	66	1750	63	

Da bi se postigli gubici razine A_0 potrebno je da se u transformatorima ugrade najbolji limovi po pitanju gubitaka debljine 0,23 mm. Transformatori s jezgrom od amorfnog materijala postižu gubitke jezgre razine $A_0/2$.

U tablici 6 dan je pregled intenziteta buke nekih karakterističnih izvora.

Tablica 6 Intenziteti različitih zvukova

Izvor buke	Intenzitet zvuka
Šuštanje lišća	10 dB
Vrlo tihi šapat	20 dB
Dnevna soba	40 dB
Razgovor	66 dB
Prometna ulica	75 dB
Unutrašnjost autobusa	80 dB
Podzemna željeznica	90 dB
Bučna tvornica	100 dB
Mlazni avion	120 dB

Prema Pravilniku o najvišim dopuštenim razinama buke u sredini u kojoj ljudi rade i borave granična vrijednost razine buke za dan iznosi $L_{day}=55$ dB, dok najveća dopuštena vrijednost razine buke za noć iznosi $L_{night}=40$ dB [5].

Mjerenje buke u okolišu vrši se prema normama HRN ISO 1996-1:2004 i HRN ISO 1996-2:2008 te odabirom mjernih uređaja koji se uklapaju u Pravilnik i tehničku specifikaciju. Emisija buke transformatora s jezgrom od amorfnog materijala mjerila se na udaljenostima 1m, 5m, 10m, 15m, 20m, 25m i 30m te rezultati su prikazani u tablici 7.

Tablica 7 Rezultati mjerenja ekvivalentne razine buke i usporedba s dopuštenom razinom

Izvori buke		MJEŠTO MJERENJA	Izmjerena ekvivalentna razina buke(dB)	Povišena razina buke zbog položaja mikrofona	Prilagođenje		Ocjenska razina buke u dB	Propisane najviše razine buke u dB
Isključeni	Uključeni				Tonalna prilagodba	Impulsna prilagodba		
+		MM1(#)	41,6	0	0	0	41,6	45
	+	MM2(#)	42,2	0	0	0	42,2	42,6
	+	MM3(#)	41,8	0	0	0	41,8	42,6
	+	MM4(#)	41,6	0	0	0	41,6	42,6
	+	MM5(#)	41,6	0	0	0	41,6	42,6
	+	MM6(#)	41,6	0	0	0	41,6	42,6
	+	MM7(#)	41,6	0	0	0	41,6	42,6

Gdje su MM1 (#) - udaljenost na 1 m, MM2 (#) - udaljenost na 5 m, MM3 (#) - udaljenost na 10 m, MM4 (#) - udaljenost na 15 m, MM5 (#) - udaljenost na 20 m, MM6 (#) - udaljenost na 25 m, MM7 (#) - udaljenost na 30 m.

Prilikom mjerenja za period dana na mjernom terminalu trafostanice očitana su sljedeća opterećenja po fazama $I_1 = 37,8$ A, $I_2 = 71,8$ A, $I_3 = 53,2$ A. Prema analizi mjerenja buke za TS Dugopolje - 4 rezultati mjerenja zadovoljavaju zahtjeve iz Pravilnika o najvišim dopuštenim razinama buke u sredini u kojoj ljudi rade i borave.

4. Isplativost zamjene transformatora

Da bi se napravio proračun isplativosti zamjene postojećeg transformatora sa energetskim učinkovitijim transformatorom [7] nužno je odrediti godišnje troškove transformatora prema sljedećem izrazu:

$$W_{loss} = (P_0 + P_k \times L^2) \times 8760$$

Pri čemu su:

W_{loss} – godišnji gubici energije u kWh

P_0 – gubici praznog hoda u kWh

P_k – gubici opterećenja u kWh

8760 – broj sati u godini

Za izračun cijene troškova gubitaka potrebno je da gubici budu sagledavani prema trenutku kupovine da bi se mogli staviti u istu perspektivu sa kupovnom cijenom i zato potrebno je izračunati ukupne kapitalizirane troškove gubitaka TCC_{loss} (eng. Total Capitalized Cost) .

$$TCC_{loss} = W_{loss} \times \frac{(1+i)^n - 1}{i \times (1+i)^n} \times C \times 8760$$

Kako bi se napravio proračun ekonomske analize transformatora potrebno je izračunati troškove životnog vijeka TCO (eng. Total Cost of Ownership). U jednoj formuli izračunava se trošak kupovine transformatora kao i njegovog korištenja i održavanja, zatim se uspoređuju uzimajući u obzir vremensku promjenjivost vrijednosti novca.

U praksi može se napraviti pojednostavljenje. Dok svaki transformator ima svoju kupovnu cijenu i faktore gubitaka, drugi troškovi poput instalacije, održavanja i demontiranja, bit će slični za slične tehnologije, tako da se ti navedeni elementi mogu izostaviti iz proračuna. Ukoliko se uspoređuju različite tehnologije, primjerice suhi transformator i uljni transformator, tada će se ti elementi uzeti u obzir. U proračunu sagledavat će se kupovna cijena i troškovi gubitaka. Cjelokupni trošak posjedovanja zadan je sljedećim izrazom :

$$TCO = PP + A \times P_0 + B \times P_k$$

Pri čemu je :

TCO - kapitalizirani troškovi transformatora [HRK]

PP - kupovna cijena transformatora [HRK]

A - Cijena gubitaka u praznom hodu [HRK/W]

P_0 - gubici praznog hoda [W]

B - Cijena gubitaka po opterećenju [HRK/W]

P_k - gubici opterećenja [W]

Svaki priključeni transformator na mrežu proizvodi gubitke praznog hoda P_0 i gubitke zbog tereta P_k . Gubici praznog hoda nastaju usljed histereze i vrtložnih struja u jezgri kad je transformator pod naponom, odnosno 8760 sati u godini i ne ovisi o opterećenju. Gubici tereta proporcionalni su kvadratu struje tereta ($P_k \sim I^2$). P_0 i P_k predstavljaju gubitak energije pa je važno pri nabavljanju novog transformatora voditi računa o troškovima gubitaka koje transformator proizvodi tijekom svog životnog vijeka.

Faktor A i B ovise o opterećenju transformatora i cijeni električne energije. Izbor faktora A i B kompliciran je budući da ovise o opterećenju transformatora koje je nepoznato, kao i cijeni energije koje su sklone promjenama.

Sljedeći izraz zadan je za izračun faktora A i B:

$$A = \frac{(1+i)^n - 1}{i \times (1+i)^n} \times C_{kWh} \times 8760$$

$$B = \frac{(1+i)^n - 1}{i \times (1+i)^n} \times C_{kWh} \times 8760 \times \left(\frac{I_l}{I_r} \right)^2$$

Gdje su:

i – kamatna stopa [% / godini]

n – radni vijek [godina]

C_{kWh} – cijena kWh [kn/kWh]

8760 – broj sati u godini

I_l – struja opterećenja

I_r – nazivna struja

Ove formule pretpostavljaju da su cijena energije i opterećenja konstantni tokom radnog vijeka transformatora.

Za izračun isplativosti zamjene postojećeg transformatora sa transformatorom s jezgrom od amorfnog materijala obrađen je transformator snage 250 kVA kojih na promatranom području ima 460 te čine 15 % instalirane snage distribucijskog područja.

4.1 Proračun isplativosti zamjene transformatora 250 kVA sa energetske učinkovitijim transformatorom

Za izračun isplativosti transformatora zamjene transformatora imamo sljedeće parametre :

Klasični transformator

S= 250 kVA

U= 10/0,4 kV

P_0 = 425 W

P_k = 3250 W

PP= 45 000 HRK

Transformator s jezgrom od amorfnog materijala

S= 250 kVA

U= 10/0,4 kV

P_0 = 150 W

P_k = 2750 W

PP= 69 000 HRK

Za izračun godišnjih gubitaka koji se računaju prema W_{loss} transformatora snage 250 kVA, napona 10/0,4 kV uzeti su u obzir gubici praznog hoda P_0 = 425 W, gubici kratkog spoja P_k = 3250 W, te srednje opterećenje transformatora L = 0,6.

$$W_{loss} = (P_0 + P_k \times L^2) \times 8760 = (425 + 3250 \times 0,6^2) \times 8760 = 13\,972,2 \text{ kWh}$$

Cijena troškova gubitaka TCC_{loss} navedenog transformatora uz kamatu i = 6 %, životni vijek n = 30 godina i prosječnu cijenu energije C_{kWh} = 0,5 kn/kWh :

$$TCC_{loss} = W_{loss} \times \frac{(1+i)^n - 1}{i \times (1+i)^n} \times C = 13972,2 \times \frac{(1+0,06)^{30} - 1}{0,06 \times (1+0,06)^{30}} \times 0,5 = 96\,163 \text{ HRK}$$

Ukupan trošak posjedovanja TCO računa se uz kamatnu stopu $i = 6 \%$, procijenjeni životni vijek $n = 30$ godina i prosječnu cijenu energije $C_{kWh} = 0,5$ kn/kWh. Faktor A iznosi 6,88 HRK/W te faktor B iznosi 1,25 HRK/W. Gubici praznog hoda novoga transformatora iznose $P_0 = 150$ W, gubici kratkog spoja iznose $P_k = 2750$ W.

$$TCO = PP + A \times P_0 + B \times P_k = 69000 + 6,88 \times 150 + 1,25 \times 2750 = 73\,470 \text{ HRK}$$

Ušteda zamjene starog transformatora 250 kVA sa energetske učinkovitijim transformatorom u periodu od 30 godina iznosi :

$$\Delta = TCC_{loss} - TCO = 96163 - 73470 = 22\,693 \text{ HRK}$$

Ukupan broj instaliranih transformatora snage 250 kVA čini oko 15 % instalirane snage distribucijskog područja, to je ukupno 460 jedinica koje bi se postepeno mogle zamjeniti sa energetske učinkovitijim transformatorima. U ovom slučaju cijena transformatora s jezgrom od amornog materijala je za 35 % skuplja od klasičnog transformatora koja će u slučaju serijske proizvodnje sigurno biti povoljnija.

5. Zaključak

U radu je prikazano tehnološko rješenje TS Dugopolje - 4. Napravljena je analiza učinka ugradnje transformatora s jezgrom od amornog materijala u TS Dugopolje - 4 te utjecaj na okoliš. Mjerenjem magnetskih i električnih polja utvrđeno je da izmjerena vrijednost udovoljava zahtjevima Pravilnika o zaštiti elektromagnetskih polja te nema nikakav utjecaj na okoliš i na ostala područja boravka ljudi.

Transformator s jezgrom od amornog materijala ima nešto veću buku od klasičnog transformatora, ali mjerenjem utvrđeno je da buka transformatora s jezgrom od amornog isplativosti zamjene transformatora sa novim vidljivo je da ušteda opravdava investiciju. Investiranje u energetske učinkovite transformatore znači smanjenje gubitaka, smanjenje utjecaja na okoliš, produženje životnog vijeka i povećanje energetske učinkovitosti.

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Transformer with amorphous core in distribution network

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Abstract. This paper contains an analysis of a transformer with core of amorphous material compared with classical transformer. The advantages of transformers with core of amorphous material are low core losses, low magnetizing current, higher energy efficiency and longer lifetime. It is estimated that no-load losses account for more than 70% of all losses in transformer and approximately 25% of all technical losses generated in electrical network. By reducing the losses it would contribute to greater energy efficiency and thus it would increase the economy drive. Transformers with core of amorphous material have 50% lower core losses in comparison to the best classical transformers.

Key words: *Distribution transformer, amorphous core, core losses, energy efficiency*

Razvoj aplikacije za autentifikaciju i autorizaciju korisnika uporabom tehnologije radio frekvencijske identifikacije

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Sažetak. Većina današnjih sustava za kontrolu pristupa i evidenciju radnog vremena temelji se na radio frekvencijskoj identifikaciji (RFID). Ovi sustavi koriste čitače RFID kartica, mrežnu tehnologiju Ethernet i protokol TCP/IP za komunikaciju s centralnim poslužiteljem. Na poslužitelju se nalazi baza podataka o svim korisnicima sustava, pravima pristupa (autorizacijske razine), a autentifikacija korisnika se obavlja pomoću beskontaktna kartice. U ovom radu opisuje se tehnologija RFID i navode njene najčešće primjene kao i sklopovlje upotrebjeno za izgradnju uređaja. Na kraju rada prikazana je izrađena web aplikacija za prikupljanje i obradu podataka te administriranje sustava. Razvijena aplikacija namijenjena je za kontrolu pristupa učionicama i laboratorijima te evidentiranje studenata i nastavnika. Uređaj je izrađen korištenjem platforme Arduino Uno, a web aplikacija primjenom programskog jezika PHP i baze podataka MySQL.

Ključne riječi: *RFID, Arduino, Ethernet, Authentication, Authorization*

1. Uvod

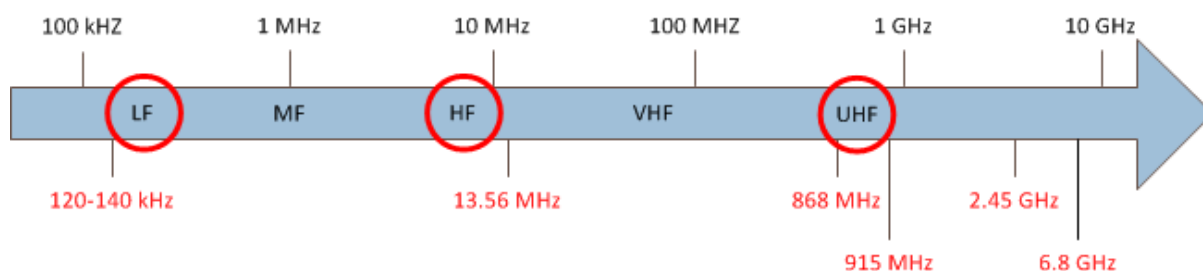
Zakonske odredbe propisuju da svaka pravna osoba mora voditi evidenciju o prisustvu djelatnika na radnom mjestu i na zahtjev ovlaštene osobe dužna ju je predložiti. Ukoliko se radi o malim tvrtkama vođenje evidencije obično preuzima jedna osoba unutar organizacije. Kod velikih organizacija koje uz veliki broj djelatnika imaju i smjenski rad obično se pribjegava digitalnom vođenju evidencije. Visoka učilišta pak propisuju obvezu prisustva nastavi za studente i vođenje interne evidencije. Ovaj proces oduzima vrijeme nastavniku ukoliko se vodi ručno, a ukoliko se studenti sami potpisuju, tada je vrlo često i nevjerodostojno te zahtjeva napredniji pristup.

U ovom radu ćemo prezentirati izradu sustava za autentifikaciju i autorizaciju korisnika korištenjem RFID tehnologije, a glavna namjena će mu biti digitalno vođenje evidencije o prisutnosti studenata na predavanjima kao i evidencija radnog vremena nastavnog osoblja. Sam sustav sastoji se od dvije ključne komponente, fizičkog sklopovlja čitača i aplikativne podrške u obliku web aplikacije koja se oslanja na relacijsku bazu podataka. Princip rada sustava jednostavan je i temelji se na korisničkoj prijavi korištenjem RFID kartice prilikom ulaska u laboratorij ili predavaonicu za studente, odnosno nastavnike. U tu svrhu, nastavno osoblje će zadužiti RFID kartice, a studenti za prijavu koriste ISAK kartice, odnosno službenu studentsku ispravu poznatiju pod nazivom e-Indeks koja je već u upotrebi na velikoj većini visokoškolskih ustanova u Republici Hrvatskoj.

S obzirom na vrlo visoke cijene komercijalno dostupnih sustava, ne računajući troškove ugradnje i održavanja, želimo pokazati kako visoka učilišta mogu sama razviti sustav za ove potrebe, pri čemu studenti izravno sudjeluju u razvoju te time unaprijeđuju svoje tehničke vještine i znanja na polju elektronike, informacijskih i komunikacijskih sustava.

1.1 Tehnologija RFID

Tehnologija RFID (eng. Radio Frequency Identification) je tehnologija bežičnog prijenosa podataka pomoću radijske frekvencije. Već više desetaka godina ta se tehnologija primjenjuje u različitim granama djelatnosti, a zadnjih godina dobila je globalni zamah, ponajviše zahvaljujući činjenici da je sve češće susrećemo ugrađenu u mobilne uređaje novije generacije. RFID komunikacija temelji se na stvaranju elektromagnetskih valova u odašiljačima i njihovom otkrivanju na udaljenom prijemniku [1]. Bitno je naglasiti da RFID tehnologija za komunikaciju ne zahtijeva uspostavu vizualnog kontakta između prijemnika i odašiljača, no njen domet ovisi o više faktora, a ponajviše o korištenom frekvencijskom području. Izbor radne frekvencije uvelike ovisi o radnim karakteristikama sustava pa se u skladu s tim frekvencija rada odabire ovisno o namjeni i radnoj okolini. Frekvencije su regulirane posebnim pravilnicima za standardizaciju i regulaciju RF spektra, pri čemu različiti dijelovi svijeta koriste različite dijelove RF spektra, no za praktičnu primjenu RFID tehnologije koriste se tri osnovna područja i nekoliko frekventnih pojaseva (slika 1.).



Slika 1 Frekvencijski spektar dodjeljen tehnologiji RFID

S obzirom na to da se RFID tehnologija najčešće koristi u svrhu identifikacije osoba ili objekata, najčešće korištena metoda je pohranjivanje jedinstvenog identifikatora u obliku serijskog broja ili neke druge informacije na mikročip koji zajedno s antenom čini RFID transponder. Transponder komunicira s čitačem putem radio signala (jednosmjerno ili dvosmjerno), a čitač je povezan sa kontrolerom ili računalom za komunikaciju s centralnom bazom podataka u kojoj su pohranjeni podaci bitni za rad sustava.

Tablica 1 Komunikacijske tehnologije NFC i RFID

	NFC	RFID
Vrsta mreže	PAN	PAN
f (MHz)	13.56	0.125-0.134 13.56 860-960 2450 - 6800
Brzina prijenosa (kbit/s)	106-424	400
Doseg	<10 cm	<6 m
Potrošnja	veoma niska	veoma niska
Topologija	P2P	P2P
Primjena	usluge plaćanja, evidencije	evidencije

Tehnologija RFID temelji se na normama ISO/IEC 14443 i ISO/IEC 18000-3. Norma ISO/IEC 14443 definira kartice koje se koriste za pohranu podataka. Druga norma, ISO/IEC 18000-3, specificira komunikaciju RFID koju koriste uređaji NFC (eng. Near Field Communication) kratkog doseg, a danas je sve više prisutna u mobilnim telefonima i tabletima [2]. Glavne karakteristike komunikacijskih tehnologija NFC i RFID dane su u tablici 1. [3]. Iz tablice 1 vidljivo je da su glavne razlike između ove dvije tehnologije u frekvencijskim područjima rada i komunikacijskom dosegu. Naime, komunikacijski doseg kod tehnologije NFC iznosi do 10 cm dok kod tehnologije RFID on iznosi do 6 m.

1.2 Primjene RFID tehnologije

Zbog niza prednosti koje RFID sustavi imaju nad drugim sustavima za identifikaciju oni danas omogućuju izrazito velik broj primjena. Bez obzira na svoje komparativne prednosti, korištenje RFID sustava ostavlja i određeni prostor za eventualne mogućnosti zlorabe. Iz tog razloga se kontinuirano usavršavaju nove metode i algoritmi zaštite koji se implementiraju u sustave bazirane na RFID tehnologiji.

Na slici 2 prikazane su neke od tipičnih aplikacija gdje se primjenjuje ova tehnologija. Uobičajena primjena tehnologije RFID još od samih početaka bila je upravo identifikacija osoba i kontrola prolaska, pri čemu su korisnici identificirani prislanjanjem kartice na čitač. Vrlo brzo se uvidjelo da se tehnologija RFID može koristiti i za ostale namjene, tako da je američka vojska počela označavati nuklearni materijal, a masovniju primjenu doživjela je za naplatu cestarina. U razvijenijim zemljama RFID se koristi na aerodromima kako bi se olakšalo praćenje putne prtljage i tako smanjile šanse njenog gubitka. Uobičajena primjena RFID tehnologije je i u biometrijskim putovnicama, gdje se u internu memoriju transpondera pohranjuju biometrijske karakteristike vlasnika kao što su otisci svih prstiju i ostalih osobnih podataka, a također rezultira i nemogućnošću izrade falsifikata putovnice. Ova tehnologija je svoju primjenu pronašla u mnogim knjižnicama i tako ubrzala proces izdavanja i vraćanja knjiga te istovremeno onemogućila otuđenje. U medicini, često se koristi za označavanje pacijenata te uzoraka tkiva i krvi u bankama krvi i laboratorijima. U rodilištima majka i beba označavaju se jednokratnim narukvicama u kojima je implementiran transponder.



Slika 2 Primjena tehnologija RFID

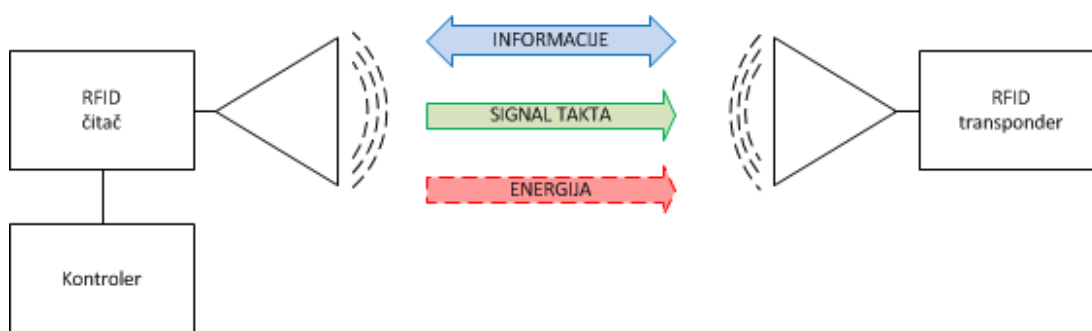
Osim za evidenciju životinja u zoološkim vrtovima i laboratorijima, RFID tehnologija pronašla je svoju primjenu i u označavanju životinjskih jedinki u divljini, a mnoge zemlje uvele su zakonske obveze čipiranja kućnih ljubimaca kako bi se u slučaju napuštanja ili gubitka lakše došlo do vlasnika. U logistici se koristi za praćenje poštanskih pošiljki te robe na skladištu. Posljednjih godina eksperimentira se s primjenom ove tehnologije u velikim trgovačkim lancima tako da se pri prolasku ispred RFID čitača automatski očitaju svi kupljeni

proizvodi i obračuna ukupan iznos robe koju korisnik treba platiti. Nove primjene se pronalaze svakodnevno budući da RFID tehnologija pruža izuzetno siguran i jedinstven način identifikacije.

1.3 Osnovne komponente RFID sustava

Svaki sustav baziran na RFID tehnologiji (slika 3) sastoji se od tri ključne komponente:

- kontroler - vrši funkciju baze podataka i upravljanja sklopovljem
- čitač - sastoji se od antene, radio frekvencijskog sklopovlja te upravljačkog sklopovlja za komunikaciju s kontrolerom i
- transponder - sastoji se od poluvodičkog integriranog sklopa, integrirane antene, a ponekad i baterije te sadrži kodirane podatke.



Slika 3 Osnovne komponente RFID sustava

Kao medij za prijenos podataka između transpondera i čitača koristi se zračno sučelje. Čitač s kontrolerom ili centralnim računalom može biti povezan žično ili bežično ovisno o okruženju i namjeni samog sustava. Komunikacija između transpondera i čitača na zračnom sučelju je uglavnom zaštićena posebnim kriptografskim algoritmima.

Kontroler RFID je uređaj koji upravlja radom cijelog sustava, a njegova glavna uloga je povezivanje većeg broja RFID čitača na zajedničku komunikacijsku infrastrukturu te uspostava centraliziranog podsustava za obradu informacija. Ulogu kontrolera najčešće obavlja osobno računalo, radna stanica ili mikroračunalo. U velikim sustavima može postojati više kontrolera koji su obično zasnovani na mikroračunalima, a koji su zatim vezani na centralno računalo ili poslužitelj koji raspolaže centralnom bazom podataka.

Čitač RFID je elektronički uređaj koji omogućuje komunikaciju, odnosno prijenos podataka između transpondera i kontrolera odnosno centralnog računala. Ovisno o namjeni postoje razne izvedbe čitača koje se razlikuju po fizičkoj izvedbi i kompleksnosti sklopovlja. Jednostavniji modeli čitača omogućuju komunikaciju sa samo jednom vrstom transpondera pri čemu se obično koristi samo jedan frekventni pojas i jedan komunikacijski protokol, dok oni složeniji imaju mogućnost komunikacije korištenjem više protokola te omogućuju selekciju podataka, provjeru i ispravljanje eventualnih grešaka u komunikaciji.

Osnovne funkcije koje ostvaruju RFID čitači su:

- čitanje podataka s RFID transpondera
- pisanje podataka na RFID transponder
- prijenos podataka prema kontroleru i
- napajanje pasivnih transpondera.

Osnovni dijelovi RFID čitača su antenski sklop, RF modul za komunikaciju s transponderom te upravljačko sklopovlje koje služi za komunikaciju sa centralnim kontrolerom ili računalom. Antena i RF modul igraju veliku ulogu kod čitača, budući da osim moduliranja i

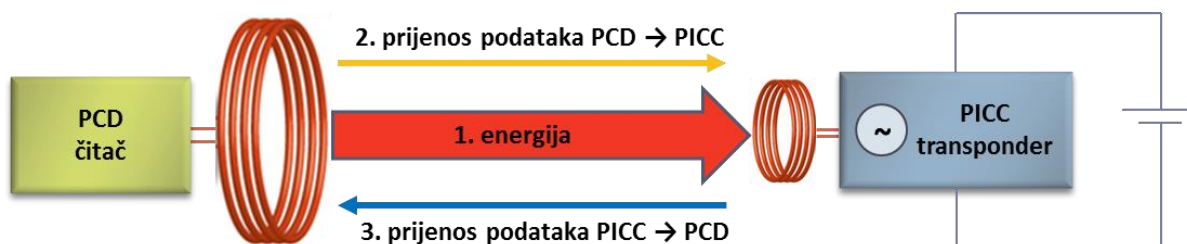
demoduliranja podataka na radijskom sučelju imaju zadatak i generirati elektromagnetsko polje za napajanje pasivnih transpondera. Većina modernih RFID čitača primjenom naprednih tehnika modulacije i korištenjem takozvanog „*anti-collision*“ algoritma ima mogućnost prepoznavanja i očitavanja više transpondera koji se istovremeno nalaze u dometu čitača bez njihove međusobne interferencije prilikom komunikacije. Antikolizijski mehanizam temelji se na principu da čitač prvo identificira sve transpondere koji se nalaze u njegovom dometu, a zatim inicira komunikaciju sa svakim transponderom pojedinačno.

Čitači uglavnom sve naredbe za rad primaju od centralnog kontrolera ili nadređenog računala, pri čemu kontroler odnosno računalo inicira proces i šalje čitaču zapovijed da aktivira RF sučelje. Antena RFID čitača emitira radio signal koji zatim aktivira transponder. Ovisno o primljenom signalu, transponder zatim šalje podatke prema čitaču ili prima podatke od čitača te ih zapisuje u svoju internu memoriju. S obzirom na to da se najčešće radi o podacima male veličine, koji se uglavnom kreću u rasponu od par bajtova do par kilobajta, komunikacija s transponderom je veoma kratka pa je moguće očitati veliki broj transpondera u relativno kratkom vremenu.

Transponderi RFID, poznati i kao „*tagovi*“, su sklopovi koji sadrže jedinstveni identifikator obično u obliku serijskog broja. Sama riječ *transponder* izvedena je od riječi *transmitter/responder* prema namjeni samog uređaja koji na zahtjev čitača odgovara traženim podatkom.

Dolaze u više formi i oblika, što ponajviše ovisi o njihovoj finalnoj primjeni. Najčešće dolaze u formatu kartica, privjesaka, narukvica, ušnih markica ili naljepnica. Međutim postoje i varijante u obliku staklenih ampula malih dimenzija koje se ugrađuju pod kožu životinja ili ljudi, u svrhu identifikacije. Transponderi mogu imati oblik naljepnica, etiketa ili pločica pri čemu se RF zavojnica nalazi na papiru ili foliji zajedno s memorijskim mikročipom.

Transponderi se međusobno razlikuju po frekvenciji, obliku, veličini, komunikacijskom protokolu, komunikacijskom dosegu i načinu pohranjivanja podataka. Neovisno o izvedbi i frekvenciji sve transpondere karakterizira činjenica da se sastoje od tri osnovna dijela (slika 4): antene, mikročipa i kućišta. Antena je izvedena u obliku bakrene zavojnice. Njezina svrha je napajanje čipa kod pasivnih varijanti transpondera te omogućavanje komunikacije s čitačem. Mikročip se najčešće napaja energijom primljenog signala, no postoje i transponderi opremljeni vlastitim izvorom napajanja. Nakon što transponder primi signal od RFID čitača jedinstveni identifikator kodira se u povratni signal koji se šalje natrag prema RFID čitaču.

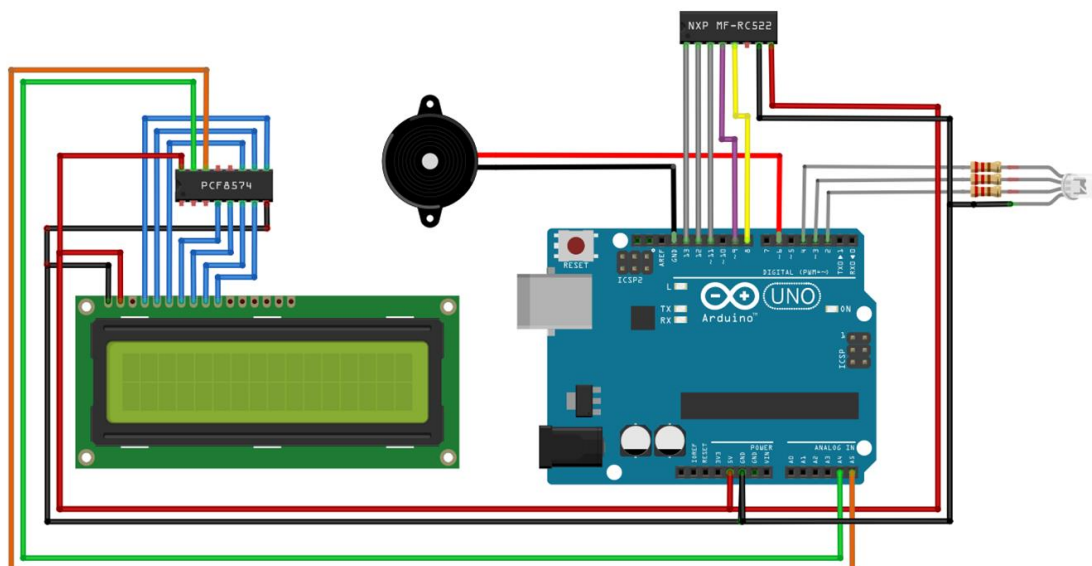


Slika 4 Prikaz komunikacije čitača sa transponderom

Unutar interne memorije mikročipa sadržani su podaci koji se mogu razlikovati po količini i sadržaju. Osnovne varijante transpondera raspolažu samo sa jedinstvenim identifikatorom transpondera, dok složenije varijante raspolažu većom količinom memorije te mogu pohraniti veću količinu podataka.

2. Implementacija sklopovlja

Shematski prikaz izrađenog uređaja prikazana je na slici 5, a na shemi nije prikazan Ethernet modul zbog bolje preglednosti slike. Uređaj se sastoji od Arduino Una R3 koji koristi Atmega328P mikroračunalo [4]. Ovo mikroračunalo raspolaže s 32 KB Flash memorije, 2 KB SRAM i 1 KB EEPROM memorije.



Slika 5 Shematski prikaz realiziranog uređaja

Mrežna povezanost ostvarena je korištenjem Ethernet shiela s Wiznet W5100 [5] chipsetom te je moguće ostvariti brzinu od 100 Mbit/s. Programska biblioteka razvijena za ovaj modul omogućuje komunikaciju korištenjem TCP, UDP, ICMP, IGMP, IPv4, ARP, PPPoE i Ethernet protokola, a implementirana je podrška i za DHCP odnosno dinamičku dodjelu IP adresa. Komunikacija s ATmega328P mikroračunalom izvedena je preko SPI sabirnice, dok se komunikacija s web poslužiteljem odvija korištenjem postojeće mrežne infrastrukture.

Za očitavanje kartica korišten je RFID modul NXP MF-RC522 [6] koji radi na frekvenciji od 13.56 MHz, te omogućuje komunikaciju s ISO/IEC 14443A/MIFARE karticama, odnosno MIFARE S50, S70, Pro, UltraLight i DESfire tipovima kartica. Modul RFID je s mikroračunalom povezan korištenjem SPI sabirnice, ali ovisno o potrebi ima mogućnost spajanja i putem I2C odnosno UART sučelja.

Alfanumerički 16x2 LCD Hitachi HD44780 služi za prikaz poruka prema korisniku. Ovaj modul raspolaže isključivo paralelnim komunikacijskim sučeljem koje može komunicirati korištenjem kodnih riječi širine četiri ili osam bita. Odlučili smo se za korištenje dodatnog modula zasnovanog na integriranom krugu PCF8574 koji omogućuje spajanje LCD-a sa mikroračunalom putem I2C sabirnice, pri čemu se koriste samo dvije komunikacijske linije, budući da se radi o serijskom protokolu. Time se omogućuje eventualno proširenje sustava u budućnosti. Također, za korištenje ovog načina komunikacije, korištena je odgovarajuća programska biblioteka. Za dodatnu zvučnu i svjetlosnu signalizaciju, sustav je opremljen piezo zujalicom i RGB LED čime se omogućuje fleksibilnije korištenje sustava i veća korisnička orijentiranost samog sustava. Na slici 6 prikazan je kompletan uređaj prilikom testiranja svih funkcionalnosti, dok je na slici 7 prikazan gotovi uređaj u kućištu povezan na mrežu.



Slika 6 Provjera funkcionalnosti sustava



Slika 7 Uređaj u kućištu povezan na mrežu

Programski kod za uređaj napisan je u programskom jeziku C++. Korišteno je Arduino IDE razvojno sučelje prikazano na slici 8. Također, na slici 8 vide se upotrebljene programske biblioteke koje omogućavaju komunikaciju Arduina s ostalim modulima kao i predefinirane konstante koje se koriste za signalizaciju korisniku putem RGB LED i piezo zujalice.

```

RFID | Arduino 1.6.6
File Edit Sketch Tools Help

RFID

/* Ethernet-based RFID reader with WizNet W5100 and NXP MFR522 */
#include <Ethernet.h>
byte mac[] = {0xDE, 0xAD, 0xBE, 0xEF, 0xFE, 0xED};
IPAddress ip(192, 168, 1, 101);
IPAddress server(192, 168, 1, 100);
EthernetClient client;

#include <SPI.h> // SPI bus support
#include <RFID.h> // RFID MFR522 module support
#define SS_PIN 8 // chip select pin
#define RST_PIN 9 // reset pin
#define BUZZER 6 // buzzer pin
RFID rfid(SS_PIN, RST_PIN);

#include <Wire.h>
#include <LiquidCrystal_I2C.h> // I2C LCD module support
LiquidCrystal_I2C lcd(0x27, 16, 2); // 16x2 char LCD

enum colors { // Enumerate LED colors
  RGB_RED,
  RGB_GREEN,
  RGB_BLUE
};

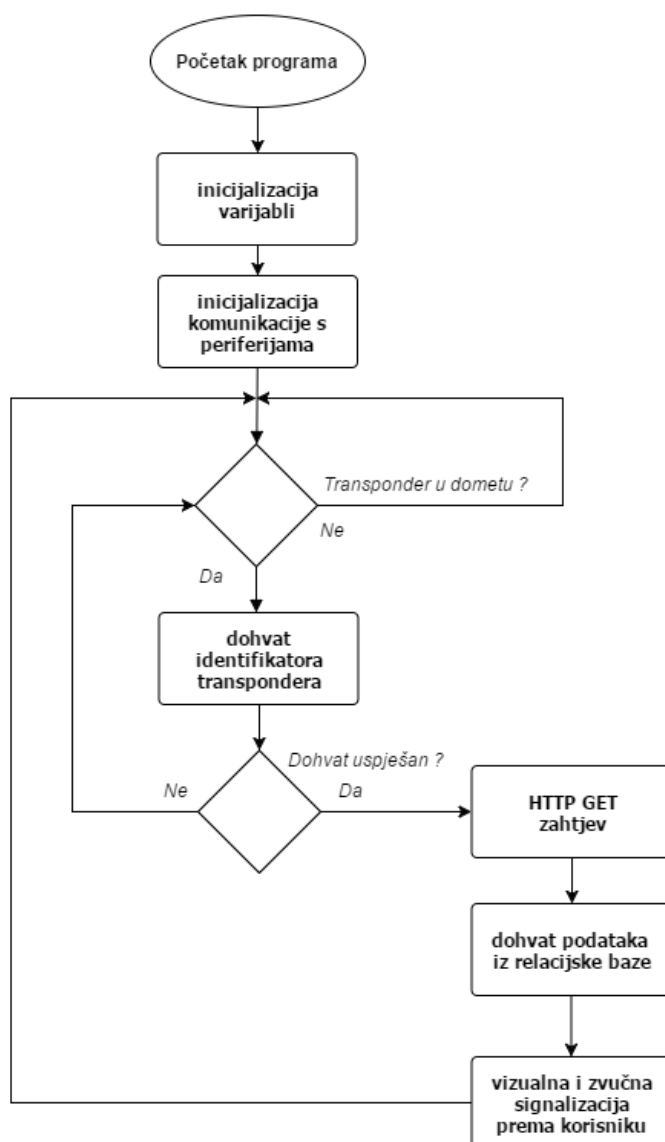
// Enumerate buzzer tones
enum tones {
  INIT_OK,
  GRANTED,
  DENIED,
  CHECK
};

// global variables
int i = 0;
int color; // color status
int sound_tone; // tone status
int card_found; // card status
  
```

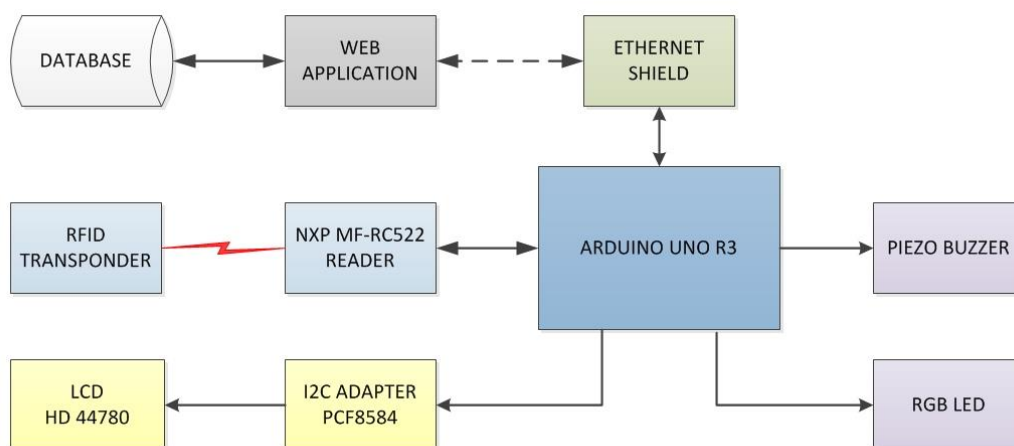
Slika 8 Arduino razvojno sučelje, korištene biblioteke i predefinirane konstante

Programski kod svakog Arduino programa sastoji se od tri glavna dijela: inicijalizacije varijabli, funkcije *setup()* i funkcije *loop()*. Na samom početku programa potrebno je inicijalizirati sve varijable korištene u programu pri čemu je nužno uzeti u obzir da se radi o mikroracunalu s ograničenom količinom programske memorije te je potrebno voditi računa o optimizaciji i tipovima korištenih varijabli. Funkcija *setup()* poziva se isključivo jednom, prilikom pokretanja uređaja, a unutar nje vršimo inicijalizaciju komunikacije s perifernim uređajima. Nakon toga se poziva funkcija *loop()* unutar koje je smješten programski kod koji se vrti u beskonačnoj petlji. Kod programa za Arduino platformu prikazan je blok dijagramom na slici 9, a on obavlja sljedeće funkcionalnosti:

1. Komunikaciju s modulom čitača RFID - provjerava je li transponder u dometu čitača RFID te u trenutku kada se transponder približi čitaču uspostavi komunikaciju i isčitava serijski broj transpondera.
2. Komunikacija s web poslužiteljem - uređaj šalje upit centralnom poslužitelju korištenjem HTTP GET zahtjeva slanjem jedinstvenog identifikatora uređaja u mreži i serijskog broja transpondera, a web poslužitelj kada zaprimi zahtjev vrši njegovu analizu i šalje povratnu informaciju uređaju.
3. Signalizacija korisniku – ovisno o uspješnosti zahtjeva uređaj obavještava korisnika zvučnim i vizualnim signalom te prikazuje poruku na zaslonu LCD displeja.
4. Stanje čekanja - po završetku komunikacije s web poslužiteljem uređaj prelazi u stanje čekanja u kojem se ništa ne događa dok se ne uoči transpoder u dometu čitača.



Slika 9 Blok dijagram implementiranog koda



Slika 10 Prikaz arhitekture kompletnog sustava

Na slici 10 prikazana je arhitektura kompletnog sustava koji pored samog uređaja uključuje i komunikaciju s poslužiteljem putem razvijene aplikacije.

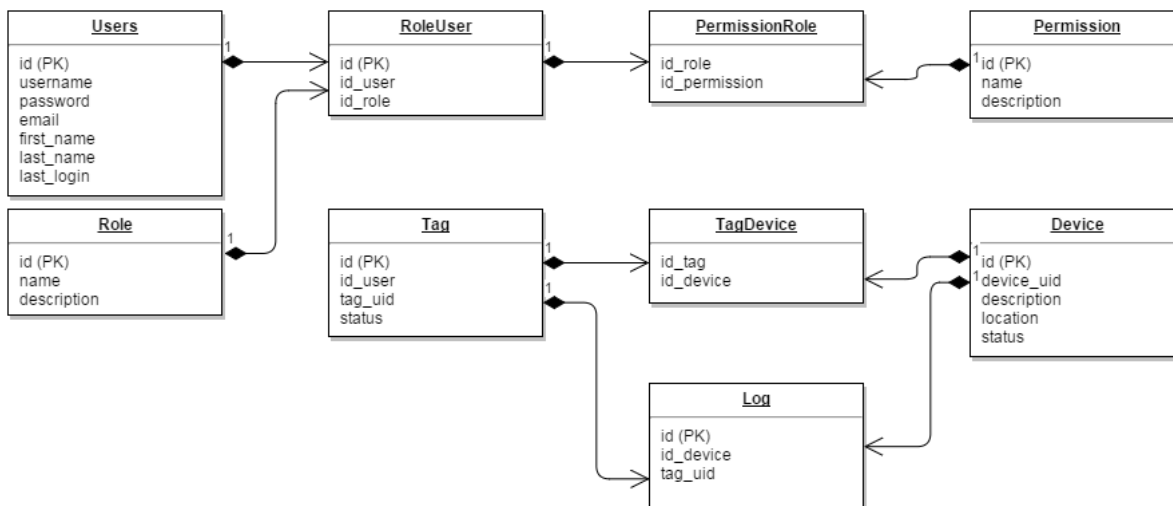
3. Aplikacijska podrška

Osim hardverskog sklopa, druga neizostavna komponenta sustava je web aplikacija koja se sastoji od korisničkog web sučelja te baze podataka u kojoj su pohranjeni svi podaci bitni za funkcioniranje sustava. Web aplikacija je napisana u programskom jeziku PHP, korištenjem Laravel 5 razvojnog okvira [7], dok je korisničko sučelje dizajnirano korištenjem Bootstrap komponenti. Za pohranu podataka korištena je MySQL relacijska baza podataka [8].

U odnosu na desktop aplikacije web temeljeno rješenje pruža daleko veću fleksibilnost, nije potrebna instalacija dodatnog softvera prije uporabe te je moguće ostvariti pristup sustavu sa bilo koje lokacije neovisno o instaliranom operacijskom sustavu ili tipu platforme (računalo, tablet, mobilni telefon). Korisnik se u aplikaciju prijavljuje korištenjem odgovarajućih podataka za pristup, a ovisno o dodjeljenim ovlastima (autorizacijske razine) ima mogućnost pristupa samo određenim dijelovima aplikacije.

Sve web komponente koje su korištene za izradu aplikacije su javno objavljene pod *open-source* licencom kako bi se aplikacija u budućnosti po potrebi mogla nadograđivati. S obzirom na to da se radi o web aplikaciji podrazumijeva se da će ista biti instalirana na web poslužitelju pa je stoga neophodno osigurati da poslužitelj ima instaliranu podršku za PHP i MySQL, pri čemu odabir operativnog sustava nije ključan.

Na slici 11 prikazana je struktura razvijene baze podataka. Za rad s aplikacijom nužno se prijaviti upisivanjem korisničkog imena i lozinke. Ovisno o dodjeljenim pravima u sustavu korisnik može pristupiti pregledu, unosu ili izmjeni podataka o studentima i nastavnicima. Korisnik može upravljati sustavom ovisno o dodijeljenim dozvolama u sustavu. Moguće je definirati više korisničkih uloga s različitim razinama prava upravljanja. Sama aplikacija omogućuje upravljanje korisnicima, grupama korisnika i njihovim ovlastima, upravljanje zapisima te ima mogućnost ispisa odnosno izvoza podataka kako bi se evidencije po potrebi mogle koristiti u drugim aplikacijama.



Slika 11 Struktura razvijene baze podataka

Kako je zamišljeno da svaki laboratorij posjeduje vlastiti čitač u aplikaciju je ugrađena mogućnost upravljanja čitačima tako da je skaliranje sustava iznimno jednostavno. Preduvjet za korištenje sustava je evidentiranje svih korisničkih RFID kartica u aplikaciji, a u tu svrhu koristi se modul upravljanje karticama gdje se evidentira serijski identifikator pojedine kartice i osobni podaci o korisniku. U slučaju gubitka kartice vrlo lako je moguće korisniku izdati novu karticu te ju je potrebno dodjeliti korisniku upisivanjem njezinog serijskog broja.

Pristup podacima pohranjenim u bazu podataka obavlja se putem web aplikacije. Na slici 12 prikazan je primjer liste korisnika koji su se prijavljivali na sustav.

SecuRFID - Zapisi

10 records per page

ID	TAG ID	LOKACIJA	STATUS	VRIJEME	OPCIJE
1	Marko Marković	Glavni ulaz	USPIJEŠNO	2014-06-27 09:02:46	🔍
2	Marko Marković	Glavni ulaz	USPIJEŠNO	2014-06-27 09:03:57	🔍
3	Ante Antić	Glavni ulaz	NEUSPIJEŠNO	2014-06-27 09:03:58	🔍
4	Marko Marković	Glavni ulaz	USPIJEŠNO	2014-06-27 09:03:59	🔍
5	Ivo Ivić	Glavni ulaz	USPIJEŠNO	2014-06-27 09:03:59	🔍
6	Marko Marković	Glavni ulaz	USPIJEŠNO	2014-06-27 09:03:59	🔍
7	Ivo Ivić	Glavni ulaz	USPIJEŠNO	2014-06-27 09:04:42	🔍
8	Ivo Ivić	Glavni ulaz	USPIJEŠNO	2014-06-27 09:08:44	🔍
9	Ivo Ivić	Glavni ulaz	USPIJEŠNO	2014-06-27 09:08:55	🔍
10	Marko Marković	Glavni ulaz	NEUSPIJEŠNO	2014-06-27 09:09:54	🔍

Showing 1 to 10 of 36 entries

Navigation: Previous 1 2 3 4 Next

Slika 12 Prikaz liste zapisa

4. Zaključak

Kroz ovaj rad pokazano je kako se korištenjem relativno jeftinih modula dostupnih na tržištu može razviti uređaj za autorizaciju i autentifikaciju korisnika uz odgovarajući stupanj sigurnosti. Razvijeno rješenje nekoliko je puta jeftinije od komercijalno dostupnih uređaja na tržištu. Korištenje softvera izdanog pod *open-source* licencom omogućuje transparentnu nadogradnju kao i lakši razvoj dodatnih funkcionalnosti koje se mogu implementirati ovisno o potrebi. Sustav je dizajniran na način da ima izrazito jednostavno horizontalno skaliranje te je princip dodavanja novih uređaja i korisnika izuzetno jednostavan. Zbog relativno malih poruka (upita) moguće je posluživati veliki broj udaljenih čitača istovremeno.

Jedan od bitnih ciljeva realizacije ovog projekta je bio omogućiti studentima kroz praktičan rad primjenu stečenih teorijskih znanja kao i stjecanje novih znanja. Primjenom ovog principa studenti se bolje pripremaju za tržište rada i stječu znanja koja su odmah primjenjiva kod poslodavca.

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- [6] <http://playground.arduino.cc/Learning/MFRC522>
- [7] <https://laravel.com/docs/master>
- [8] <https://www.mysql.com/>

Application development for users' authentication and authorization using radio-frequency identification technology

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Abstract. Most of today's access control and time attendance systems are based on radio frequency identification (RFID). These systems use RFID readers, Ethernet networking technology and the TCP/IP protocol for communication with the central server. A database, which is located on the central server, contains information about all users and their access levels. Users' authentication is

done by using contactless RFID cards. In the paper, the principles of RFID technology and its most common applications are described, and so is the hardware used for the device construction. Finally, the developed web application for data acquisition and processing and system administration is presented. This application is made for classroom and laboratory access control, and for logging the time attendance of students and teachers. The device is based on the Arduino Uno platform, and the programming language PHP and a MySQL database were used in the making of the application.

Keywords: *RFID, Arduino, Ethernet, Authentication, Authorization*

Širokopojasni prijenos podataka elektroenergetskim vodovima

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Sažetak. U radu se razmatra širokopojasna telekomunikacijska tehnologija za prijenos podataka elektroenergetskom infrastrukturom. Objašnjava se princip komunikacije elektroenergetskim vodovima (*Power Line Communications*, PLC) i navode se prednosti uporabe ove tehnologije. Naglasak je na odabiru modulacijske sheme za projektiranje PLC sustava i na rješavanju problema elektromagnetske usklađenosti (*electromagnetic compability*, EMC) u skladu s europskim normama. Shema multipleksiranja s višestrukim podnosiocima u frekvencijskoj domeni (*Orthogonal Frequency Division Multiplexing*, OFDM) optimalna je za prijenos širokopojasnih podataka velikim brzinama po vodovima elektroenergetske mreže koristeći frekvencije ispod 100 MHz. Daje se pregled zastupljenosti PLC-a u elektroprivredama te komercijalizacija ove tehnologije u svijetu. Opisuju se prednosti PLC-a u odnosu na druge tehnologije i predviđa se smjer razvoja ove tehnologije.

Ključne riječi: komunikacije elektroenergetskim vodovima (PLC), elektromagnetska usklađenost, modulacije.

1. Uvod

Širokopojasna komunikacija elektroenergetskim vodovima (*Broadband over Power Lines*, BPL) je novija tehnologija koja osigurava prijenosni kapacitet veći od 2 Mbit/s. Postoji niz pilotskih, ali i komercijalnih instalacija BPL-a, kojima se primarno pruža pristup internetu. Neki od implementiranih sustava koriste se i za davanje usluga podrške elektroenergetskoj djelatnosti.

Osim brzog pristupa internetu, razmatra se i govorna komunikacija preko interneta (*voice over IP*). Implementirani BPL sustav omogućava: stalni pristup internetu, pristup postavljanju i skidanju podataka pomoću *HomePlug* modema, uspostavu lokalne mreže brzine veće od 3 Mbit/s po nižim mjesečnim cijenama nego što su za druge širokopojasne usluge. Jednostavna je instalacija opreme i aktivacija usluge. Uz to, nije potrebno dodatno ožičenje u kućanstvu. Postoji automatsko otkrivanje pada i potvrda povratka napajanja, daljinski nadzor i operacije s mogućnošću daljinskog isključenja i uključanja kupaca, učinkovitiji programi upravljanja opterećenjem na mjernom mjestu te automatsko očitavanje brojila.

Izlazak na energetska tržišta s telekomunikacijskom uslugom, predstavlja velik izazov za elektroprivredu jer traži poboljšanje financijskih rezultata, pouzdanosti i sigurnosti, kao i pružanja što boljih usluga korisnicima. Širokopojasni PLC stvara novi izvor prihoda time što nudi širokopojasni pristup internetu, telefoniji i drugim uslugama, postojećim korisnicima električne energije.

Mnogi PLC pokušaji uspješno su dovršeni u Europi, što dokazuje održivost rješenja alternativnih telekomunikacijskih mreža, koristeći već postojeću infrastrukturu.

2. Europske norme i standardi

U komunikacijskim sustavima postoje propisani pravilnici i norme za preciziranje tehničkih svojstva komunikacijskih jedinica, bez obzira na proizvođača. Jedna od prepreka implementaciji i upotrebi PLC tehnologije je spor i dugotrajan razvoj međunarodnih normi i standarda te razlika u standardizaciji. Parametri koji su najvažniji u standardizaciji su najveća dozvoljena snaga prijenosa i dozvoljeni frekvencijski pojas kako bi se ograničila interferencija s drugim telekomunikacijskim uslugama i spriječilo gušenje ovog malog signala unutar elektroenergetske mreže. Europska zajednica za elektrotehničku standardizaciju (CENELEC) izdala je regulative koje su usko vezane uz komunikaciju na niskonaponskim električnim instalacijama. [1] Prema istim određene su sljedeće norme:

- EN50065-1 norma regulira osnovne zahtjeve, frekvencijske pojaseve i elektromagnetske smetnje
- EN50065-4-2 norma regulira niskonaponski filter i zaštitne mjere
- EN50065-7 - regulira impedancije uređaja.

Pri projektiranju PLC modema važno je definirati frekvencijski opseg za prijenos signala. Primjerice, u Sjevernoj Americi se ne koristi radio frekvencijski pojas od 150 do 350 kHz te je prema tome FCC razvio standard koji dozvoljava frekvencijski pojas u rasponu od 100 do 450 kHz. Istovremeno, u Japanu se koriste frekvencije od 10 kHz do 450 kHz. Prema CENELEC-u na europskom tržištu definiran je EN50065-1 standard koji dozvoljava uže područje, od 3 do 148.5 kHz (tablica 2.1.).

Tablica 2.1 Podjela frekvencija prema CENELEC EN50065-1 [1]

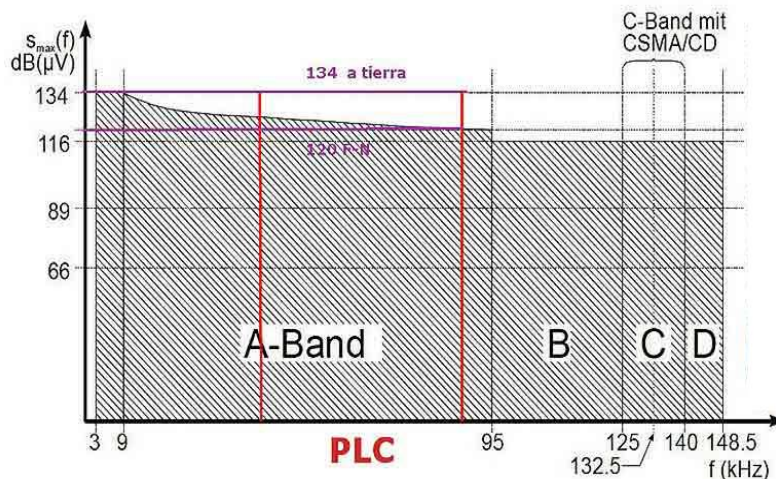
Pojas	Frekvencije	Namjena
	(3 - 9) kHz	Aplikacije distributera
A	(9 - 95) kHz	Aplikacije distributera i njihovih suradnika
B	(95 - 125) kHz	Privatne aplikacije (unutar objekta) bez ograničenja
C	(125 - 140) kHz	Privatne aplikacije (unutar objekta) uz korištenje protokola
D	(140 – 148.5) kHz	Privatne aplikacije (unutar objekta) bez ograničenja

Maksimalni izlazni nivoi (naponi) u rasponu od 9 kHz do 150 kHz za jednofazne uređaje prikazani su u tablici 2.2. Mjerenje mora biti učinjeno u skladu sa CISPR 16 publikacijom, koja uključuje detektor kvazi vrhunca te mjerenje u trajanju jedne minute na određenim točkama na CISPR umjetnoj mreži.

Tablica 2.2 Raspodjela frekvencija i maksimalnog prijenosnog nivoa prema CENELEC EN50065-1 [1]

Frekvencijski pojas	Maksimalni prijenosni nivo	Način primjene
(9 - 95) kHz	134 dB [μV]	
(95 – 148.5) kHz	116 dB [μV]	uređaji opće namjene
(95 – 148.5) kHz	134 dB [μV]	posebni uređaji (industrijske aplikacije)

CENELEC norma (slika 2.1.) ne definira modulacijsku shemu ni brzinu prijenosa, ali uski frekventni pojas može rezultirati smanjenjem kapaciteta komunikacijskog kanala i brzine prijenosa podatka. Također, veća je vjerojatnost da se uslijed šumova i slabljenjem signala dodatno smanji brzina ili u potpunosti prekine prijenos podatka.



Slika 2.1 Frekvencijski pojas i razina signala po EN50065

Izvor: [http://blog.bioelectronica.es/nuevos-contadores-de-la-luz-analisis-de-electromog/\(10.02.2016.\)](http://blog.bioelectronica.es/nuevos-contadores-de-la-luz-analisis-de-electromog/(10.02.2016.))

3. Obrada signala i multipleksni sustavi

Pod pojmom modulacije ili moduliranja smatra se proces mijenjanja električnog signala koji sadrži informaciju prijenosa. Kod moduliranja mijenja se jedan ili više parametara pomoćnog signala ovisno o signalu koji prenosi informaciju. Pomoćni signal zove se prijenosni signal ili nositelj. Veliki je broj modulacijskih tehnika koje se koriste ili su se koristile u PLC tehnologijama. Među njima prevladavaju amplitudna digitalna (*Amplitude Shift Keying*, ASK) i frekvencijska digitalna modulacija (*Frequency Shift Keying*, FSK).

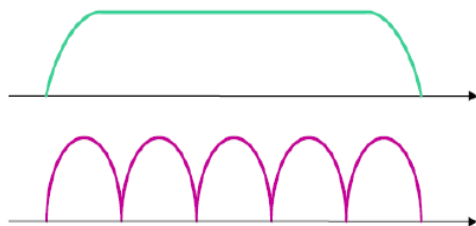
Korištenje navedenih modulacija rezultira brzinom prijenosa signala do 19.2 kbps (kilobita po sekundi), ali zbog prigušenja i smetnji na energetske mreži postiže se brzina prijenosa od svega nekoliko kbps. Važno je napomenuti da navedene modulacije u potpunosti zadovoljavaju sve CENELEC norme. Maksimalne brzine prijenosa koje se mogu ostvariti iznose 200 kbps. Dakle, izbor modulacije nije jednostavan i prvenstveno ovisi o konkretnoj aplikaciji. Najčešće korištene modulacije su ortogonalno frekvencijsko multipleksiranje (*Orthogonal Frequency Division Multiplexing*, OFDM) i raspršeni spektar s izravnim nizom (*Direct-Sequence Spread Spectrum*, DSSS).

Frekvencijska modulacija s ortogonalnim multipleksiranjem (*Orthogonal Frequency Division Multiplexing*, OFDM) omogućava veliku brzinu prijenosa podataka zadržavajući pri tome složenost i točnost prenesenih podataka. Kod prijenosa podataka velikim brzinama problem za prijenos predstavljaju propadi u kanalu te zbog toga nije moguće obnoviti podatke upotrebom običnog, jednostavnog prijemnika. [10]

Nadalje, ta činjenica rezultira potrebom da se koriste složeni prijemnici koji se koriste složenim računskim postupcima u svrhu procjene prijenosnog kanala, tj. Ujednačavanja, da bi se uz pomoć procjene obnovile informacije. OFDM modulacija pojednostavljuje problem ujednačavanja na način da pretvara frekvencijski selektivni kanal u „ravni“ kanal. [6] Prednost OFDM modulacije je činjenica da umjesto jednog istodobno koristi više nositelja (slika 3.1.).

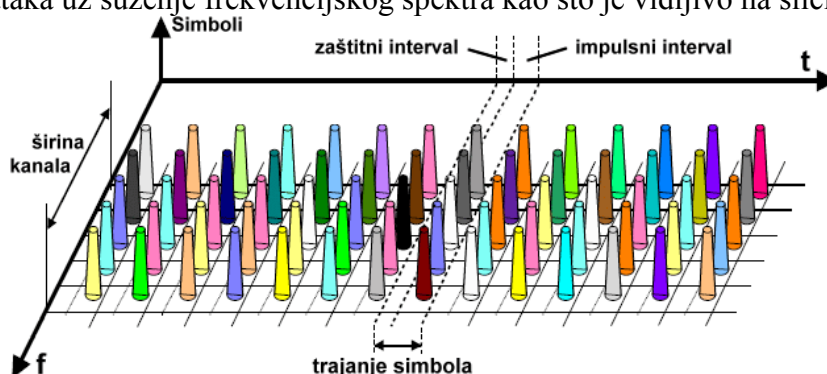
Serijski slijed podataka velike brzine prijenosa razdijeli se na nekoliko paralelnih sljedova i svaki od tih paralelnih sljedova manje je brzine i zasebno modulira jednog od više nosilaca. Nastali modulirani signali zauzimaju manju širinu pojasa i svaki od nastalih moduliranih signala smješta se u zasebni pojas. Podaci se prenose na paralelni način uz pomoć više nosilaca. Zbog relativno male širine pojasa svakog od više moduliranih signala, promjene frekvencijske prijenosne karakteristike komunikacijskog kanala unutar pojasa svakoga

moduliranog signala male su, što rezultira zanemarivim smetnjama između simbola. OFDM modulacija se također koristi u sustavima za brzi prijenos podataka telefonskom linijom (*Asymmetric Digital Subscriber Line*, ADSL), a predviđena je i za digitalnu televiziju.



Slika 3.1 Prikaz OFDM modulacije - korištenje više nosioca umjesto jednog [4]

Dakle, možemo reći da OFDM modulacija kojom se više signala različitih kompleksnih frekvencija (međusobno sinkronih i ortogonalnih) kombinira u jedan i tako povećava propusnost podataka uz suženje frekvencijskog spektra kao što je vidljivo na slici 3.2.



Slika 3.2 OFDM presjek

Izvor: <http://www.informatics.buzdo.com/extras/dvb.htm> (01.06.2015.)

Tehnika raspršenog spektra (*Direct Sequence Spread Spectrum*, DSSS) predstavlja modulaciju signala koji nosi informaciju na način da koristi pseudo slučajni niz koji je nezavisan od signala informacije. Rezultat je raspršivanje spektra signala na šire frekvencijsko područje od početne širine spektra signala. Prije prijenosa spektar signala se „raspršuje“ dok se na prijemnoj strani sažima (skuplja). Raspršivanje signala uz pomoć pseudo slučajnog niza omogućuje korištenje medija za prijenos elektromagnetskih valova od strane većeg broja korisnika zbog male snage signala.

Zanimljiva je i spoznaja da zbog velikog broja mogućih različitih pseudo slučajnih kodova, prisluškivanje nije moguće, što je interesantno u mnogim sektorima, a posebice za vojne primjene. Prednost DSSS tehnike činjenica je da je raspršeni spektar otporniji na uskopojasni šum i ometanje signala te da je takav spektar slabije primjetan od uskopojasnog. DSSS metoda izvediva je u analognoj i digitalnoj domeni.

3.1. Odabir modulacijske sheme za projektiranje PLC sustava

Prigušenje kanala i šum određuju kapacitet koji se koristi za komunikacije. Procjena kapaciteta kanala za elektroenergetske *linkove* ukazuje isplativim prijenos podataka puno većim brzinama od dosadašnjih. Da bi se razvili sustavi s velikim kapacitetom kanala potrebno je pažljivo odabrati modulacijsku shemu i prilagoditi je za optimalni PLC sustav jer se povećanje brzine podataka ne može ostvariti povećanjem pojasne širine ili dodjeljivanjem novih frekvencijskih područja. To znači da se samo uporabom sofisticiranijih modulacijskih shema može poboljšati iskoristivost spektra ili odgovarajućom adaptacijskom strategijom povećati otpornost na impulсни šum i povećati brzina prijenosa podataka. Prvo je potrebno

usporediti parametre modulacijskih shema koje dolaze u obzir za pronalaženje optimalnog rješenja za PLC sustav. To su:

- tehnike raspršenog spektra (*Spread Spectrum Techniques, SST*)
- shema s jednim širokopojasnim nosiocem, bez ujednačivača (ekvalizatora)
- shema s jednim širokopojasnim nosiocem i ujednačivačem
- shema s više širokopojasnih nosioca i s ujednačivačem
- shema višestrukog prijenosa s frekvencijskom raspodjelom (kanala) i ortogonalnim nosiocima (*Orthogonal Frequency Division Multiplexing, OFDM*).

Kriteriji odabira najpogodnije modulacijske sheme su:

- iskoristivost spektra - izražena brojem bitova u sekundi koji se mogu ubaciti u 1 Hz pojasne širine primjenom određene modulacije, tj. $bit/(s \cdot Hz)$
- maksimalna brzina prijenosa podataka $Mbit/s$
- otpornost na kanalna izobličenja
- otpornost na impulsni šum
- svojstva fleksibilnosti i prilagodbe
- cijena sustava
- elektromagnetska kompatibilnost (EMC).

Tehnike raspršenog spektra odlikuju se imunošću na selektivno prigušenje i na sve vrste uskopojasnih smetnji (interferencija) uzrokovanih djelovanjem neželjenih signala u komunikacijskom sustavu, malom iskoristivošću spektra (što je nepovoljno zbog ograničenih spektralnih resursa, pa je u PLC tehnologiji cilj postići maksimalnu iskoristivost spektra) i niskom spektralnom gustoćom snage što je pogodno s gledišta elektromagnetske kompatibilnosti (tablica 3.1.). Osim toga, višestruki pristup mediju može se ostvariti s kodiranom raspodjelom po vremenu i frekvenciji, CDMA (*Code Division Multiple Access*), bez globalne koordinacije ili sinkronizacije.

Tablica 3.1 Usporedba različitih metoda prijenosa za komunikaciju elektroenergetskim vodovima [9]

Modulacijske sheme	spektralna učinkovitost [b/(sHz)]	maksimalna brzina prijenosa podataka [Mb/s]	otpornost na kanalna izobličenja	otpornost na impulsni šum	svojstva fleksibilnosti i prilagodljivosti	troškovi sustava	EMC
SST	< 0.1	~ 0.5	-	0	--	--	+
shema s 1 širokopojasnim nos. bez ekv.	1 - 2	< 1	--	+	--	++	--
shema s 1 širokopojasnim nos. s ekv.	1 - 2	~ 2	+	+	0	-	-
shema s više širokopojasnih nos.s ekv.	1 - 4	~ 3	+	0	0	-	0
OFDM	>> 1	> 10	++	0	++	-	+

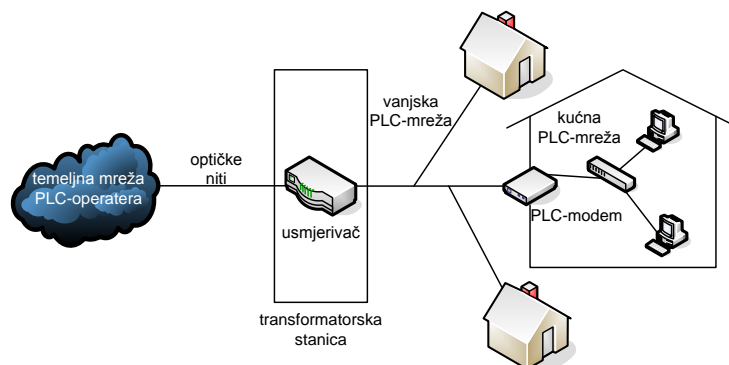
4. Širokopojasna komunikacija elektroenergetskim vodovima

Komunikacije vodovima elektroenergetske mreže su zanimljive operatorima elektroenergetske mreže jer je osnovna ideja da se širokopojasni podaci optičkim nitima prenose iz mreže do transformatorskih stanica odakle se dalje razvode vodovima elektroenergetske mreže do krajnjih korisnika, kao što je prikazano na slici 4.1.

PLC mreža između transformatorske stanice i PLC modema na području korisnika naziva se vanjska (*outdoor*) PLC mreža dok se ona u kući krajnjeg korisnika naziva unutarnja (*indoor*). Komunikacija preko elektroenergetske mreže zahtijeva velike brzine i domet prijenosa (*Broadband Power-line, BPL*). BPL radi na principu slanja podataka pomoću radiovalova preko elektroenergetskih vodova.

Signal se pretvara u bežični signal i s električnog stupa usmjeren je prema modemu koji se nalazi u korisnikovom domu. BPL daje umreženi dom bez potrebe za novim ožičavanjem.

Visokobrzinski pristup internetu elektroenergetskim vodovima, kako je pokazalo istraživanje FCC-a, pruža korisnicima usluge poput e-pošte, internet telefoniranja i drugih usluga. [3]



Slika 4.1 Topologija pristupne mreže realizirana PLC-om

Razlikujemo dvije vrste BPL tehnologija: pristupni BPL (*Access BPL*) implementiran nad vanjskom PLC mrežom i BPL unutar zgrade (*In-building BPL*) implementiran nad kućnom PLC mrežom.

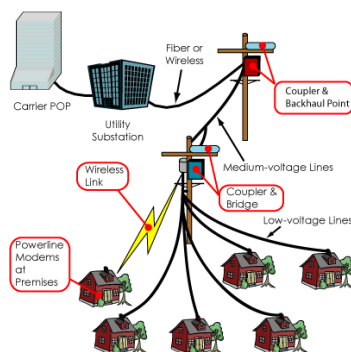
Danas pristupni BPL podržava prijenos podataka brzinom do 45 Mbita/s u oba smjera. Pristupni BPL, slično kao i mreža kabela televizije, predstavlja dijeljeni medij te je potrebno ograničiti broj korisnika pristupnog BPL-a po svakoj transformatorskoj stanici kako bi se agregatna brzina dijelila s manjim brojem. Osnovna mana pristupnog BPL-a je nedostatak standarda i normi na svjetskoj razini. [3]

Širokopojasni PLC (*Broadband over Power Lines, BPL*) u realizaciji nailazi na probleme premoštenja transformatora, interferenciju, neprilagođenost električnih vodova za prijenos visokofrekventnih signala, sigurnost itd. Elektroenergetski transformatori namijenjeni su transformaciji napona frekvencije 50/60 Hz, uz funkciju frekvencijskog filtra. Prema tome, transformatori ne propuštaju signale koji su frekvencije od nekoliko desetaka MHz što je ključni razlog zašto transformatore treba premostiti za visokofrekventne signale. Taj postupak zahtijeva značajna financijska sredstva. Npr., u Europi se s jednog transformatora napaja i do nekoliko stotina domaćinstava, u SAD-u se s jednog transformatora napaja od jednog do deset domaćinstava, dok Japan koristi jedan transformator za 30 kućanstava. Dakle, jasno je da bi u Europi prijenos sa srednjenaponske mreže na niskonaponsku mrežu do krajnjeg korisnika ekonomski gledano bio najisplativiji.

Nadalje, pojavljuje se problem atenuacije (pojava slabljenja jakosti zvučnih ili elektromagnetskih signala zbog pretvaranja dijela njihove energije u druge oblike energije) visokofrekventnih signala i izrazitih šumova. Činjenica je da vodovi nisu oklopljeni i iz tog razloga se ponašaju kao antene. BPL koristi frekvencije na kojima je pozicioniran kratkovalni radio i niži dio visokofrekvencijskog područja (*Very High Frequency, VHF*) što je razlog zbog kojeg bi BPL potencijalno mogao stvarati smetnje radioamaterima, vojsci i aviokompanijama. [4] Ta činjenica je razlog odustajanju od uvođenja BPL tehnologije. Jedan od načina da se riješi radio interferencija je upotreba mikrovalnih frekvencija u rasponu od 2 do 20 GHz i brzine od 216 Mbit/s. To je rezultiralo izbjegavanjem interferencije s frekvencijama radioamatera, ali može se dogoditi interferencija s frekvencijama radio astronoma od 13 MHz do 275 GHz i brojnim industrijskim i medicinskim uređajima (*Industrial Scientific and Medical, ISM*). [4]

Napon visokonaponskih vodova kreće se između 155 i 765 kV što je neprikladno za prijenos podataka jer je previše „bučan“, tj. rezultira šumovima. Struje koje teku vodovima ne vibriraju na konstantnoj frekvenciji i direktno uzrokuju pojavu interferencije, šumovi će se pojavljivati na istoj frekvenciji koju koristi signal što će oštetiti ili u potpunosti uništiti signal koji je prvobitno poslan.

BPL topologija zaobilazi ovaj problem na način da u potpunosti izbjegava visokonaponske vodove. Sustav šalje podatke i signale optičkim kabelima na prihvatljivije srednjenaponske vodove vrijednosti 7200 V. Nakon što se signal prebaci na srednjenaponske vodove podaci mogu putovati daleko, sve do faze degradacije. Kako bi se to spriječilo ugrađuju se posebni uređaji na vodove koji su služe kao „repetitori“. Repetitori uzimaju signal i ponavljaju ga u novoj seriji prijenosa, pojačavajući ga za sljedeću etapu prijenosnog puta. Uređaj na slici 4.2. (*coupler*) omogućuje signalu prijenos vodom izbjegavajući transformator koji transformira naponsku razinu s 7200 V na 240 V, uobičajen za kućanstva. Jednostavno ne postoji način da signali male snage prođu kroz transformator i zato se koristi navedena spojnica (*coupler*) koja šalje signal izbjegavajući transformator.



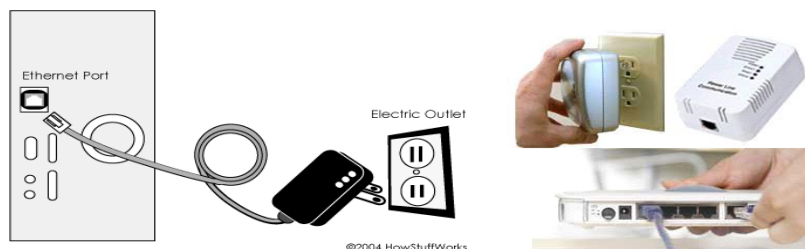
Slika 4.2 BPL topologija mreže

Izvor: http://spvp.zesoi.fer.hr/seminari/2006/DokmanicIvan_BroadbandOverPowerlines.pdf
(25.02.2016.)

Zahvaljujući spojnicama signali i podaci se mogu prebacivati između srednjenaponskih (SN) i visokonaponskih (VN) vodova do krajnjeg korisnika. Međutim, potrebno je prikazati na koji način se signal implementira unutar domaćinstva.

Tu ulogu preuzima dalekovodni modem (*Powerline modem*, BPL modem), uređaj koji se priključi u utičnicu i ima zadatak da primi signal s niskonaponskih vodova. BPL modemi koriste silikonske čipove koji su posebno dizajnirani da uspješno obrađuju radno opterećenje električne struje i iz nje izvuku „čisti“ signal i podatke koji su poslani.

Upotrebom novih tehnika modulacije i prilagodljivih algoritama realizacije, BPL modemi su sposobni kontrolirati signal i upravljati šumom elektroenergetskog voda na širokom spektru. BPL modemi (slika 4.3.) su približno veličine običnog mrežnog adaptera. Priključeni su na kućnu utičnicu, a klasičan Ethernet kabel povezan sa stolnim računalom ili laptopom završava konekciju do krajnjeg korisnika. Naravno, podržana je i bežična konekcija s modemom.



Slika 4.3 Prikaz BPL modema i njegove konekcije

Izvor: http://spvp.zesoi.fer.hr/seminari/2006/DokmanicIvan_BroadbandOverPowerlines.pdf
(25.02.2016.)

Ispituje se širokopojasni pristup internetu putem postojeće niskonaponske mreže, širokopojasni prijenos elektroenergetskim vodovima (*broadband power lines*, BPL). To je sustav koji korisnicima pruža pristup internetu velikom brzinom preko NN utičnice, što je

pokazao pilot-projekt u rezidencijalnoj četvrti Greenway Plaza. Sustav nudi jedan i po put brži pristup internetu od onog kojeg pružaju kabelski modemi.

Najnovija istaživanja pokazuju da su električni vodovi sposobni prenijeti digitalne podatke približno istim brzinama kao i DSL (*digital subscriber line*), koji koristi već postojeće telefonske linije.

DSL tehnologija zahtijeva sustav preklopnika, posebnu vrstu uređaja koji se ugrađuju kao poveznica ADSL modema i ostatka sustava telekomunikacijskog operatera – tzv. DSLAM, koju telekomunikacijski operater mora ugraditi u svoju mrežu da bi se omogućio protok veće količine podataka preko bakrenih parica, a udaljenost kućnog priključka znatno utječe na kvalitetu prijenosa (s većom udaljenošću brzina prijenosa pada). Međutim, u odnosu prema klasičnim bakrenim paricama, električne instalacije za opskrbu kućanstava električnom energijom prisutna je u kućama pa se komunikacijska infrastruktura, tzv. „strujni internet“ brzo razvija, posebice u rurarnim sredinama gdje nema širokopojasnog pristupa.

PLC tehnologiju možemo podijeliti s obzirom na razinu napona elektroenergetske mreže na: niskonaponski PLC (do 400 V), srednjenaponski (do 35 kV), visokonaponski (iznad 35 kV) i na PLC na električnim instalacijama zgrade.

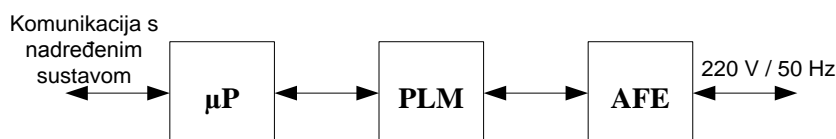
Tablica 4.1 Klasifikacija PLC-a prema načinu primjene [5]

Kriterij	Klasifikacija PLC-a
Naponski nivo EE voda na kojem se primjenjuje	Niskonaponski (NN) PLC (na vodovima napona do 400 V)
	Srednjenaponski (SN) PLC (na vodovima napona do 50 kV)
	Viskonaponski (VN) PLC (na vodovima napona od 50 kV do 400 kV)
	PLC na električnim instalacijama zgrade
Područje primjene	Za energetske PLC usluge (TK usluge za potrebe elektroprivredne djelatnosti)
	Za pristupne PLC usluge (TK usluge u pristupnim mrežama)
	Za kućne PLC usluge
Brzina komunikacije	Uskopojasni PLC (brzina prijenosa informacija reda veličine do stotinjak kbit/s)
	Širokopojasni PLC (brzina prijenosa informacija reda veličine do Mbit/s)

Što se tiče podjele s obzirom na komunikacijske brzine razlikujemo uskopojasni PLC (brzina prijenosa informacija i podataka reda veličine do stotinjak kbit/s) i širokopojasni PLC (brzina prijenosa informacija i podataka reda veličine izraženih u Mbit/s).

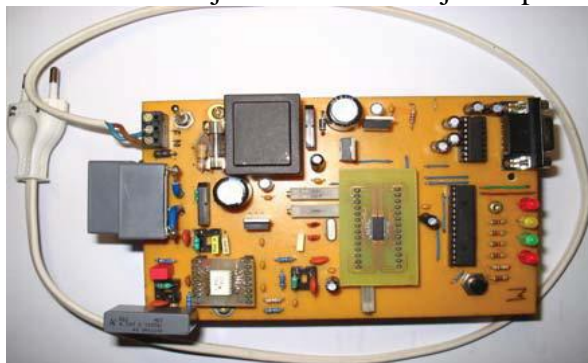
Uskopojasni PLC radi u frekvencijskom opsegu do 140 kHz. Frekvencijski opsezi 9 - 95 kHz, 125 - 140 kHz dodijeljeni su za uskopojasni PLC od strane CENELEC-a. Koristi se za: daljinsko očitavanje brojila (*Automatic meter reading*, AMR) električnih, plinskih, vodovodnih; kontrolu udaljenih uređaja (ulične rasvjete); nadzor i kontrolu proizvodnje i potrošnje električne energije; dinamičko tarifiranje; automatizaciju domova i poslovnih zgrada (automatizaciju regulacije grijanja i klima uređaja, regulaciju osvjetljenja u sobama, osiguranje i alarmiranje i dr.). Koristi se u sustavima s jednostavnim upravljanjem pomoću kratkih naredbi pa se time umanjuje važnost brzine prijenosa modema kao najvažnijeg parametra. [2]

Danas je na tržištu prisutan veliki broj različitih modema s dva različita pristupa za obavljanje procesa modulacije i demodulacije. Jedni za modulaciju i demodulaciju koriste specijalni integrirani krug prikazan na slici 4.5.



Slika 4.5 Shema PLC modema

Mikroprocesor (μP) ima funkciju komunikacije prema nadređenom sustavu (npr. upravljačko računalo) i upravljanje modemom (*Power Line Modem*, PLM) koji pretvara digitalni signal u analogni i obratno definiranim modulacijskim/demodulacijskim postupkom.



Slika 4.6 Uskopojasni PLC modem

Izvor: TG_1_2_2009_Sumiga_Hudjek_Koristenje_energetskih_vodova_u_svrhu_komunikacije.pdf

Analogni start (*Analog Front End*, AFE) je sklop koji se nalazi između PLM i energetske mreže i služi za galvansko odvajanje signala od visokog napona. Dakle, odlazni signal injektira se na elektroenergetski da bi se, što je više moguće, očistio (isfiltrirao) dolazni signal za točniju pretvorbu u digitalni oblik.

Drugi način realizacije modulacije i demodulacije je da modemi koriste digitalne signale (*Digital Signal Procesore*, DSP) tako da softver obavlja proces modulacije i demodulacije. Razlika u ova dva pristupa je u tome što DSP zamjenjuje mikroprocesor dok programski algoritmi obrade signala povećavaju fleksibilnost modema.

Uskopojasni modemi koriste se u SAD-u i Europi dugi niz godina. Glavne prednosti su im jednostavnost u realizaciji te činjenica što su usklađeni sa zakonskim regulativama i normama. Najveći nedostatak je relativno uzak frekvencijski pojas i mala brzina komunikacije.

Širokopojasni PLC još uvijek je u fazi ispitivanja i nije potpuno standardiziran. Radi u frekvencijskom opsegu od 1.6 do 30 MHz i predstavlja dijeljeni medij što znači da smanjuje brzinu po korisniku. Širokopojasni PLC treba omogućiti: pristup internetu i prijenos podataka jako velikim brzinama, video za zahtjev (VoD), govornu komunikaciju preko IP protokola (VoIP) i kućne PLC usluge (štednja energije, alarmni sustavi, upravljanje kućanskim aparatima).

IPTV (*Internet Protocol Television*) služi za distribuciju TV programa u stvarnom vremenu korištenjem širokopojasnih IP mreža. VoD (*Video on Demand*) koristi se za distribuciju video sadržaja preko širokopojasnih IP mreža na zahtjev korisnika i u vrijeme koje korisnik postavi. VoIP predstavlja integraciju konvencionalnih telefonskih servisa s različitim (*Internet Protocol*) aplikacijama zasnovanim na IP protokolu.

Potražnja za širokopojasnim modemima raste i zbog razloga što se na ovaj način mogu ponuditi raznolike usluge za korisnike. Sklopovski i programski su složeniji od uskopojasnih modema i omogućavaju puno veće brzine rada. Tradicionalna telekomunikacijska pristupna mreža sastoji se, uglavnom, od kabela s neoklopljenim upredenim paricama (*Unshielded Twisted Pair*, UTP). Više od 95 % takvih lokalnih petlji, u Hrvatskoj i u svijetu, sastoji se od jedne upredene parice koja podržava tradicionalnu fiksnu analognu govornu telefonsku uslugu (*Plain Old Telephone Service*, POTS) [8].

Paralelno s razvojem interneta tijekom devedesetih godina prošlog stoljeća razvijen je i koncept širokopojasne digitalne mreže integriranih usluga (*Broadband Integrated Services Digital Network*, B-ISDN).[7] Granica između uskopojasne (*narrowband*) i širokopojasne

komunikacije postavljena je na 2 Mbit/s (u SAD-u na 1,5 Mbit/s), tj. na brzinu veću od brzine primarnog pristupa ISDN-u (*ISDN Primary Rate Access*, ISDN PRA).

Međutim, naknadno je ta granica pomaknuta prema nižim brzinama, tj. na 144 kbit/s koliko iznosi podatkovna brzina osnovnog pristupa ISDN-u (*ISDN Basic Rate Access*, ISDN BRA).

Na početku 21. stoljeća širokopojasni pristup internetu (engl. *broadband Internet access*) postao je jedna od ključnih smjernica suvremenih telekomunikacija. Širokopojasni pristup internetu nije više isključivo mjera tehnološke razvijenosti nekog društva, već govori i o njegovom razvoju u cjelini.

4.1. Širokopojasni pristup vodovima elektroenergetske mreže

Komunikacije vodovima elektroenergetske mreže su posebno zanimljive operatorima distribucijske elektroenergetske mreže poput, npr., Hrvatske elektroprivrede (HEP). Osnovna ideja PLC-a je da se širokopojasni podaci optičkim nitima prenose iz jezgrene mreže do transformatorskih stanica, od kojih se razvode vodovima elektroenergetske mreže do krajnjih korisnika (slika 4.1.1).



Slika 4.1.1 Prikaz integriranih širokopojasnih PLC modema [5]

Već dulje vrijeme postoje standardi za uskopojasni prijenos podataka PLC-om. Prijenosni PLC sustavi, kreirani sukladno tim standardima, uglavnom služe za upravljanje elektroenergetskim postrojenjima na daljinu i rade u niskom području frekvencija (spektar signala seže do 500 kHz). Prijenosne brzine u tim sustavima kreću se do nekoliko desetaka kbit/s.

5. ZAKLJUČAK

Ideja komunikacije preko elektroenergetske mreže nije nova. Prednost korištenja elektroenergetske mreže u komunikacijske svrhe je njena rasprostranjenost. Za razliku od telekomunikacijske mreže koja je dobro rasprostranjena u razvijenim državama, elektroenergetska mreža pokriva gotovo sva naseljena područja i u razvijenim državama, ali i u državama u razvoju. Međutim, nedostatak je što je elektroenergetska mreža projektirana primarno za prijenos električne energije. Za razliku od vodova predviđenih za prijenos informacija nije zaštićena od elektromagnetskog zračenja. Do ozbiljnijeg prijenosa podataka preko elektroenergetskih vodova prihvatljivim brzinama trebalo je pričekati tehnološki razvoj brzih mikroprocesora, digitalnih procesora i specijalnih mikročipova za primjenu modulacijskih tehnika. Oni u stvarnom vremenu ostvaruju složene modulacijske postupke za pouzdan prijenos signala. Dakle, proizvodi se sve više uređaja koji koriste PLC tehnologiju i shodno tome organiziraju se međunarodni skupovi u cilju promoviranja i bržeg širenja i prihvaćanja PLC tehnologije.

Prepreka u razvoju PLC-a je sam medij. Elektroenergetski vodovi su, osim što posjeduju jake smetnje generirane od svih priključenih potrošača, predviđeni za prijenos energije, ali ne i za prijenos telekomunikacijskih signala. Suvremene modulacijske tehnike i protokoli uspješno

rješavaju probleme brzine komunikacije. Modemi kojima se realizira PLC mogu se svrstati u dvije osnovne grupe: jednostavnije uskopojasne (*Narrowband*) koje imaju manje brzine prijenosa uglavnom za upravljačke podatke i širokopojasne (*Broadband*) koje velikim brzinama prenose različite vrste upravljačkih i korisničkih informacija.

U ovom se radu analizira i procjenjuje pogodnost četiri modulacijske sheme (tehnike raspršenog spektra, sheme s jednim širokopojasnim nosiocem bez ujednačivača, sheme s jednim širokopojasnim nosiocem sa ujednačivačem, sheme s više širokopojasnih nosilaca s ujednačivačem za uporabu u PLC sustavima. Usporedbena analiza tih shema obavljena je na osnovi sljedećih kriterija: spektralne iskoristivosti, maksimalne brzine prijenosa podataka, otpornosti na kanalna izobličenja, otpornosti na impulsni šum, svojstva fleksibilnosti i adaptivnosti, cijene sustava i elektromagnetske kompatibilnosti. Rezultati ove analize pokazuju da shema OFDM ispunjava ključne zahtjeve koji se postavljaju na PLC sustav (velika spektralna iskoristivost, velike brzine prijenosa i otpornost na kanalna izobličenja). Stoga predloženo PLC rješenje sadrži dvije transmisijske tehnike temeljene na dva različita fizička sloja: jedna se temelji na *wavelet* – *OFDM PHY*, a druga na *Fast Furier Transform* – *OFDM PHY*.

Projektiranje PLC komunikacijskog sustava za veće podatkovne brzine zahtijeva u prvom redu poznavanje karakteristika kanala kao što su prijenosna funkcija, otpornost na interferenciju i kapacitet kanala. Drugim riječima, pri projektiranju treba prvo postaviti/odabrati odgovarajući model kanala elektroenergetskog voda. Međutim, projektiranje komunikacijskog kanala za prijenos po elektroenergetskomvodu na visokim frekvencijama veoma je zahtjevno (takvi kanali nikad prije nisu bili projektirani).

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Broadband data transmission through power lines

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Abstract. This paper considers the broadband telecommunications technology used to transfer data via existing electrical power infrastructure. The paper explains the principle of communication via power lines (Power Line Communications, PLC) and closely examines the benefits of using this technology. The emphasis is on selecting a modulation scheme for the design of PLC systems and finding the solution for problems with electromagnetic compatibility (electromagnetic compability, EMC) in accordance with European standards. The paper concludes with the scheme of multiplexing multiple applicants in the frequency domain (Orthogonal Frequency Division Multiplexing, OFDM), optimized for broadband transmission of high-speed data lines on the electricity network using frequencies below 100 MHz. The representation of the PLC in power systems and companies is shown in a practical overview alongside with an insight into the commercialization of technology in the world. The paper also points out the advantages of PLC in relation to other technology, and considers the direction of its future development..

Key words: *communication power lines (PLC), electromagnetic compatibility, modulation*

Komunikacija elektroenergetskim vodovima: tehnologija Internet stvari

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Sažetak. Internet stvari (*Internet of Things*, IoT) je globalna infrastruktura za informacijsko društvo. Svaki element Interneta stvari naziva se *stvar* i treba imati jedinstvenu IP adresu. Stvari mogu biti objekti stvarnog svijeta ili virtualni objekti. U radu se analiziraju neke od predloženih definicija Interneta stvari. Objašnjava se značenje i identifikacija *stvari*. Razmatranja u ovom radu su usredotočena na tehnologiju komunikacije elektroenergetskim vodovima (*Power line Communication*, PLC) koja može također biti upotrijebljena pored već postojećih bežičnih komunikacijskih tehnologija (Wi-Fi, ZigBee, Bluetooth, 6LowPAN i drugo) za podržavanje aplikacija IoT -a. Ova razmatranja uključuju: osnovnu ideju, frekvencijsko područje sustava i njegove aplikacije. Potom se razmatraju norme za PLC (IEEE 1901) koje definiraju prijenos podataka preko elektroenergetskih vodova. Rad obuhvaća dvije osnovne norme: niskofrekvencijsku uskopojasnu (*Low - Frequency Narrowband*, LF-NB) i širokopojasnu (*Broadband over Power Line*, BPL).

Ključne riječi PLC, Internet stvari, komunikacijska tehnologija, aplikacija, PLC norme

1. Uvod

Razvoj informacijske i komunikacijske tehnologije (*Information and Communication Technology*, ICT) rezultirao je, između ostalog, značajnim razvojem, proizvodnjom i primjenom bežičnih osobnih uređaja kao što su pametni telefoni, osobna računala, tableti, dlanovnici i drugo. Budući da su ovi uređaji dizajnirani za rad putem IP mreža, broj uređaja povezanih na Internet eksponencijalno raste. Tako je 2011. broj povezanih uređaja bio veći od broja ljudi [5]. Predviđa se da će do 2020. približno 100 milijardi objekata (stvari), označenih na jedinstven način, biti povezano s Internetom [5]. Povezivanje milijarde različitih objekata zahtjevan je zadatak za istraživače s izrazitim utjecajem na ljude u smislu poboljšanja kvalitete njihova života. To je dovelo do potrebe definiranja novog koncepta Interneta poznatog pod nazivom Internet stvari (*Internet of Things*, IoT) i budući Internet (*Future Internet*).

Naziv Internet stvari prvi put spominje David Brock [1]. Nakon simpozija *Electronic Product Code* u Chicagu 2003. koriste ga znanstvenici i stručnjaci u konceptu u kojem su stvari (fizikalni objekti) stvarnog svijeta bežično integrirane s objektima virtualnog svijeta informacijske tehnologije.

Vizija Interneta stvari uključuje dodjeljivanje identifikatora kao što su IP adresa i radiofrekvencijska identifikacijska elektronička oznaka (*Radio Frequency Identification*

electronic tag, RFID electronic tag) svakoj pojedinoj stvari, putem vlastitog jedinstvenog identifikatora (*Unique Identification, UID*). Naziv IoT, prema tome, odnosi se na umreženo povezivanje različitih fizikalnih objekata (npr. senzor, uređaj, brod, stablo, kuća, pas, stol, knjiga, odijelo, jelo, lijek i dr.) s virtualnim objektima informacijske tehnologije. Povezivanje objekata temelji se na uporabi bežičnih i žičnih komunikacijskih tehnologija i normi za podržavanje aplikacija IoT.

Razmatranja u ovom radu usredotočena su na tehnologiju komunikacije elektroenergetskim vodovima (*Power Line Communication, PLC*) i norme za podržavanje aplikacija IoT-a. U drugom dijelu rada analiziraju se različite definicije Interneta stvari, objašnjava se značenje i načini identifikacije stvari kao i neke aplikacije IoT-a. Povijesni podaci razvoja komunikacije elektroenergetskim vodovima, osnovna ideja, frekvencijsko područje rada i napredne modulacijske sheme PLC-a prezentirane su u trećem dijelu rada. Četvrti dio rada donosi kratke opise dviju osnovnih normi PLC-a (niskofrekvencijska uskopojasna i širokopojasna) kao i primjera aplikacija koje se temelje na tim normama. Na kraju rada dani su zaključci.

Cilj rada je ukazati na mogućnost uporabe tehnologije PLC-a za podržavanje aplikacija Interneta stvari na dobrobit krajnjih korisnika i operatora elektroenergetske mreže, primjerice Hrvatske elektroprivrede (HEP-a).

2. Internet stvari: definicije i aplikacije Interneta stvari, značenje i identifikacija stvari

Polazi se od analize različitih definicija Interneta stvari postavljenih iz konceptijskog i infrastrukturnog gledišta. Objašnjava se što je *stvar* i tehnologije označavanja stvari: radiofrekvencijska identifikacija (RFID) / elektronički kôd proizvoda (*Electronic Product Code, EPC*). Potom se navode primjeri aplikacija IoT-a.

2.1. Definicije Interneta stvari

Naziv Internet stvari prvobitno se odnosio se na arhitekturu koja sadrži sljedeće elemente [2]:

- pasivne radiofrekvencijske identifikacije (*Passive Radio Frequency Identification, RFID*), odnosno labele s “*read only*” čipovima u kojima su pohranjeni jedinstveni identifikatori svakog pojedinog objekta (stvari),
- čitače RFID uključene u lokalni (računalni) sustav, koji čitaju i prenose identitete (uobičajeno serijski broj) objekata preko radijskih linkova,
- lokalni sustav, temeljen na povezivanju protokolom IP, koji prikuplja informacije o stvarima kodirane kodom EPC koristeći protokol ONS (*Object Naming Service*),
- servere EPCIS (*EPC Information Services*) koji obrađuju dolazne zahtjeve ONS i vraćaju datoteke PML (*Physical Markup Language*), primjerice, dokumente XML koji nose značajne informacije vezane na RFIDs.

Ovo viđenje Interneta stvari pokazuje da se na Internet stvari gleda samo s tehnološkog, infrastrukturnog gledišta i da ono ne pokriva sve aspekte Interneta stvari. Iz radova koji opisuju IoT vidi se da su predložene definicije IoT-a u sadašnje vrijeme mnogo opširnije i sadržajnije.

Navedimo predloženu definiciju u skupu europskih istraživačkih projekata o Internetu stvari. “*Internet stvari povezuje objekte realnog svijeta s virtualnim svijetom*” omogućujući povezivanje u bilo koje vrijeme, na bilo kojem mjestu, za bilo što, a ne samo za bilo koga.

To se odnosi na svijet „gdje fizikalni objekti i bića kao i virtualni podaci i okolina uzajamno djeluju u istom prostoru i vremenu“ [3] (slika 1). Iz ove se definicije vidi da ona ne sadrži detaljan opis infrastrukture. IoT je definiran kao koncept.



Slika 1 Prikaz Interneta stvari

Izvor: <http://www.stantontelecom.com/smart-home-and-care-technology/> (15.11.2015.)

Postoje različite definicije Interneta stvari, različitih eksperata i udruga koje se mogu svrstati u dvije skupine obzirom na gledište iz kojega su postavljene. To uključuje:

infrastrukturno gledište, pri čemu se IoT definira kao infrastruktura koja pruža mnogobrojne tehnološke mogućnosti,

pojmovno (konceptijsko) gledište, gdje se IoT ne smatra tehničkim terminom (ne odnosi se na infrastrukturu IoT-a) već konceptom ili fenomenom.

Infrastrukturno gledanje vidi IoT kao globalni sustav međusobno povezanih računalnih mreža koji koristi TCP/IP Internet Protocol suite za komuniciranje. Konceptijska perspektiva vidi IoT kao svjetsko logičko međusobno povezivanje računala i mreža koje podržava izmjenu informacija između korisnika i djelovanje na osnovu tih informacija (uključuje uređaje, podatke, procese i ljude, tj. pretvara informacije u akcije). Treba napomenuti da su neki eksperti predlagali hibridne definicije IoT-a, pri čemu se na Internet stvari gleda kao na uslužni (aplikacijski) koncept i infrastrukturu, tj. iz hibridne perspektive.

Međutim, Međunarodna telekomunikacijska udruga, Sektor telekomunikacijske normizacije, Studijska skupina 13 (International Telecommunication Union, Telecommunication standardization sector, Study Group 13, ITU-T SG 13) predlagala je kratku definiciju kao koncept umjesto tehničke definicije (dug ili detaljan opis tehnologije), da bi IoT bio lako uključen u različita područja tehnologije i prihvaćen od svih drugih zainteresiranih studijskih skupina [4]. U sadašnje vrijeme ITU-T (Recommendation Y.2060) definira IoT kao “globalnu infrastrukturu za informacijsko društvo koja omogućuje napredne usluge međusobnim povezivanjem (fizikalnih i virtualnih) stvari temeljem postojećih i razvijajućih, interoperabilnih informacijskih i komunikacijskih tehnologija”.

Može se zaključiti da IoT nije tek proširenje današnjeg Interneta. On predstavlja skupinu povezanih inteligentnih sustava, omogućuje donošenje pametnih rješenja i koristi niz tehnologija uključujući tehnologije mjerenja, komuniciranja, umrežavanja, računanja, obrade informacija te inteligentnog nadzora i/ili upravljanja.

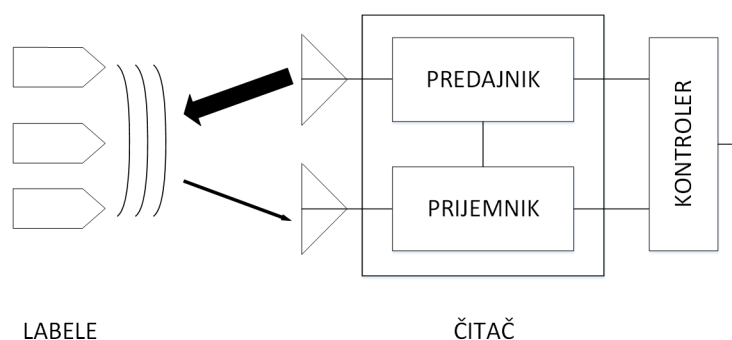
2.1. Značenje i identifikacija stvari

Naziv *stvar* može se odnositi na različite objekte (stvari) ovisno o domeni (društvo, okoliš, industrija) u kojoj se koristi. U društvu, primjerice, u zdravstvenoj njezi upotrebljavaju se pametni fiziološki senzori (stvari) za mjerenje krvnog tlaka i temperature tijela, za praćenje razine glukoze i razine kisika u krvi i sl.. U okolišu, primjerice, u pametnim kućama i zgradama sve više se koristi pametno mjerenje i upravljanje potrošnjom energije; mjerenje, nadzor i podešavanje temperature, vlažnosti i svjetlosti, pri čemu se koriste različiti senzori (stvari). Sve stvari u tim domenama mogu međusobno komunicirati uporabom automatskih uređaja povezanih s bežičnim mrežama (Zigbee, Bluetooth, 6LoWPAN, WiFi).

Svaka stvar treba imati jedinstvenu oznaku (identifikator), a složene stvari sastavljene iz većeg broja dijelova trebaju imati veći broj oznaka, zbog adresiranja, ovjere njihovog identiteta i međusobne komunikacije. Stvari se uobičajeno označavaju s dodijeljenim identifikacijskim brojevima, imenima i/ili lokacijskim adresama. Informacije o stvarima uobičajeno su kodirane uporabom jedinstvene oznake (*Unique Identification*, UID) i/ili elektroničkog koda (*Electronic Product Code*, EPC), pohranjuju se (uobičajeno) u elektroničke oznake (labela) (*Radio-frequency identification*, RFIDs) i čitaju uporabom čitača RFID. EPC je jedinstveni identifikacijski kôd koji koristi, poput bar koda, numerički sustav za identifikaciju proizvoda; općenito se smatra slijedećom generacijom tradicijskog bar koda.

Oznake RFID omogućuju automatsku identifikaciju svega čemu su dodijeljene i djeluju kao elektronički bar kôd. Pasivne oznake RFID, za razliku od aktivnih čitača RFID, nemaju baterijsko napajanje, nego koriste snagu signala čitača RFID. Pasivne oznake RFID upotrebljavaju se u transportu, primjerice, u karticama za naplaćivanje cestarine, u bankovnim karticama, u lancima snabdijevanja robom, u trgovinama na malo. Glavna primjena aktivnih oznaka RFID je u lučkim kontejnerima, u svrhu praćenja brodskog tereta i punjenja kontejnera. U kontejnere su ugrađeni ultrazvučni senzori koji odašilju informacije o razini punjenja i njihovoj težini. Kada se dostigne određena razina punjenja kontejnera postupak se automatski zaustavlja.

Napomenimo da su beskontaktna pametne kartice (*contact smart cards*, SCs) sofisticiranije u usporedbi s labelama RFID. Kartica SC sadrži mikroprocesor (malo računalo) što omogućuje računanje, dvosmjernu komunikaciju uključujući mogućnost šifriranja i druge jake sigurnosne mogućnosti te pohranu informacija. Međutim, kartica SC omogućuje izmjenu informacija na manjim udaljenostima (tipično 5 cm) i skuplja je od labela RFID.



Slika 2 Sustav RFID: uspostava radiokomunikacijskog kanala između RFID čitača i labela

Radiokomunikacijski kanal između RFID čitača i labela u kojoj su pohranjene specifične informacije o proizvodu (datum proizvodnje, rok uporabe, ime proizvođača, zemlja porijekla) uspostavlja se na slijedeći način (slika 2.). Kada labela RFID prolazi unutar definiranog područja čitač generira elektromagnetske valove. Antena integrirana s labelom prima taj signal i aktivira čip u labeli. Pri tom se uspostavlja bežični komunikacijski kanal između čitača i labela omogućujući prijenos podataka pohranjenih u labeli [4].

Tehnologija RFID i senzorska tehnologija sve više se koriste u proizvodnim lancima, zbog povećanja kontrole kvalitete proizvoda, poboljšanja logistike i korisničke usluge. Očekuje se da će RFID i srodne tehnologije biti kamen temeljac dolazećeg budućeg Interneta stvari. Dok su prve aplikacije tehnologije RFID razvijene radi zamjene bar koda u trgovinama na malo i u logistici, razvoj aktivnih komponenata učinit će da ova tehnologija bude mnogo više od jednostavne identifikacijske sheme.

2.2. Aplikacije Interneta stvari

Postoji više aplikacija i usluga IoT-a koje utječu i utjecati će na život ljudi. Njihov se utjecaj ogleda [5]:

- u izgradnji *pametnih kuća* i *zgrada* svijesnih svih zbivanja u njima i oko njih (pretežno glede mjerenja i učinkovitosti potrošnje struje, plina i vode, sigurnosti ljudi i imovine te udobnosti boravka u njima), pri čemu se koriste inteligentna brojila i senzori (stvari) povezani primjerice, u kućnu mrežu (*Home Area Network*, HAN),
- u izgradnji *pametnih gradova* (*smart cities*) što uključuje slijedeće aplikacije: sustav upravljanja prometnim tokom u kombinaciji s dinamičkom kontrolom prometne rasvjete; kontrolu ulične rasvjete; putnički informacijski sustav za javni prijevoz; pasivni nadzor kao što je integrirani javni nadzor koji se temelji na uporabi sustava digitalnog video nadzora visoke razlučivosti, sustava prepoznavanja lica i drugo,
- u zdravstvenoj njezi – posebice starijih i nemoćnih osoba u njihovim domovima i bolnicama uporabom aplikacije “*e – Health*”; ova aplikacija omogućuje praćenje zdravlja (npr. fitnesa) putem umreženih pametnih telefona s RFID senzorskim mogućnostima kao platformom za praćenje vitalnih tjelesnih parametara (temperature, pulsa, krvnog tlaka, razine glukoze i razine kisika u krvi te drugo),
- u pametnom upravljanju proizvodnjom i distribucijom energije, pri čemu se upotrebljavaju pametna mjerila i pametne mreže,
- u industriji uključujući nadzor i upravljanje proizvodnim procesima te kontrolu kvalitete proizvoda,
- u transportu što uključuje uporabu inteligentnog transportnog sustava, odnosno transportne aplikacije kao što je, primjerice, “*e - vehicle*” koja omogućuje navigaciju vozila, sigurnost na cestama te nadzor i upravljanje prometom,
- u obrazovanju, primjerice, u uporabi aplikacije *udaljeni laboratorij*, čime se tehnologija Interneta stvari integrira u nastavni proces; ova aplikacija omogućuje ne samo pristup laboratoriju i upravljanje izvana preko nekog komunikacijskog medija i izvan njegovog radnog vremena, nego i bolje iskorištavanje laboratorijskih resursa kao i povećavanje kvalitete učenja.

Može se nabrojiti još primjera aplikacija IoT-a a i još mnogo novih aplikacija će se razvijati u budućnosti. Mogućnost uporabe postojeće elektroenergetske infrastrukture za podržavanje aplikacija IoT - a dodatna je prednost za krajnjeg korisnika i PLC – operatora. To je također razlog za intenzivniji rad na primjeni tehnologije PLC i u našoj zemlji. Iz navedenih primjera aplikacija IoT-a može se zaključiti da one mogu mijenjati način funkcioniranja društva i uvelike utjecati na kvalitetu života u bliskoj budućnosti.

3. Komunikacije elektroenergetskim vodovima

Tehnologija PLC-a je alternativna pristupna komunikacijska tehnologija koja koristi elektroenergetske vodove za prijenos komunikacijskih signala. Pristupna PLC dopunjava postojeće bežične pristupne komunikacijske tehnologije (WiFi, Zigbee, Bluetooth, Ethernet i drugo) na tržištu. Rezultati ispitivanja relevantnih parametara elektroenergetskog voda u Europi i svijetu pokazuju da se može ostvariti istodoban prijenos komunikacijskih signala i elektroenergetskog vala elektroenergetskim vodovima unatoč izrazitim razlikama između

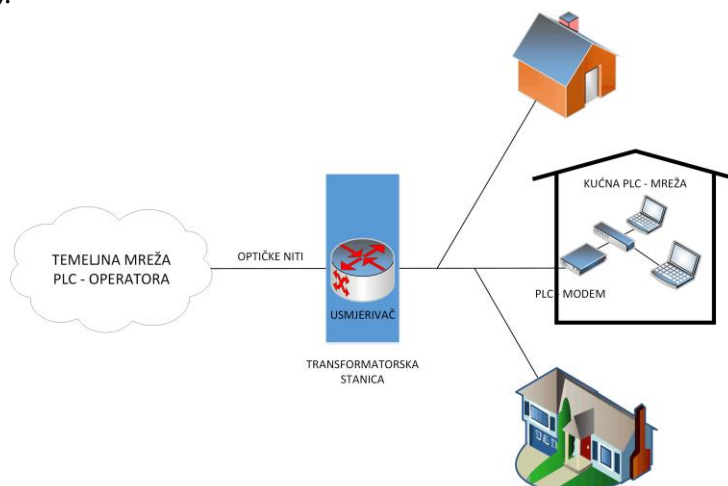
njih. Razlike se ogledaju u topologiji, strukturi i fizikalnim svojstvima elektroenergetskih vodova u usporedbi s konvencionalnim prijenosnim medijima u telekomunikacijama kao što su bakrene parice, koaksijalni i optički kabeli. Razlike postoje i u načinu zaštite tih vodova. Elektroenergetske vodove treba štititi od kratkih spojeva, telekomunikacijske od prenapona. Uporaba elektroenergetskih vodova za prijenos širokopojasnih podataka pruža višestruke prednosti korisnicima i operatorima elektroenergetske mreže.

3.1. Povijesni podaci, osnovna ideja i frekvencijsko područje rada

Razvoj tehnologije PLC-a započeo je sredinom prošlog stoljeća razvojem relejne tehnologije PLC-a. U osmom desetljeću prošlog stoljeća počinje istraživanje mogućnosti uporabe tehnologije PLC-a za podržavanje jednosmjernog prijenosa podataka, a desetak godina poslije kreću i prva ispitivanja dvosmjernog prijenosa podataka. Kronološki slijed razvoja ove tehnologije bio je slijedeći:

- 1950. tehnologija PLC-a se primjenjuje, ali u početku podržava samo uskopojasne aplikacije za udaljeno relejno upravljanje, primjerice, javnom rasvjetom; komunikacija je jednosmjerna, frekvencija 10 Hz, a izlazna snaga predajnika 10 kW,
- sredinom 1980-ih godina počinju istraživanja mogućnosti uporabe elektroenergetskih vodova za jednosmjerni prijenos podataka u frekvencijskom području između 5 i 500 kHz,
- 1997. kompanije Ascon u Švicarskoj i Norweb u Velikoj Britaniji izvršile su prva ispitivanja dvosmjernog prijenosa podataka preko elektroenergetske mreže,
- 2000. prva ispitivanja dvosmjernog prijenosa podataka primjenom tehnologije PLC-a obavile su kompanije EDF i Ascon u Francuskoj,
- skupina normi IEEE 1901, koja definira prijenos podataka preko elektroenergetskih vodova, objavljena je 2011. – 2012. [4].

Osnovna ideja PLC-a je da se širokopojasni podaci prenose optičkim nitima iz temeljne telekomunikacijske mreže do transformatorskih stanica od kojih se razvode vodovima elektroenergetske mreže do krajnjih korisnika (slika 3.). Mreža PLC-a između transformatorske stanice i PLC modema instaliranog na korisničkom području naziva se vanjska (*outdoor*) ili pristupna (*access*) mreža PLC, a ona u *privatnim/poslovnim* zgradama unutarnja (*indoor*).



Slika 3 Topologija pristupne mreže ostvarene uporabom elektroenergetskih vodova

Prijenos elektroenergetskim vodovima znači istodoban prijenos visokofrekvencijskog niskoenergetskog informacijskog signala i niskofrekvencijskog elektroenergetskog vala na visokim energetske razinama. Da bi se osigurala koegzistencija i odvajanje tih dvaju sustava, frekvencijsko područje koje se koristi za komunikacije treba biti udaljeno od

područja za prijenos elektroenergetskog vala. Tako se frekvencijsko područje od 3-148.5 kHz upotrebljava za podržavanje aplikacija uskopojasne PLC (*Narrowband PLC, NB - PLC*) tehnologije, a od 1-30 MHz za aplikacije širokopojasne PLC (*Broadband PLC, BLC*) tehnologije.

Naziv PLC odnosi se na svaku tehnologiju koja omogućuje prijenos podataka elektroenergetskim vodovima uporabom naprednih modulacijskih shema. U današnje vrijeme u tu svrhu upotrebljavaju se dvije napredne modulacijske sheme:

- Multipleksiranje s frekvencijskom raspodjelom ortogonalnih podnosilaca, (*Orthogonal Frequency Division Multiplexing, OFDM*) gdje se upotrebljava veći broj ortogonalnih podnosilaca umjesto jednog nosioca u kanalu.
- Raspršeni spektar (*Spread Spectrum, SS*) pri čemu se prijenosni signal (val nosilac) raspršuje preko kanala veće pojasne širine u usporedbi s osnovnom pojasnom širinom koja se zahtijeva za prijenos.

Drugim riječima, pri primjeni modulacije SS, koristi se istodobno veći broj frekvencija unutar frekvencijskog pojasa za prijenos jednog signala. Na taj način interferencija, koja se često događa samo na nekim frekvencijama, ima neznatan utjecaj na prijenos signala.

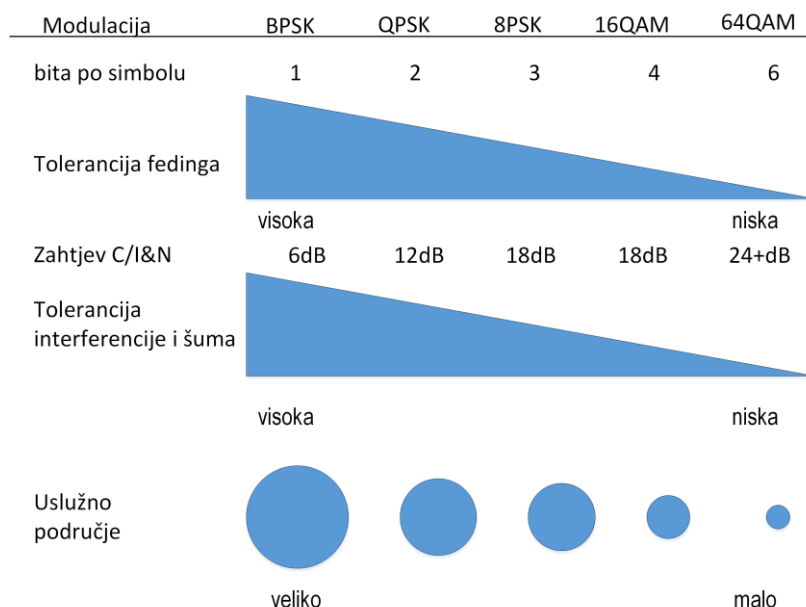
3.2. Digitalne modulacije

Sve digitalne modulacijske tehnike, na neki način manipuliraju istim elementima prijenosnog signala, što uključuje: amplitudu, frekvenciju i fazu. Odabir modulacijske tehnike temelji se na zadovoljavanju unaprijed postavljenih kriterija, pri čemu se ostvaruju željene prednosti na račun "žrtvovanja" drugih prednosti kao što su: zahtijevana pojasna širina, maksimalna podatkovna brzina, složenost digitalnog kruga, robusnost i zahtijevana snaga signala s obzirom na šum i interferenciju u kanalu, da bi prijemnik mogao točno rekonstruirati preneseni informacijski signal. Omjeri koji definiraju zahtijevanu snagu su C/N (*Carrier to Noise*), C/I (*Carrier to Interference*) i energija po bitu u odnosu na šum, E_b/N (*Energy per bit relative to Noise ratio*).

Količina podataka koju treba prenijeti stalno se povećava pa moderna digitalna komunikacijska oprema ima sve veće zahtjeve glede propusnosti kanala. Frekvencijski spektar postaje sve zagušeniji, stoga su potrebne napredne modulacijske tehnike da bi se postigla željena propusnost u uskopojasnim kanalima. Faza i amplituda kao modulacijske karakteristike pri tom se implementiraju na složenije načine da bi se povećala propusnost kanala. Tako se ostvaruje niz složenih digitalnih modulacija: BPSK (BiPhase Shift Keying); QPSK (Quadrature Phase Shift Keying); 8PSK (8 Phase Shift Keying); 16 QAM (16 Quadrature Amplitude Modulation) i 64QAM (64 Quadrature Amplitude Modulation).

Jednostavna modulacija je veoma robusna, ali s robusnošću dolaze oštra ograničenja kapaciteta kanala. Robusnost složenih sustava koji koriste složene modulacije (BPSK, QPSK, 8PSK, 16QAM, 64 QAM) je manja, imaju veći potencijalni kapacitet, ali zahtijevaju veću gustoću snage signala na prijemniku, da bi prijemnik točno rekonstruirao preneseni informacijski signal. Složena modulacija također zahtijeva veću snagu za učinkovito pokrivanje istog područja signalom u usporedbi s jednostavnom modulacijom, ali osigurava veću propusnost u danom kanalu (slika 4.). Ako se odabere odviše složena modulacija (primjerice, 64 QAM) sustav može imati oštra ograničenja glede područja pokrivanja, odnosno veoma malo uslužno područje.

U najgorem slučaju učinkovita komunikacija je nemoguća preko željenog područja pokrivanja svakog predajnika, zbog velikih pogrešaka u prijenosu [6].



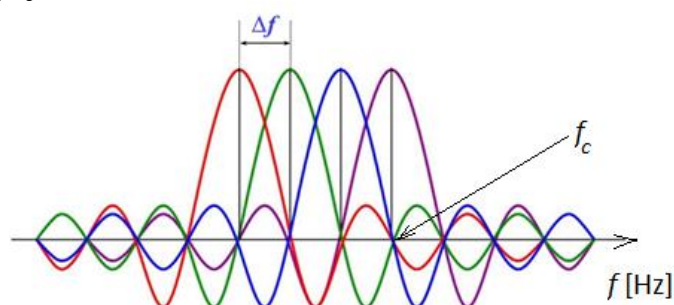
Slika 4 Usporedba modulacija: BPSK, QPSK, 8PSK, 16QAM i 64QAM

Izvor: http://cdserv.wbut.ac.in/81-312-0046-9/Ebook/Olexa_eBook.pdf

U modemu PLC-a, instaliranom u kući korisnika (slika 3.), uobičajeno se upotrebljavaju napredne modulaicijske sheme OFDM i SS.

3.2.1. Multipleksiranje s frekvencijskom raspodjelom ortogonalnih podnosilaca

U prijenosu podatkovnog signala primjenom modulaicijske sheme OFDM upotrebljava se veći broj ortogonalnih podnosilaca s pripadnim uskim frekvencijskim pojasevima umjesto jednog uskopojasnog nosioca unutar kanala (slika 5.). To znači da se raspoloživi frekvencijski pojas kanala dijeli na veći broj podkanala, pri čemu svaki podkanal ima svoj vlastiti modem (modulator/demodulator). Takav se prijenos može ostvariti, ako je zadovoljen uvjet ortogonalnosti podnosilaca, odnosno ako je frekvencijski razmak Δf između dva susjedna podnosioca jednak recipročnoj vrijednosti trajanja (T) simbola OFDM, $\Delta f = 1/T$. Napomenimo da se u prijenosu podatkovnog signala binarni informacijski simboli ("0" i "1") prvo preslikavaju u OFDM simbole uporabom OFDM modulatora u svakom podkanalu, a potom OFDM simboli moduliraju podnosiocce. Svaki se ortogonalni podnosilac može neovisno modulirati primjenom, primjerice, signala QPSK ili QAM što ovisi o odabranoj podatkovnoj brzini prijenosa.



Slika 5 OFDM: prikaz raspodjele podnosilaca u frekvencijskoj domeni

Izvor: <http://www.revolutionwifi.net/revolutionwifi/2015/3/how-ofdm-subcarriers-work>

Iz slike 5. se vidi, da se frekvencijski spektri podkanalnih podnosilaca prekrivaju, ali su razmaci Δf između podnosilaca jednaki. To znači da je uvjet ortogonalnosti podnosilaca zadovoljen. Iz slike 5. također se vidi da snaga informacijskog signala na centralnoj frekvenciji (f_c) pojasa podnosioca u svakom podkanalu poprima vršnu vrijednost kada je

snaga susjednih signala u promatranom podkanalu jednaka nuli. Može se zaključiti da su osnovne prednosti primjene OFDM-a:

- velika spektralna učinkovitost, što vodi većim prijenosnim brzinama,
- velika fleksibilnost glede prilagodbe raspoloživoj pojasnoj širini kanala,
- manja osjetljivost na višestazni *fading* (*multipath fading*), tj. na slučajan, statistički, vremenski ovisan efekt dodatnog slabljenja signala na propagacijskoj stazi; to je veoma korisno u tipičnom zemaljskom propagacijskom okolišu s različitim preprekama na propagacijskoj stazi gdje dolazi do refleksija signala; prenošeni signal zbog toga stiže u prijemnik stazama različitih duljina što ima za posljedicu izobličenje prijemnog signala.

Kako se svaki ortogonalni podnosilac može neovisno modulirati, modulacija se može odabrati za svaki podnosilac (podkanal) ovisno o *fedingu* u okolišu propagacijske staze. Implementacija ove fleksibilnosti dodaje složenost sustavu, ali omogućuje maksimalnu propusnost kanala, zbog mogućnosti dinamičkog prilagođavanja frekvencijskom *fedingu* kanala. Što je tehnologija prijenosa i prijema sofisticiranija svaki bit postaje uži, a time pojasna širina sve veća.

Tehnika OFDM-a primjenjuje se i u bežičnim telekomunikacijskim mrežama temeljenim na normama IEEE 802.11a, IEEE 802.11g, IEEE 802.16 i IEEE 802.20. Napomenimo da proizvođači opreme temeljene na vlasničkim OFDM rješenjima nude različite razine složenosti opreme što ovisi o proizvođaču i namjeni opreme. Treba naglasiti da se u implementaciji OFDM-a u opremi temeljenoj na normama IEEE 802.11a i IEEE 802.11g koristi ista modulacija na svim podnosiocima. OFDM, zbog svoje fleksibilnosti i spektralne učinkovitosti, sve više se koristi kao osnova normiranih žičnih i bežičnih podatkovnih komunikacijskih tehnologija kao i vlasničkih normi proizvođača.

4. Norme komunikacija elektroenergetskim vodovima

Donošenje opće prihvaćenih normi koje pokrivaju IoT i PLC tehnologije izrazito je važno, jer vlasnička rješenja i norme fragmentiraju industriju. Normizacija uređaja, mreža i aplikacija omogućuje globalna rješenja za bešavni rad i smanjuje troškove. U ovom dijelu rada prezentirane su dvije osnovne PLC norme iz grupe normi IEEE 1901: širokopojasna (*Broadband over Power Line*, BPL) i niskofrekvencijska uskopolasna (*Low Frequency Band*, LF – NB).

4.1. Širokopojasna norma i niskofrekvencijska uskopolasna norma

Skupina PLC normi IEEE 1901, objavljena 2010 - 2012. , specificira prijenos podataka preko elektroenergetskih vodova, odnosno podržava aplikacije IoT-a. Postoje dvije osnovne norme: širokopojasna (BPL) i niskofrekvencijska uskopolasna (LF - NB).

Norma BPL IEEE 1901 dizajnirana je za uporabu u širokom području aplikacija IoT-a kao što su: pametna energija (Smart Energy, SE), transport, privatne i poslovne lokalne mreže (Local Area Networks, LAN-s) i drugo. Umreženi proizvodi sukladni s normom IEEE 1901 omogućit će podatkovne brzine veće od 500 Mb/s u aplikacijama lokalnih mreža kao i udaljenosti do 1500 m u aplikacijama prve/posljednje milje. Tehnologije specificirane s normom IEEE 1901 koriste napredne modulacijske tehnike OFDM i SS za prijenos podataka preko standardnih elektroenergetskih vodova bilo kojeg napona na prijenosnim frekvencijama manjim od 100 MHz. Tako će PLC biti, između ostalog, dopuna bežičnim lokalnim mrežama (Wireless Area Networks, WLAN-s) i omogućiti linkove kroz zidove i druge radiofrekvencijske prepreke kao i veće udaljenosti u usporedbi s normalnim dosegom bežičnih mreža. U hotelima i drugim višekatnim zgradama PLC će biti također dopuna bežičnoj mreži prenoseći multimedijske podatke preko većih udaljenosti i osiguravajući bežični završetak komunikacijskog linka posljednjih nekoliko metara [7].

Norma IEEE P1901.2 za LF – NB PLC objavljena je 2012. Ova je norma dizajnirana radi specificiranja sigurne komunikacije elektroenergetskim vodovima na podatkovnim brzinama do 500 kb/s i prijenosnim frekvencijama manjim od 500 kHz. Norma IEEE P1901.2 podržava aplikacije pametne mreže kao što su kućno umrežavanje (home area networking), rasvjeta, komunikacije solarnim pločama (solar – panel communications) i drugo. Ova norma osigurava koegzistenciju s BPL uređajima minimizirajući izvanpojasne emisije na frekvencijama većim od 500 kHz [8].

5. Zaključak

U radu se razmatra tehnologija komunikacije preko elektroenergetskih vodova kao jedna od pristupnih komunikacijskih tehnologija za podržavanje aplikacija Interneta stvari. Polazi se od analize različitih predloženih definicija Interneta stvari postavljenih iz infrastrukturnog i/ili pojmovnog (konceptijskog) gledišta. Zaključuje se da Internet stvari nije tek proširenje današnjeg Interneta, nego globalna infrastruktura za informacijsko društvo. Potom se objašnjava značenje termina *stvar*, načini označavanja stvari i tehnologija radiofrekvencijske identifikacije koja je široko prihvaćena u društvenoj, okolišnoj i industrijskoj domeni, zbog točnosti i brzine prikupljanja identiteta stvari. Diskutiraju se različite aplikacije Interneta stvari od zdravstvene njege, pametnih kuća / zgrada do pametnih mreža i logistike. Opisuju se dvije tehnologije i norme komunikacije elektroenergetskim vodovima za podržavanja aplikacija Interneta stvari: širokopojasna i niskofrekvencijska uskopojasna. Zaključuje se da mnoštvo aplikacija Interneta stvari može biti dostupno krajnjim korisnicima preko postojeće elektroenergetske infrastrukture. To je dodatna prednost za krajnje korisnike i PLC operatore i razlog za intenzivniji rad na primjeni tehnologije komunikacije elektroenergetskim vodovima i u našoj zemlji.

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Power line communication: tehnologies for the internet of things

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Abstract. Internet of Things (IoT) is a concept in which real-world things (physical objects) are seamlessly integrated with the virtual world of information technology. Each component of the Internet of Things is called a "thing" and should have a unique address. Things could be real world objects or virtual objects. This paper analyzes some of the proposed definitions of IoT. It provides the identification and explains the meanings of things. Considerations in this paper are focused on communication technology over power lines (Power Line Communication, PLC). Both the PLC technology and existing existing wireless communication technologies (Wi-Fi, ZigBee, Bluetooth, 6LoWPAN and others) are suitable for supporting IoT applications. These considerations include the principle and the frequency range of the system and its applications. Subsequently discussed are the PLC standards (IEEE 1901) that define data transmission over power lines. The paper covers two basic PLC standards: Low Frequency Narrow Band (LF-NB) and Broadband over Power Line (BPL).

Key words: *power line communication (PLC), Internet of Things (IoT), communication technology, applications, PLC standard*

Organizacija i postavljanje računala u laboratorijima izradom slike sustava

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Sažetak. U ovom radu prikazana je organizacija i postavljanje računala u laboratorijima namijenjenima za održavanje vježbi na Odsjeku za informacijsku tehnologiju na Sveučilišnom odjelu za stručne studije u Splitu. Zbog ograničenog broja laboratorija u odnosu na broj kolegija, sva računala moraju podržavati cjelokupan skup tehnologija koje se koriste u nastavi Odsjeka. Zbog toga su birana razvojna okruženja s podrškom za široki skup tehnologija, pri čemu se vodilo računa o tome da računala ne budu preopterećena. Kod odabira softvera važna je suradnja s nastavnicima, kao i detaljno isprobavanje instalacije. Kako bi se olakšalo održavanje i nadogradnja laboratorija, sva računala su identično postavljena. Na početku je odabrano računalo na koje je instalirana potrebna programska podrška te je prema njemu izrađena slika sustava (eng. *system image*) koja je kasnije primijenjena na ostatak laboratorija. Na taj način olakšana je ponovna instalacija računala u slučaju kvara, kao i redovita instalacija koja se provodi prije početka svakog semestra.

Ključne riječi: *slika sustava, administracija računalnog laboratorija*

1. Uvod

Nastava laboratorijskih vježbi na Odsjeku za informacijsku tehnologiju Sveučilišnog odjela za stručne studije u Splitu izvodi se na 64 računala raspoređena u pet informatičkih laboratorija. Laboratoriji nisu specijalizirani, a kako se na računalima održavaju vježbe iz pedesetak različitih kolegija, bio je velik izazov napraviti softversku podlogu koja će s jedne strane zadovoljiti potrebe svih kolegija, a s druge strane biti pouzdana i jednostavna za održavanje. Prilikom odabira softvera izuzetno je bitna suradnja nastavničkog osoblja i sistem administratora u svrhu odabira razvojnih okruženja koja će optimalno opteretiti računalo, studentima biti intuitivna za korištenje, a ujedno i pratiti trendove koje postavlja tržište rada. Važnu ulogu u tome ima postupak kloniranja diska, pri čemu se između hardverski sličnih računala prenosi cjelokupna slika diska, zajedno s operativnim sustavom i svim instaliranim programima. Nakon nabave računala, na jedno računalo instalirani su svi potrebni programi, namještene sigurnosne postavke te su napravljena sva namještanja programa specifičnih za pojedinačne kolegije. Na pripremu inicijalnog računala utrošen je velik broj radnih sati te je teško zamisliti okruženje s većim brojem sličnih računala na kojem bi imalo složeniji postupak instalacije trebalo ponoviti na svakom računalu pojedinačno. Stoga je već kod početne instalacije napravljena slika koja je klonirana na ostala računala. Kako se računala intenzivno koriste u nastavi, kraj semestra dočekaju s velikim brojem privremenih studentskih datoteka i zastarjelim softverom. Zato se ispitni rokovi u veljači i rujnu iskoriste za nadogradnje i osvježavanje slike, kako bi računala bila spremna za sljedeći semestar.

2. Priprema računala

Nakon završetka semestra, napravi se uvid u stanje laboratorija. Od računala koja su u kvaru izdvoje se ona koja imaju očigledan hardverski problem, kako bi se detaljnije dijagnosticirala prije mogućeg slanja na servis. Od ispravnih računala odabere se jedno koje će poslužiti kao podloga za daljnju nadogradnju i na njega raspakira slika sustava napravljena na početku prethodnog semestra. Računalo se tako vraća u spremljeno stanje (eng. *snapshot*) na kojem se nikada nije izvodila nastava, a sve radnje koje su se na njemu do tada izvodile, bile su u kontroliranom okruženju. Unatoč oprezu, postoji mogućnost da je računalo u prošlosti bilo kompromitirano pa ga se prije spajanja na mrežu provjerava antivirusnim programom sa svježim definicijama. Uzevši u obzir da svaki put prođe gotovo pola godine od stvaranja slike do trenutka raspakiranja i provjere, antivirusni bi program trebao, s velikom vjerojatnošću, otkriti zloćudne programe koji su u međuvremenu registrirani. Kako bi se osigurala memorijski čista antivirusna okolina i izbjeglo nepotrebno opterećivanje operativnog sustava, koji je podloga za daljnju instalaciju, koristi se posebna distribucija antivirusnog programa u obliku tzv. *rescue* CD-a, tj. namjenskog CD-a sa samostalnim operativnim sustavom i integriranim antivirusnim programom koji omogućava skeniranje računala neovisno o sadržaju tvrdog diska i instaliranom operativnom sustavu. U tu svrhu, zadnjih godina na Odsjeku za IT, koristi se *rescue* CD tvrtke Kaspersky.

Prvi korak u osvježavanju softvera na računalu ažuriranje je Windows operacijskog sustava uz pomoć alata *Windows Update*. Ažuriranje se obavlja ručno, nakon čega se isprobavaju kritične funkcionalnosti operativnog sustava. Sustav automatske nadogradnje ne koristi se kako bi se spriječila mogućnost da problematična zakrpa uzrokuje probleme u radu laboratorija. S obzirom na to da se prilikom nadogradnje Windowsa osvježavaju i pogonski programi (eng. *drivers*), nakon nadogradnje provjeri se stanje hardvera u Windows upravitelju uređaja (eng. *device manager*).

U sljedećem koraku osvježava se instalirani softver i instaliraju se najnovije verzije pomoćnih programa. Nadograđuju se *web* preglednici i dodatci za njih (eng. *plugins*) od kojih se kao problematičan izdvaja dodatak *Flash player*. Prema dostupnim podacima, samo u prošloj godini za navedeni dodatak otkriveno je preko 300 sigurnosnih propusta [1], stoga se *Flash* na računalo ne instalira kao zasebni dodatak, već se koristi verzija *Flash playera* uključena u preglednik *Chrome*. Ta verzija *Flasha* izvodi se u izdvojenom sigurnom sloju preglednika (eng. *sandbox*), čime je značajno smanjen rizik korištenja ovog dodatka [2].

Osim pomoćnih programa, instaliraju se nove i nadograđene verzije alata koji se koriste na vježbama. Pritom se izbjegavaju veće nadogradnje i prelazak na nove verzije razvojnih okruženja koja nisu potpuno kompatibilna sa starim verzijama jer se računala u laboratorijima koriste za rad na projektima i izradu završnih radova, zbog čega velike i nenajavljene promjene alata nisu poželjne. Za sljedeću akademsku godinu priprema se nadogradnja razvojnog okruženja *Microsoft Visual Studio* s verzije 2012 na 2015, pri čemu će zbog velikog broja izmjena i specifičnosti u tablici kompatibilnosti [3], nadogradnja biti izvedena u dogovoru sa svim nastavnicima koji navedeno okruženje koriste u nastavnom procesu.

Nakon što se završi instalacija programa, napravi se detaljno čišćenje sustava. Prvo se isključe nepotrebni programi i servisi koji se pokreću s operativnim sustavom, nakon čega se napravi čišćenje diska. Prvi prolaz napravi se specijaliziranim alatom *CCleaner*, nakon čega se ručno pobrišu nepotrebne datoteke koje su promakle *CCleaneru*, npr. datoteke privremene pohrane (eng. *cache*) raznih programa, instalacijske datoteke nadogradnji, sadržaj privremenih direktorija i slično.

Nakon postavljanja računala, nastavnici trebaju testirati razvojna okruženja i programe specifične za svoj kolegij. U nastavi koristi se velik broj različitih alata pa je moguće da se nakon nadogradnje pojavi softverski problem ili nekompatibilnost koja nije postojala u staroj verziji. U tu svrhu odvoji se nekoliko dana kako bi nastavnici isprobali alate koje koriste na vježbama. Prije testiranja napravi se radna slika diska (eng. *disk image*) koja se vraća na računalo nakon testiranja kako bi se poništile promjene koje su nastavnici možda napravili. Nakon vraćanja radne slike naprave se samo promjene koje su izričito zatražene i nužne.

Na samom kraju obnove sustava promijeni se administratorska lozinka u *Windowsima*. Administratorski račun ne koristi se u uobičajenom radu, a lozinka nije poznata nikome osim nastavnicima koji održavaju laboratorije. Studenti rade na računu s ograničenom razinom prava, a operativni sustav namješten je tako da se prilikom paljenja prijavi na studentski račun bez unosa lozinke.

Posljednji korak u pripremi računala je defragmentacija diska. Instalacijski programi prilikom nadogradnje prepisuju stare verzije datoteka novima, pri čemu dolazi do fragmentacije zapisa na površini diska. S obzirom na to da će pripremljena slika biti raspakirana na više od 60 računala i biti intenzivno korištena kroz cijeli semestar, svaki dobitak na brzini čitanja i zapisivanja na disk važan je.

Ovako pripremljeno računalo spremno je za izradu slike. Kako bi konačna slika bila što manja, u operativnom sustavu isključena je podrška za hibernaciju (veličina hibernacijske datoteke odgovara veličini radne memorije u računalu) i uključena je opcija brisanja stranične datoteke (eng. *pagefile*) prilikom gašenja računala. Stranična datoteka redovito zauzima nekoliko gigabajta prostora na disku, a neće biti potrebna prilikom sljedećeg paljenja (na nekom drugom računalu). Uklanjanjem datoteka *hiberfys.sys* i *pagefile.dat* konačna datoteka slike smanjena je za više od 5 GB-a.

3. Kloniranje slike diska na računala u laboratoriju

Izradom slike stvara se potpuna i cjelovita kopija svih podataka zapisanih na disku. Za razliku od kopiranja ili arhiviranja datoteka uobičajenim alatima unutar operativnog sustava, kod izrade slike diska spremaju se i svi metapodatci vezani za datoteke, zapisi potrebni za podizanje operativnog sustava (eng. *boot record*) te indeksi i ostali elementi datotečnog sustava koji omogućavaju naknadnu potpunu rekonstrukciju svih zapisa na disku.

Metoda koja obuhvaća izradu slike diska na jednom računalu i njeno preslikavanje na drugo računalo sa sličnim hardverom naziva se kloniranje diska (kloniranje sustava). Navedena metoda koristi se u laboratorijima IT-a od 2001. godine kada su napravljena prva kloniranja softverom *Ghost*. U međuvremenu je na Odsjeku korišteno nekoliko programskih rješenja za kloniranje (*Trinity Rescue Kit*, *CloneZilla*), a od 2015. koristi se program *AOMEI Backupper Standard*. Program je besplatan, a pokazao se pouzdan i jednostavan za korištenje što je važno jer su u proces održavanja laboratorija od nedavno uključeni i studenti koji u sklopu stručne prakse održavaju računala i pomažu u izvođenju procesa opisanog u članku.

Kod stvaranja slike diska, općenito postoje tri pristupa: kopiranje cijelog diska sektor po sektor, pri čemu se stvara potpuna slika diska i svi sektori kopiraju se neovisno o tome jesu li iskorišteni ili nisu. Navedena metoda je najpouzdanija i radi neovisno o datotečnom sustavu na disku, ali izlazna datoteka stvorena tako je najveća. Drugim pristupom kopiraju se samo sektori na koje su zapisani korisni podatci. Na takav način stvara se slika koja sadrži sve podatke potrebne za rekonstrukciju postojećeg stanja sustava uz znatne uštede na prostoru. Treći pristup koristi se za sigurnosnu pohranu (eng. *backup*) i kopiraju se samo datoteke direktno dostupne iz operativnog sustava, pri čemu cjelokupan integritet podataka na disku nije sačuvan, stoga iz takve slike načelno nije moguće oporaviti sustav. Kod stvaranja slike diska na Odsjeku za IT koristi se drugi opisani pristup koji je u programu *AOMEI Backupper*

nazvan *Intelligent Sector Backup*. Originalni disk kapaciteta je 500 GB i podijeljen je na dvije particije na kojima je zauzeto ukupno 59 GB prostora. Podatci se sažimaju srednjom razinom sažimanja (opcija *Normal Compression*), pri čemu je kod kloniranja u veljači 2016. dobivena izlazna datoteka od 34 GB i postignuta razina sažimanja od 62 %. $34 \text{ GB} / (59 \text{ GB} - 4 \text{ GB pagefile}) = 62 \%$.

Prilikom kloniranja, *AOMEI Backupper* pokreće se s *boot* CD-a, bez instalacije na računalo. *Backupper* je relativno novi softverski proizvod kojeg proizvođač često osvježava novim verzijama pa se svaki semestar napravi nekoliko novih CD-a uz pomoć alata *AOMEI Make Disk*. Kod izrade CD-a bira se između sustava zasnovanog na *Linux kernelu* ili na *Windows PE okruženju* (eng. *Windows Preinstall Enviroment*). Program *Backupper* pokrenut iz *Windows PE okruženja* pruža više mogućnosti u odnosu na Linux verziju [4], a kako nije uočena važnija nekompatibilnost ugrađenih *Windows drivera* na CD-u s hardverom u laboratoriju, koristi se *Windows PE* modul. Izrađena slika kopira se na nekoliko vanjskih USB diskova te se klonira na ostala računala u laboratoriju.

4. Naknadno namještanje pojedinačnih računala

Nakon što se na sva računala klonira sadržaj izvornog diska, potrebno je namjestiti mrežne postavke specifične za svako računalo. Na mreži nije instaliran DHCP server pa se na svakom računalu unose podatci o IP adresi, podmreži, zadanom usmjerniku i DNS poslužitelju. Osim toga, namješta se i NetBIOS naziv računala i radna grupa kako bi se olakšao pristup dijeljenim datotekama.

Potom slijedi aktivacija operativnog sustava i ostalih alata čiji sustav licenciranja ne podržava kloniranje. Naime, uobičajen postupak registriranja pojedinačnog softvera sastoji se od unošenja i verifikacije pojedinačnog registracijskog ključa, što kod metode kloniranja diska nije moguće automatizirati. Kloniranjem se svi podatci s izvornog diska, zajedno s registracijskim ključem preslikaju, a korištenje istog ključa na više računala najčešće nije u skladu s licenčnim odredbama proizvođača softvera, tako da je za većinu programa potreban ručan unos ključa za svako pojedinačno računalo. Ipak, dio softvera na Odsjeku registriran je VLK ključevima za količinsko licenciranje (eng. *Volume Licence Key*) koji omogućavaju korištenje istog ključa na različitim računalima, što znatno olakšava instalaciju većeg broja računala metodom kloniranja slike diska.

5. Planovi za unaprjeđenje postupka održavanja i organizacije laboratorija

Budući da se u toku semestra velik broj studenata služi istim laboratorijima, na računalima se stvara puno nepotrebnih datoteka koje stvaraju nered u radnim direktorijima i predstavljaju problem u nastavnom procesu jer studenti mogu koristiti gotova rješenja zaostala na računalima od prethodne grupe. S obzirom na to, bilo bi idealno kada bi se tragovi aktivnosti studenta na računalu poništile nakon završetka rada i kada bi se računalo vratilo u prvobitno stanje nakon odjave iz sustava. Razmatrana su softverska rješenja koja nakon svakog gašenja vraćaju sustav u prethodno stanje, na primjer komercijalni *Deep Freeze* te besplatni *Microsoft Windows Steady State* (više se ne razvija). Iako bi neko od navedenih rješenja olakšalo održavanje sustava i uklanjanje privremenih datoteka, ocijenjeno je da bi korištenje navedenih rješenja moglo uzrokovati veće probleme. Naime, računala u laboratorijima nisu spojena na sustav neprekidnog napajanja pa bi u slučaju nestanka struje za vrijeme vježbi ili ispita došlo do gubitka svih podataka, što se ne može dozvoliti. Jedno od rješenja koje bi se moglo implementirati u budućnosti je skripta ili program koji bi prema zadanim pravilima u pozadini brisao zaostale datoteke.

Kako bi se povećala razina sigurnosti, studentima su postavljena visoka ograničenja u dodijeljenim korisničkim pravima. Zbog postavljenih ograničenja, pojavio se problem

izvođenja vježbi koje zahtijevaju administratorsku razinu upravljanja OS-om (uglavnom kolegiji koji se bave mrežama, hardverom i operacijskim sustavima). Kako bi se olakšalo održavanje vježbi, na računala je instalirana virtualizacijska platforma *VMware* koja omogućava pokretanje virtualnih strojeva specijaliziranih za svaki pojedini kolegij. Dio nastavnika koristi virtualizacijsku platformu i priprema virtualne strojeve prema svojim potrebama. Tako se ostvaruje visoka razina fleksibilnosti kod pripreme i izvođenja vježbi, a kako sve promjene koje studenti naprave na vježbama ostaju na virtualnom računalu, računalo domaćin (eng. *host*) nije ugroženo. Treba razmotriti mogućnost da se razviju specijalizirani virtualni strojevi za sve kolegije jer tako pred nastavnicima ne bi bila ograničenja koja se javljaju kao posljedica dijeljenja jednog sustava između svih kolegija. Osim toga, olakšalo bi se održavanje i nadogradnja te povećala sigurnost laboratorija, a nastavnici bi u nastavu lakše uključivali najnovije tehnologije.

Vezano za postupak kloniranja diska, trebalo bi isprobati PXE modul za stvaranje radnog okruženja prije pokretanja operativnog sustava (eng. *Preboot Execution Environment*) koji je izdala firma AOMEI i koji omogućava jednostavno postavljanje PXE poslužitelja na mreži. Takav poslužitelj olakšava postupak kloniranja jer omogućava pokretanje Windows PE ili Linux podloge s potrebnim alatima preko mreže. Ugrađeni DHCP poslužitelj na zahtjev šalje postavke mreže i PXE okruženja, nakon čega klijent putem TFTP protokola može zatražiti datoteke potrebne za pokretanje priručnog operativnog sustava. Osim toga, moguće je i samu sliku diska prenijeti preko mreže, čime se može dodatno pojednostavniti i ubrzati kloniranje te ukloniti potreba za korištenjem vanjskih diskova. Kloniranje preko mreže za sada se ne koristi u laboratorijima Odsjeka jer pogonski programi ugrađeni u AOMEI *boot* CD ne podržavaju mrežnu karticu na računalima, tako da mreža nakon pokretanja Windows PE sustava nije dostupna. U AOMEI *boot* CD moguće je ugraditi korisničke pogonske programe pa bi se tako mogao riješiti navedeni problem. Opisani postupak isprobat će se prilikom nekog od sljedećih osvježavanja laboratorija.

6. Zaključak

Proces održavanja laboratorija na Odsjeku za IT neprekidno se razvija od osnivanja studija i formiranja prvih računalnih laboratorija do danas. Pritom su oblikovani postupci koji osiguravaju visoku dostupnost računala kroz semestar i brzi oporavak u slučaju softverskog kvara, kao i jednostavno osvježavanje softvera u ciklusima koji su vezani za semestre akademske godine. Kroz sve godine primjene ovog postupka, nije zabilježen ni jedan ozbiljniji prekid u radu laboratorija. Važnu ulogu u tome odigrao je i sustav korisničkih prava koji je s vremenom optimiziran na način da se studentima omogući slobodan rad, a da s druge strane računalo bude zaštićeno od zlonamjernih korisnika i programa. Razvojem softvera za kloniranje i nadogradnjom lokalne mreže na brži, gigabitni *ethernet*, omogućit će se još lakša nadogradnja i održavanje laboratorija, pri čemu će postupak kloniranja i dalje biti najvažniji dio postupka, barem dok ne zažive drugačiji modeli računarstva zasnovani na uslugama u oblaku (eng. *cloud services*), virtualizacijom radne površine (eng. *desktop virtualization*) i napretkom koncepta posluživanja programa kao usluge (eng. *software as service*) i slično.

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The organisation of computer laboratory setup using system image

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Abstract. This article describes the organisation of the laboratory setup at the University Department of Professional Studies of the University of Split. Due to a limited number of computers, laboratories cannot be strictly specialized to a single technology stack. Technologies installed were carefully chosen to provide most coverage with optimal performance load. Collaboration with teachers is as important as thoroughly proofing installation stability. All of the computers are cloned in order to facilitate the setup and maintenance. The origin of the cloning image is a manually-installed computer. This approach facilitates seasonal reinstallations as well as repairs.

Key words: *image, computer laboratories administration*

Organizacija predavanja i vježbi u sklopu kolegija uvod u programiranje uvođenjem Pythona kao novog programskog jezika

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Sažetak. Odabir programskog jezika, kao onog kojim će se započeti programerska edukacija, jedan je od čestih problema s kojim se nastavnici susreću. U specifičnim projektima odabir često diktiraju subjektivni i objektivni razlozi, dok u slučaju odabira za edukaciju, tehnologija se treba prilagoditi specifičnim predznanjima studenata, heterogenosti grupe koja pristupa edukaciji i mnogim drugim čimbenicima. Zbog velikog broja odlučujućih faktora, konačan odabir ne može uvijek zadovoljiti sve potrebe i vrlo je vjerojatno da se veći broj stručnjaka nikada ne bi uspio usuglasiti oko jedne tehnologije. U radu je prikazano na koji način su se organizirale vježbe i predavanja u sklopu kolegija Uvod u programiranje koji se provodi na Sveučilišnom odjelu za stručne studije u Splitu budući da se od ove akademske godine uveo *Python* kao programski jezik. *Python* je programski jezik otvorenog koda koji naglasak stavlja na semantiku i programsku logiku, dok je sintaksa minimalna i intuitivna. Budući da je u sklopu kolegija naglasak na razvijanju programske logike općenito, bez obzira na specifični programski jezik, *Python* se pokazuje kao dobar odabir. Predavanja i vježbe su koncipirane kroz rješavanje raznih matematičkih problema, ali i kroz studentima bliže probleme iz stvarnog svijeta, kojima se od njih očekuje primjena i kombiniranje dotadašnjeg znanja. Na takav način ih se, između ostalog, uvodi u raščlanjivanje većih problema na manje. Kao integrirana razvojna okolina odabran je *Spyder*, besplatni IDE otvorenog koda.

Ključne riječi: Python, edukacija, programiranje

1. Uvod

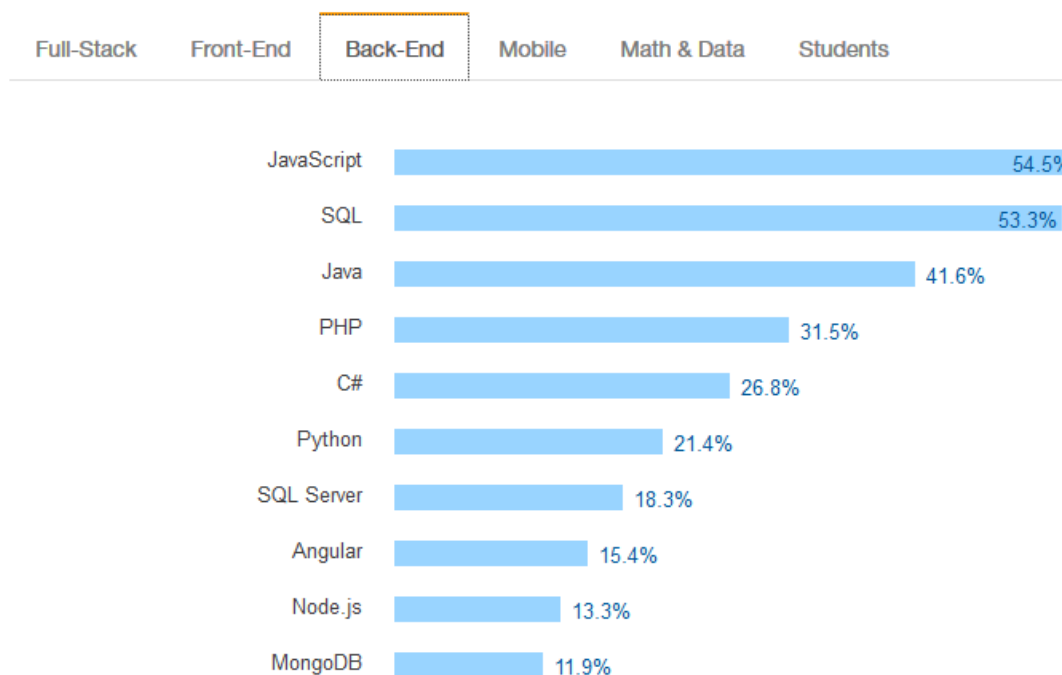
Kada se započinje učiti programiranje jako je važan odabir programskog jezika. Studenti su raznolika skupina i usvajanje osnovnih koncepata ovisi o prethodnom iskustvu svakog od njih. Često su studenti uvjereni kako su napisali ispravan kod, ali ne razumiju zašto njihov program ne radi ono što očekuju, kao što su prenijeli autori u [1]. Ovaj problem je potrebno rješavati u kolegiju Uvod u programiranje jer se broj programerskih predmeta na višim godinama povećava i bez dobrog temelja, nemoguće ih je popratiti. Ispravan pristup je da se svaki problem, koji je previše složen da se jednostavno opiše, razbije u skup manjih podproblema. Ovaj proces zahtijeva korištenje kompleksnih kognitivnih vještina kao što su rasuđivanje, planiranje i rješavanje problema. Programer prvo u glavi stvara apstraktnu sliku tijeka procesa koju potom pretače u stvarnost, smišljajući logičke strukture koje diktiraju odvijanje programa i tek na kraju to sve skupa pretače u kod koristeći konkretni programski jezik [2]. Do sada se nastava Uvoda u programiranje (UP) na Odjelu za stručne studije održavala koristeći *Visual Basic.NET* što je bio dobar izbor za prvi susret s kodiranjem, ali mana mu je bila zahtjevna sintaksa. Međutim, zbog sve veće popularnosti *Pythona* za različite namjene te jednostavne sintakse, ove godine se krenulo s njim kao novim odabirom. Na ovaj način se fokus s učenja složene sintakse jezika prebacuje na raščlanjivanje složenijih problema na manje. *Python* je programski jezik koji podržava različite paradigme kako za proceduralan tako i za objektno-orijentiran i funkcionalan pristup programiranju, a svoju popularnost zadobio je zbog velikog broja biblioteka (eng. *library*) i podrške zajednice

otvorenog koda (eng. *open source community*). Osim što je jako praktičan za edukacijske svrhe, pruža mogućnost vezivanja za već postojeće biblioteke u C- u te se zbog toga koristi i u profesionalnom svijetu.

2. Odabir programskog jezika

Kod osmišljavanja programa za kolegij Uvod u programiranje, jako je bitno voditi računa o odabiru tehnologije koja svojim specifičnostima ne odvraća mnogo pažnju s osnovne logike upravljanja programskim tokom. Treba se odmaknuti od programskih jezika „niže razine“ koji od programera zahtijevaju promišljanja o zauzimanju i oslobađanju memorije. Također, treba biti oprezan da odabrani jezik „više razine“ ne sakriva od studenta operacije koje spadaju u domenu programske logike ili ograničiti njihovu upotrebu. Nastoji se ne oslanjati se na specifičan paket tehnologija. Takvi paketi omogućuju korisniku brzi rezultat na principu „slaganja kockica“ i vremenski nisu dugog vijeka jer evolviraju i mijenjaju se. Stoga studentima pružaju usku, specifičnu i kratkoročnu vještinu. Imajući to na umu, pristupa se programskom jeziku koji ima široku primjenu u profesionalnom svijetu (Slika 1 [3]), popularan je i ne stavlja strogi naglasak na rad s memorijom i deklariranjem tipova varijabli. Programski jezik koji inzistira na striktno definiranim tipovima podataka (statički definirani tipovi varijabli) također odvlači od fokusa na usvajanje programske logike. Stoga je za potrebe kolegija izabran programski kolegij *Python* kao jezik s dinamičkim tipovima (eng. *dynamically typed*). Budući da ne ovisimo o vanjskim paketima, razlike *Pythona* 2.7 ili 3.5 uglavnom ne stvaraju probleme, barem kad je programska logika u pitanju. Popularnost ovog programskog jezika posljednjih godina u porastu je.

Most Popular Technologies per Dev Type



Slika 1

3. Python

Python je više paradigmatški, interpreterski jezik visoke razine. Osim toga, jezik je s dinamičkim tipovima podataka i naglaskom na čitkost koda. Vrlo je pogodan za početnike, kao i za iskusne programere koji mijenjaju tehnologiju zbog relativno nezahtjevne sintakse. Tako će *Python* ispravno interpretirati i linije koda s elementima sintakse nekih drugih programskih jezika na koje je programer navikao (zgrade, točka zarez, itd.). *Python* ne zahtijeva razvojno okruženje, već se

naredbe mogu unositi jedna po jedna direktno u interpreter u terminalu. Da bi se studentima olakšao postupak unosa programskog koda u tekstualni editor te pokretanje u interpreteru, koristimo razvojno okruženje *Spyder*. Ono dolazi u sklopu programskog paketa Anakonda [4], koji se pokazao prikladan i za neke predmete viših godina. Od dodatnih alata, *Spyder* nudi i programsku podršku za ispravljanje grešaka (eng. *debugger*), čijim korištenjem studenti mogu detaljno pratiti tijek izvođenja programa služeći se točkama prekida (eng. *break point*). Studenti, također, mogu pratiti ispravnost svog algoritma kroz preglednik varijabli (eng. *variable explorer*). Međutim, neke pogodnosti *Pythona* mogu imati negativne posljedice. *Python* se oslanja na ispravno uvlačenje blokova koda, čime se zaobilazi korištenje nečitkih zagrada, no neispravno formatiranje naoko istog koda rezultira greškama koje početnik teško uočava. Također, varijable definirane u užem dosegu neke petlje (eng. *scope*) vidljive su iz šireg dosega. To proizlazi iz činjenice što životni vijek varijable prelazi doseg u kojem je varijabla kreirana. Isto tako, varijable korištene u globalnom dosegu jedne *Python* skripte, ostaju u memoriji interpretera i prilikom izvršavanja drugih skripti.

4. Organizacija vježbi i predavanja

Budući da su studenti, u smislu predznanja, heterogena skupina jako je teško osmisliti program koji će biti optimalan za sve. Preduvjeti za uspješno usvajanje novih koncepata su poznavanje matematike i osnovnog služenja računalom. Sadržaj se obrađuje u ciklusima koji se okvirno mogu opisati kao:

- uvod u programsku logiku (kroz dijagrame toka i pisanje pseudokoda)
- upoznavanje sa sintaksom programskog jezika
- kreiranje varijabli, unos vrijednosti te ispis na ekranu (ulaz, izlaz)
- upravljanje tokom programa uz pomoć uvjeta
- upravljanje tokom programa uz pomoć petlji
- izbjegavanje repetitivnog koda i apstrakcija korištenjem funkcija
- upoznavanje s osnovama rekurzije
- složeni tipovi podataka (skupovi, n-torke, liste, rječnici, stringovi)
- promjenjivost i nepromjenjivost
- osnove objektno-orijentiranog i funkcionalnog programiranja

4.1. Uvod u programsku logiku i upoznavanje s razvojnim okruženjem

Prije susreta s konkretnim programskim jezikom, studentima se pokušava vizualno predočiti postupak računalnog rješavanja nekog problema (algoritma). Dijagrami toka su idealan izbor kao početni korak k apstraktnijem računalnom razmišljanju. Kroz ove dijagrame studenti se unaprijed upoznaju s konceptima uvjeta i petlji, a da pri tome nemaju direktan kontakt s kodom. Od njih se očekuje da grafički prikažu korake u rješavanju jednostavnih matematičkih problema. To je dobar uvod u pisanje pseudokoda, koji bi bio sljedeća faza u učenju, ali se preskače jer mu je *Python* sam po sebi sličan. Prelaskom na pisanje koda u interpreter, prvo se uče matematički i logički operatori te uvjeti. Obrađuju se i bitovni operatori kao i operacije s binarnim brojevima. Ovaj pristup ima dvojaku namjenu. Prva je da se osjeti rad u interpreteru i upozna s funkcionalnostima koje on donosi. Druga, važnija namjena, je da se nauči ispravno formirati kraće i duže logičke izraze kako bi se usvojila ta vještina specifična za područje programiranja. Upravo ovo pokazuje se najtežim za studente, dijelom zbog novih koncepata s kojima se nisu ranije imali prilike susresti, a dijelom zbog apstraktne prirode operacija s binarnim brojevima (bitovni operatori). Uvođenjem unosa teksta s tastature zadaci dobivaju manju apstraktnost te studenti bolje reagiraju na rješavanje takvih problema (interakcija s korisnikom).

4.2. Upravljanje tokom programa uz pomoć uvjeta i petlji

Upoznavanje s petljama uvodi se kroz ponavljanje dijelova programa, kao primjerice unos i ispis broja sve dok taj broj ne udovolji nekom uvjetu i sl. Ovdje se spontano usađuje spoznaja o ograničavanju petlje uvjetom, bez kojeg je petlja beskonačna. Koncept petlji (s pripadajućim uvjetom) ključna je građevna jedinica svakog algoritma i prvi je pravi izazov za početnika. Studenti su često nesigurni po pitanju gdje i koji tip petlje upotrijebiti te kako definirati uvjet prekida. Olakotna činjenica je što *Python* ne zahtijeva eksplicitno definiranje tipova varijabli pa se stoga studenti mogu fokusirati na problem. Također, im se nastoji zadati jednostavan, ali opsežan zadatak za vježbu koji im je po tematici zanimljiv i poznat iz realnog svijeta. Kao primjer možemo navesti igru rulet, u kojemu korisnik određuje koliko puta želi igrati, koliki ulog želi staviti i na koju kombinaciju. Ovakav tip zadatka interesantan je pokazatelj shvaćanja ili neshvaćanja petlji i uvjeta. Realizira se korištenjem ugniježđenih uvjeta što studentima predstavlja problem ako se koriste „pod izbori“. Na primjeru izbornika jedna grupa studenata koncipirala je izbornik bez hijerarhije (odaberite broj: 1. parni, 2. neparni, 3. 1 - 18, 4. 19 - 36, 5. jedan broj) te nisu imali većih problema prilikom realizacije. Druga grupa radila je hijerarhijski izbornik s podizbornicima (odaberite opciju: 1. parni/neparni, 2. raspon brojeva, 3. specifičan broj). Potom bi, ovisno o izboru, korisniku bio prikazan odgovarajući podizbornik (npr. za opciju 1 - parni, opciju 2 - neparni). Kod ovakvih ugniježđivanja primijećeni su višestruki problemi. Studenti nisu znali otkloniti greške iako se najčešće radilo o jednostavnom problemu s uvlačenjem (ispravno formatiranje koda). Također, osmišljavanje algoritma s ugniježđenim kodom nije se pokazalo kao trivijalna zadaća. Od logičkih problema zamijećeno je miješanje i (eng. *and*) i ili (eng. *or*) operatora. Na primjer, ako ulog mora biti između 0 i 1000 žetona, studenti su često gledali da je ulog veći i jednak 0 *ILI* manje i jednak 1000, što je logički ispravno za bilo koji broj (rezultat logičkog izraza uvijek je istinit). Točan logički izraz bi koristio logički operator *I* (broj mora biti *I* veće jednako 0 *I* manje jednako 1000) da bi broj pripao u raspon 0 - 1000. Stoga smo se zadržali na ovoj problematici veći broj sati od planiranog. Iz ovoga razloga vodilo se računa da svi naredni zadaci sadržavaju i ovu problematiku radi utvrđivanja.

4.3. Funkcije i složeni tipovi podataka

Kroz opsežne zadatke namjerno se prikazalo ponavljanje određenih dijelova koda. Tako se opravdala potreba za postojanjem i korištenjem funkcija, kao novog dijela gradiva. Neki od zadataka bili su ponovno zadani, no trebalo ih je riješiti korištenjem funkcija uključujući cijeli primjer pojednostavljene kartaške igre Ajnc. Predstavio im se koncept kompozicije funkcija kroz upotrebu *min* i *max* funkcija za dva broja, na primjeru najvećeg/najmanjeg broja od tri. Najveći kamen spoticanja su rekurzivne funkcije (funkcije koje pozivaju same sebe). Studenti često ne shvaćaju njihovu primjenu (za koju ni nema potrebe na njihovoj razini znanja) i prihvataju ih kao još jednu komplikaciju koja je samoj sebi svrha. Stoga postoji represija k rekurzijama i u pravilu bivaju najlošije svladane. U kolegijima viših godina, studenti koji odaberu smjer programiranje, će se upoznati s njihovom pravom primjenom (optimizacija pri raznim algoritmima za pretraživanje) te im je korisno imati bazno predznanje.

Savladavši prethodno navedena poglavlja organizira se prvi kolokvij. I ovdje je praksa pokazala da studenti koji nisu uspješno položili prvi kolokvij imaju problema sa savladavanjem čitavog kolegija. Gradivo koje je predviđeno za drugi dio kolegija stavlja naglasak na složene tipove podataka. Studenti nalaze ovaj dio gradiva jednostavnijim, vjerojatno zbog činjenice da se ne radi o logičkim izrazima koji zahtijevaju kreativno logičko razmišljanje prilikom osmišljavanja rješenja. Složeni tipovi podataka (*n*-torke, liste rječnici, stringovi) su jako zastupljeni u profesionalnoj programerskoj svakodnevnici i zbog toga se u zadacima za vježbu stavlja naglasak na manipulaciju s takvim tipovima. Detalje se implementacije složenih struktura skriva, dok se veća pažnja posvećuje promjenjivosti i nepromjenjivosti tipova u *Pythonu*. U ovoj fazi se ne potiče upotreba pomoćnih metoda koje posjeduju navedeni tipovi podataka. Njihovo korištenje će biti prezentirano kroz upoznavanje s konceptima objektno-orijentiranog programiranja, kao uvoda u kolegij koji se sluša

na višim godinama. Od studenata zahtijeva se da svojom kreativnošću i razmišljanjem postignu funkcionalnost koje navedene metode nude.

5. Zaključak

Svladavanje gradiva iz kolegija Uvod u programiranje jako je bitno kao temelj k razumijevanju predmeta računalne struke. Početnicima koji se nisu upoznali s konceptom programiranja u prethodnom obrazovanju, ovo je vrlo zahtjevan korak za razumijevanje što programiranje uopće predstavlja. Prvi susret može biti pomalo zastrašujuć i to rezultira raslojavanjem studenata u smislu napredovanja. Vrlo je teško osmisliti program koji neće biti prejednostavan naprednim studentima, a koji slabiji studenti mogu pratiti. Upravo zbog njih, problemi koji se rješavaju se stavljaju u kontekst bliske im i zanimljive tematike (igre na sreću, konjske utrke, pikselizirane slike kod matrica itd.) te se pokušava ne dodatno ih obeshrabriti naprednim zadacima iz područja matematike i fizike. Ovim se potiče dobrovoljan rad studenta kod kuće te promišljanje i intrigiranje kako će doći do konačnog rješenja. U suprotnom se riskira „treening“ sintakse na štetu kreativnog osmišljavanja algoritma. Dok pojedini autori tvrde kako neke osobe uopće ne mogu naučiti programirati, ostali tvrde kako možda neće svi postati vrsni programeri, ali bi mogli usvojiti osnovna znanja i vještine iz programiranja [1]. Cilj ovog kolegija je usmjeriti ih upravo k tome. Gradivo prvog dijela kolegija pokazuje se težim za usvojiti zbog većeg naglaska na programsku logiku, a manjeg na vještinu manipuliranja podacima koja se može usvojiti bez velike potrebe za kreativnim i logičkim razmišljanjem. Usvajanje osnovnih algoritamskih građevnih jedinica (uvjeti i petlje) ne znači nužno i sposobnost pronalaženja primjene za iste. Stoga je vrlo važno da student bude zaintrigiran da svojevoljno i aktivno razvije tu sposobnost samostalnim angažmanom kod kuće kao i u sklopu nastave.

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Organising lectures and exercises in Basic programming class using Python as new programming language

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Abstract. The choice of programming language to be used for education is the most difficult task teachers often encounter. In real-world projects, the technology stack is often dictated by project specifications and

requirements. On the other hand, the technology stack in education must be adapted to student background. Due to the diversity of the requirements, there is no ideal technology, so the choice must be a compromise. This article outlines the methods used to organise exercises and lectures in the Basic Programming class. As of year 2015/16 the programming language Python is being used as the introductory language to programming at the University Department of Professional Studies. Python is an open-source language that emphasizes semantics and logic over syntax. Since the Basic programming class teaches programming logic, Python is a good fit. Students are eased into the techniques of problem solving through mathematical and real-world modelled exercises. Spyder is used as an open-source Integrated development environment.

Key words: *Python, education, programming*

Radni parametri solarnog toplinskog sustava za pripremu PTV-a

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Sažetak. U radu su prikazani rezultati mjerenja radnih parametara solarnog toplinskog sustava koji se u laboratoriju koristi za zagrijavanje potrošne tople vode. Solarni toplinski pretvornik smješten je na lokaciji 43°31'21" N i 16°27'01" E, usmjeren prema jugu i to pod fiksnim nagibom od 30° u odnosu na horizontalnu plohu. Mjerenje radnih parametara izvršeno je za dva specifična perioda, ljetni i zimski, kako bi se analizirao rad sustava u različitim uvjetima dozračene sunčeve energije. Na osnovu izmjerenih radnih parametara procijenjene su učinkovitosti i koeficijenti pokrivanja solarnog toplinskog sustava. Dobiveni rezultati uspoređeni su s podacima raspoloživim u stručnoj literaturi.

Ključne riječi: sunčeva energija, solarni toplinski sustav, učinkovitost, koeficijent pokrivanja

1. Uvod

Potrebe za energijom kontinuirano se povećavaju. U posljednjih 40 godina ukupna svjetska opskrba primarnom energijom udvostručila se, dok se u istom vremenskom periodu svjetska potrošnja električne energije povećala za oko 3,8 puta [1]. Unatoč mnogobrojnim aktivnostima u cilju pronalaženja adekvatne zamjene, još uvijek se najveći dio energije dobiva iz fosilnih goriva; oko 85 % primarna energija te oko 80 % električna energija [1]. Takvi trendovi imaju negativne utjecaje na okoliš, odnosno imaju za rezultat klimatske promjene, povećanje prosječnih temperatura zraka te povećanje koncentracije ugljikova dioksida.

Kako bi se negativni utjecaji na okoliš umanjili, na razne načine potiče se proizvodnja električne i toplinske energije iz obnovljivih izvora energije. Među njima sunčeva energija zauzima značajno mjesto.

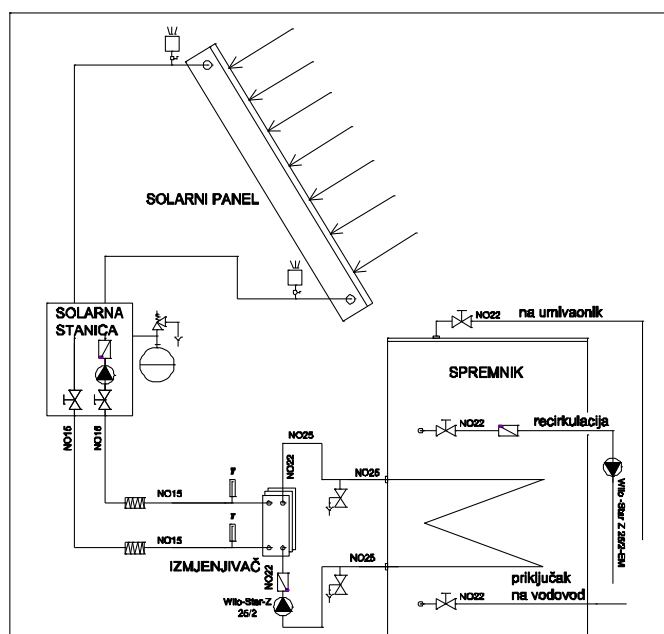
Sunce u prosjeku dnevno dozrači na površinu Zemlje oko 1 kWh/m² energije [2]. U Hrvatskoj se vrijednosti dnevne dozračene energije kreću, ovisno o zemljopisnom položaju, između 3,0 i 4,5 kWh/m² [2]. Godišnja dozračena sunčeva energija na površinu Hrvatske iznosi oko 74.000 TWh/god, što je za oko 650 puta veći iznos od ukupne godišnje potrošnje energije u Hrvatskoj.

Tijekom 2014. u EU instalirano je oko 2,9 miliona četvornih metara površine solarnih toplinskih kolektora [3], od čega najviše pločastih kolektora. U Republici Hrvatskoj tijekom 2014. instalirano je 18.400 m² pločastih kolektora te 2.500 m² vakuumskih kolektora ekvivalentne toplinske snage 14,6 MW_{th} [3]. Za usporedbu, u 2013. ekvivalentna toplinska snaga instaliranih toplinskih kolektora iznosila je oko 12,2 MW_{th}.

Procjena je da je do kraja 2014. u Republici Hrvatskoj sveukupno (kumulativno) instalirano oko 157.950 m² solarnih toplinskih kolektora ekvivalentne toplinske snage oko 111 MW_{th} (što iznosi oko 0,037 m²/stanovniku, dok je EU prosjek oko 0,093 m²/stanovniku) [3].

2. Laboratorijski solarni toplinski sustav za pripremu PTV-a

Laboratorijski solarni toplinski sustav (slika 1) sastoji se od spremnika potrošne tople vode (PTV) volumena 150 litara, pločastog izmjenjivača topline snage 1,4 kW, pločastog solarnog toplinskog pretvornika površine apsorbera 2,32 m² te solarne stanice s pripadajućom armaturom (cirkulacijska pumpa s tri brzine, regulacijsko-sigurnosni elementi, upravljačko-mjerna jedinica). Sustav se sastoji iz primarnog i sekundarnog cirkulacijskog kruga. U primarnom krugu cirkulira toplinski medij (Tyfocor-LS), koji preuzima toplinsku energiju iz pločastog solarnog toplinskog pretvornika te je prenosi i predaje pločastom izmjenjivaču topline. Protok toplinskog medija tijekom rada sustava iznosio je 2 litre/min. Voda, koja cirkulira sekundarnim krugom, preuzima toplinu od toplinskog medija u pločastom izmjenjivaču topline te je predaje potrošnoj toploj vodi u spremniku. Konačni prijenos topline s vode iz sekundarnog kruga na PTV vrši se putem izmjenjivača topline u obliku zavojnice koji se nalazi unutar spremnika PTV-a.



Slika 1 Shematski prikaz laboratorijskog solarnog toplinskog sustava

Solarni toplinski pretvornik (slika 2) smješten je na lokaciji 43°31'21" N i 16°27'01" E (Kopilica, Split) i to pod fiksnim nagibom od 30° u odnosu na horizontalnu plohu te usmjeren prema jugu.

Laboratorijski solarni toplinski sustav može predstavljati stvarni sustav za pripremu potrošne tople vode jednog dvočlanog kućanstva. Za potrebe ovog rada, a na osnovu preporuka iz literature [4, 5], definirani su osnovni parametri sustava, kao što su volumen spremnika PTV-a i temperatura vode na izljevnom mjestu.

Na osnovu „srednjeg zahtjeva“ za količinom PTV-a [4] te na osnovu odabrane temperature vode na izljevnom mjestu od 45°C, proizlazi potreba za toplom vodom od 35 litara/dan po osobi. Ne ulazeći u detaljni proračun dimenzioniranja solarnog spremnika, a pridržavajući se smjernica za dimenzioniranje malih solarnih sustava danih u literaturi [4, 6], proizlazi da je potreban volumen solarnog spremnika:

$$V_{\text{sol}} (\text{litara}) = \text{prosječna dnevna potrošnja tople vode (litara)} \times 2 \quad (1)$$

$$V_{\text{sol}} (\text{litara}) = 35 \text{ litara/dan, osobi} \times 2 \text{ osobe} \times 2$$

$$V_{\text{sol}} (\text{litara}) = 140$$

Na osnovu dobivenog volumena od 140 litara, proizlazi da spremnik potrošne tople vode od 150 litara (slika 2), koji je sastavni dio laboratorijskog solarnog toplinskog sustava, u potpunosti zadovoljava predviđene potrebe.



Slika 2 Solarni toplinski spremnik s pločastim izmjenjivačem topline; solarni toplinski pretvornik

3. Rezultati mjerenja radnih parametara solarnog toplinskog sustava

Mjerenje radnih parametara solarnog toplinskog sustava izvršeno je za dva karakteristična perioda, ljetni (lipanj i srpanj) i zimski period (veljača). Mjerenjem su obuhvaćeni podaci o dozračenju energiji sunca (na plohu nagnutu pod kutom od 30°), temperatura toplinskog medija, temperatura potrošne tople vode unutar spremnika te temperatura vanjskog zraka.

Mjerenje dozračenju energije sunca izvršeno je pokretnim mjernim uređajem te u određenim mjernim intervalima (svakih pola sata). Tako očitane vrijednosti dozračenju sunčeve energije predstavljaju trenutnu vrijednost s kojima se ne može pouzdano odrediti ukupna dozračenju energija sunca tijekom rada solarnog toplinskog sustava. U nastavku će izmjerene vrijednosti biti uspoređene s vrijednostima dostupnim iz javnog internetskog servisa PVGIS (eng. *Photovoltaic Geographical Information System*) [7].

Mjerenje temperature toplinskog medija izvršeno je na mjestu spoja cijevne instalacije solarnog toplinskog sustava s pločastim izmjenjivačem topline. Na samom pločastom izmjenjivaču topline mjerene su i temperature toplinskog medija na izlazu iz pločastog izmjenjivača topline te vrijednosti temperature ulaza i izlaza cirkulacijske vode (radni medij sekundarnog kruga prijenosa topline).

Temperatura potrošne tople vode mjerena je u uronjenoj čahuri unutar spremnika PTV-a, a koja se nalazi otprilike po sredini visine spremnika. Kako bi se postigla ujednačena temperatura potrošne tople vode po visini spremnika, tijekom rada solarnog toplinskog sustava vršena je recirkulacija vode u spremniku.

Konačno, temperatura vanjskog zraka mjerena je na lokaciji postavljanja solarnog toplinskog pretvornika temperaturnim senzorom laboratorijske meteorološke postaje.

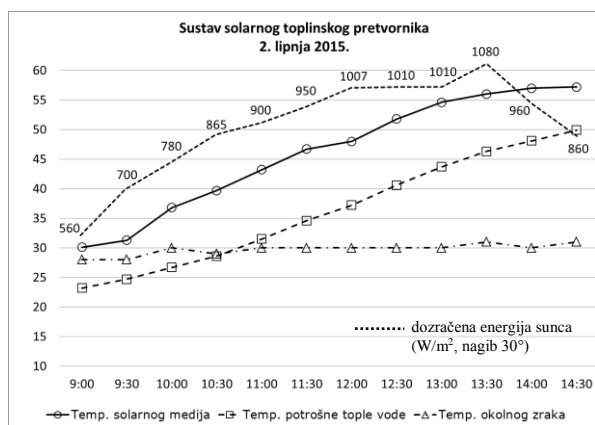
Mjerenje radnih parametara solarnog toplinskog sustava ima za svrhu demonstraciju rada laboratorijskog solarnog sustava u različitim uvjetima dozračenju energije sunca. Konačno, na osnovu izmjerenih vrijednosti određeni su neki od osnovnih radnih parametara malih solarnih toplinskih sustava, kao što su na primjer učinkovitost i koeficijent pokrivanja.

3.1 Mjerenje radnih parametara tijekom ljeta 2015.

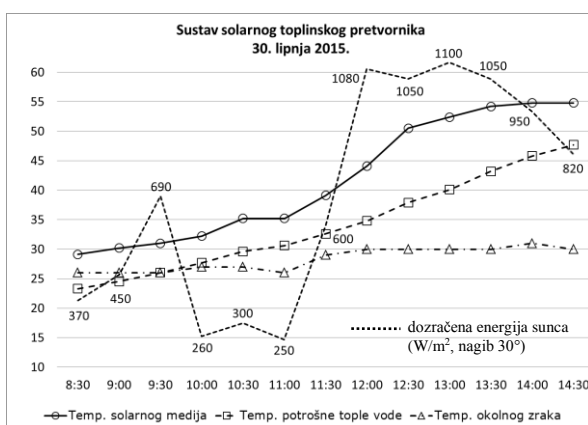
Mjerenje radnih parametara u ljetnom periodu izvršeno je tijekom lipnja i srpnja 2015. Rezultati mjerenja za četiri odabrana dana (dva u lipnju i dva u srpnju), prikazuju promjenu temperature PTV-a unutar spremnika i to od početne temperature (sobne) do konačne temperature na kraju mjerenja (slike 3, 4, 5 i 6). Tijekom lipnja početna temperatura PTV-a iznosila je oko 23°C, dok je ista tijekom srpnja bila oko 25°C.

Na slici 3 prikazani su rezultati mjerenja tijekom vedrog dana u lipnju 2015., pri čemu se PTV do završetka perioda mjerenja zagrijala na 50°C, uz prirast temperature tijekom mjerenja od 3,5 do 6,5°C/sat. Na slici 4 prikazani su rezultati mjerenja tijekom dana (lipanj 2015.) s prolaznom naoblakom, vidljivom iz podataka o dozračenoj energiji sunca. Zbog smanjene količine dozračene energije PTV se zagrijala na 47,7°C, uz prirast temperature tijekom perioda mjerenja od 2,9 do 5,7°C/sat.

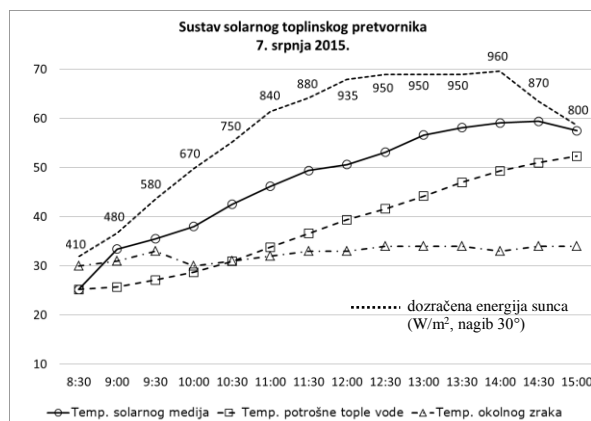
Na slikama 5 i 6 prikazani su rezultati mjerenja tijekom srpnja, pri čemu su postignute nešto veće konačne temperature PTV-a. Do završetka perioda mjerenja PTV se zagrijala na oko 55°C, dok je temperatura toplinskog medija dosegla oko 60°C.



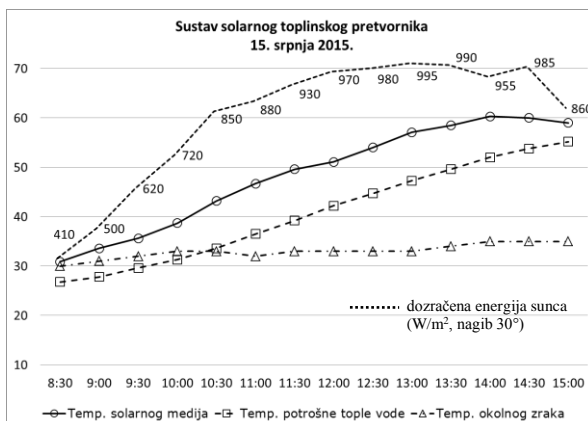
Slika 3 Rezultati mjerenja br. 1 (2. lipnja 2015.)



Slika 4 Rezultati mjerenja br. 2 (30. lipnja 2015.)



Slika 5 Rezultati mjerenja br. 3 (7. srpnja 2015.)



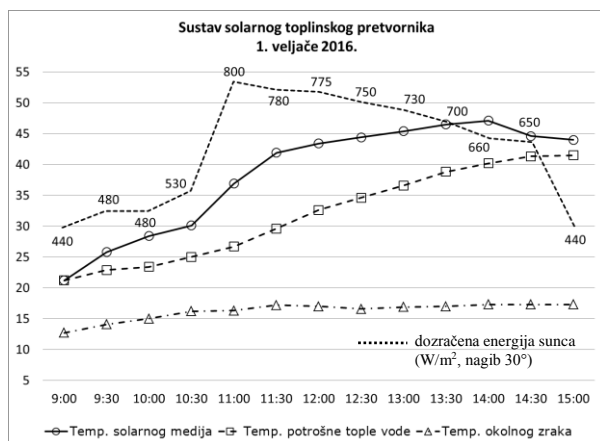
Slika 6 Rezultati mjerenja br. 4 (15. srpnja 2015.)

Uz temperature toplinskog (solarnog) medija i potrošne tople vode, na slikama 3, 4, 5 i 6 prikazane su izmjerene vrijednosti temperatura vanjskog zraka (°C) te vrijednosti dozračene energije sunca na plohu pod nagibom od 30°, odnosno na solarni toplinski pretvornik (W/m²). Iste će u nastavku biti korištene prilikom procjene učinkovitosti i koeficijenta pokrivanja solarnog toplinskog sustava.

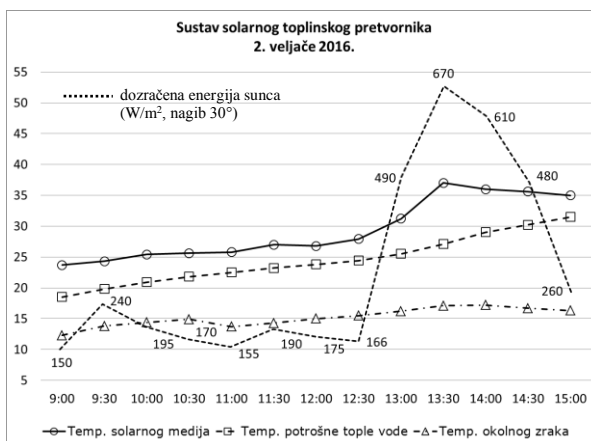
3.2 Mjerenje radnih parametara tijekom zime 2016.

Mjerenje radnih parametara u zimskom periodu izvršeno je tijekom veljače 2016. Rezultati mjerenja za četiri odabrana dana prikazani su slikama 7, 8, 9 i 10. U ovom slučaju početna temperatura PTV-a unutar spremnika iznosila je oko 20°C (sobna temperatura).

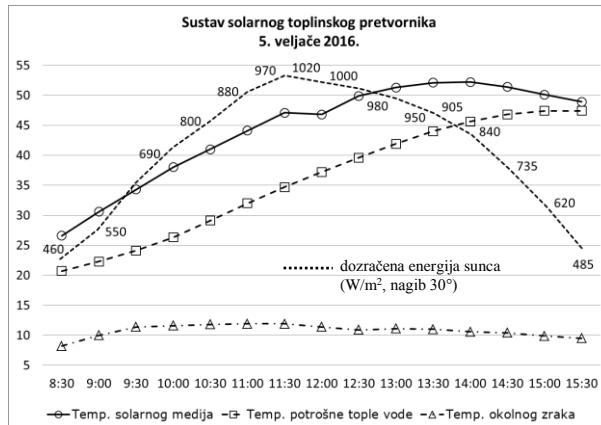
Na osnovu prikazanih rezultata proizlazi da i tijekom veljače, pod uvjetom čistog neba i uzimajući u obzir navedenu početnu temperaturu PTV-a, solarni toplinski sustav može zadovoljiti potrebe za toplinskom energijom potrebnom za zagrijavanje PTV-a na 45°C. Tako je, prema rezultatima mjerenja na slici 9, konačna temperatura PTV-a iznosila 47,4°C, dok je prirast temperature PTV-a tijekom mjerenja iznosio od 0,6 do 5,6°C/sat.



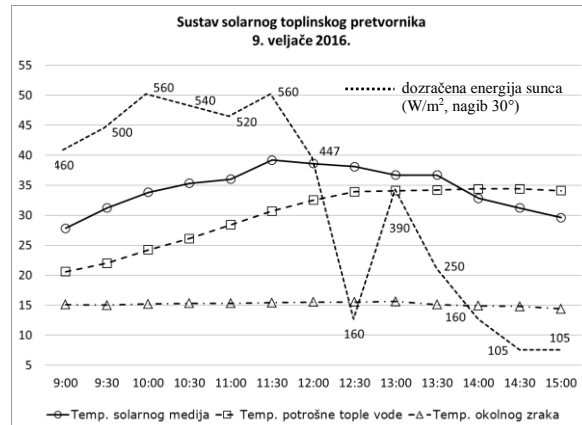
Slika 7 Rezultati mjerenja br. 5 (1. veljače 2016.)



Slika 8 Rezultati mjerenja br. 6 (2. veljače 2016.)



Slika 9 Rezultati mjerenja br. 7 (5. veljače 2016.)



Slika 10 Rezultati mjerenja br. 8 (9. veljače 2016.)

U preostalim slučajevima (slike 7, 8 i 10), kada je zbog djelovanja dnevne naoblake bio smanjen intenzitet dozračene energije sunca, nisu zadovoljene ukupne potrebe za toplinskom energijom za pripremu PTV-a.

Tako je, na primjer, 2. veljače 2016. (slika 8) najviša postignuta temperatura PTV-a iznosila oko 31,5°C, dok je ostvareni prirast temperature PTV-a tijekom mjerenja iznosio od 1,3 do 3,5°C/sat.

Neka od mjerenja provedenih tijekom veljače 2016. (oblačni dani) pokazala su da solarnim toplinskim sustavom nije moguće ostvariti zagrijavanje PTV-a, odnosno sustav nije ni bio u funkciji zbog niske temperature toplinskog medija u solarnom toplinskom pretvorniku.

4. Procjena učinkovitosti i koeficijenta pokrivanja solarnog toplinskog sustava

Na osnovu izmjerenih podataka izvršen je proračun predane toplinske energije potrošnoj toploj vodi i to prema izrazu:

$$Q_{PTV} = m \times c \times \Delta t_{PTV} \quad (2)$$

Pri čemu su:

m – masa vode sadržane u spremniku PTV-a (kg)

c – specifični toplinski kapacitet PTV-a (kJ/kg°C)

Δt_{PTV} – razlika temperature PTV-a, od početne do konačne temperature grijanja (°C).

Dovedena toplina PTV-u, za svako od mjerenja tijekom ljetnog perioda, prikazana je u tablici 1.

Tablica 1 Dovedena toplina potrošnoj toploj vodi – ljetni period

	$t_{TM,max}$ (°C)	$t_{PTV,max}$ (°C)	Δt_{PTV} (°C)	Q_{PTV} (kJ)
mjerenje 1 (2. lipnja 2015.)	57,2	49,9	26,7	16.735
mjerenje 2 (30. lipnja 2015.)	54,8	47,7	24,4	15.294
mjerenje 3 (7. srpnja 2015.)	59,4	52,3	27,1	16.986
mjerenje 4 (15. srpnja 2015.)	60,3	55,2	28,4	17.801

$t_{TM,max}$ – najviša postignuta temperatura toplinskog medija na ulazu u pločasti izmjenjivač topline (°C)

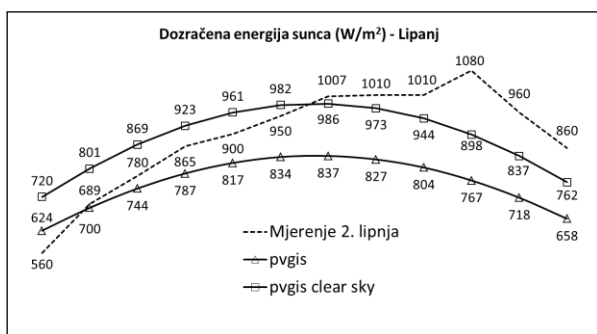
$t_{PTV,max}$ – najviša postignuta temperatura potrošne tople vode u spremniku (°C)

S obzirom na to da je mjerenje dozračene sunčeve energije izvršeno u određenim mjernim intervalima (svakih pola sata) te da se s tako očitanim vrijednostima ne može pouzdano odrediti ukupna dozračena energija sunca tijekom rada solarnog toplinskog sustava, izvršena je usporedba izmjerenih vrijednosti s vrijednostima dostupnim iz javnog internetskog servisa PVGIS [7].

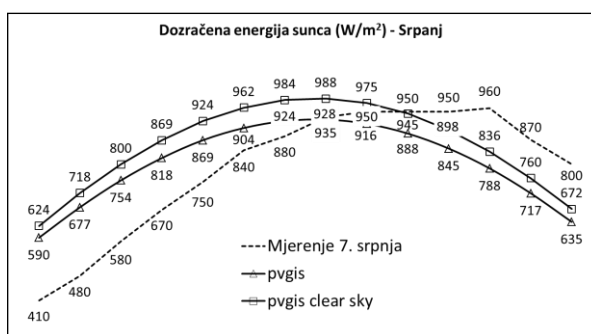
U tu svrhu, u okviru PVGIS-a definirana je lokacija postavljanja solarnog toplinskog pretvornika te su dobivene prosječne dnevne vrijednosti dozračene energije sunca za plohu pod nagibom od 30° (na osnovu mjesečnog prosjeka).

Vrijednosti dozračene energije sunca za uvjete prosječne naoblake (pvgis) i uvjete čistog neba (pvgis clear sky) za lipanj i srpanj prikazani su na slikama 11 i 12. Zajedno s vrijednostima iz PVGIS-a prikazane su i izmjerene vrijednosti tijekom 2. lipnja i 7. srpnja 2015., a u okviru vremenskog perioda mjerenja kao što je prikazano na slikama u 3. poglavlju. Prikazane vrijednosti dozračene energije sunca iz PVGIS-a često se koriste pri planiranju manjih solarnih toplinskih i fotonaponskih sustava.

Kako bi se napravila procjena učinkovitosti i koeficijenta pokrivanja solarnog toplinskog sustava, korišteni su podaci o izmjerenoj dozračenoj energiji sunca. Pri tome je pretpostavljeno da između perioda mjerenja (svakih pola sata) nije bilo značajnije promjene dozračene energije sunca u odnosu na izmjerene vrijednosti svakog perioda mjerenja.



Slika 11 Dozračena energija sunca (2. lipnja 2015.)



Slika 12 Dozračena energija sunca (7. srpnja 2015.)

Učinkovitost solarnog toplinskog sustava izračunata je na osnovu izraza:

$$\eta_{\text{SOL}} = E_{\text{PTV}} / E_{\text{SOL}} \quad (3)$$

Pri čemu su:

η_{SOL} – učinkovitost solarnog toplinskog sustava (%)

E_{PTV} – energija koja je predana potrošnoj toploj vodi solarnim sustavom u danu (kWh)

E_{SOL} – solarna energija koja djeluje na solarni toplinski pretvornik u danu (kWh).

Koeficijent pokrivanja solarnog toplinskog sustava izračunat je na osnovu izraza:

$$C = Q_{\text{PTV}} / Q_{\text{POT}} \quad (4)$$

Pri čemu su:

C – koeficijent pokrivanja solarnog sustava (%)

Q_{POT} – potrebna toplina za zagrijavanje potrošne tople vode u danu (kJ)

Q_{PTV} – toplina koja je predana potrošnoj toploj vodi solarnim sustavom u danu (kJ).

Vrijednosti učinkovitosti i koeficijenta pokrivanja solarnog toplinskog sustava u ljetnom periodu, a s obzirom na gore navedene radne parametre sustava, prikazani su u tablici 2 (za mjerenja izvršena 2. lipnja i 7. srpnja 2015.).

Tablica 2 Procjena učinkovitosti i koeficijenta pokrivanja solarnog toplinskog sustava – ljetni period

	E_{SOL} (kWh)	E_{PTV} (kWh)	η_{SOL} (%)	Q_{POT} (kJ)	Q_{PTV} (kJ)	C (%)
mjerenje 1 (2. lipnja 2015.)	9,35	4,65	49,69	13.664,1	16.735,4	122,5
mjerenje 3 (7. srpnja 2015.)	10,09	4,72	46,74	12.410,5	16.986,1	136,8

Procijenjene vrijednosti učinkovitosti i koeficijenta pokrivanja solarnog toplinskog sustava iz tablice 2 u skladu su s podacima iz stručne literature [5,8,9].

Koeficijent pokrivanja solarnog toplinskog sustava za pripremu PTV-a u ljetnom periodu veći je od potrebnih 100 %. Ako se uzmu u obzir odabrani radni parametri sustava, proizlazi da u ljetnom periodu solarni toplinski sustav proizvodi više toplinske energije nego što je potrebno, odnosno, potrošnu toplu vodu zagrijava na višu temperaturu (i do 55°C) od odabrane (45°C).

Jedan od parametara koji utječe na učinkovitost solarnog toplinskog sustava je temperatura vanjskog zraka. Utjecaj temperature vanjskog zraka nije uključen u analize koje su izvršene u okviru ovog rada. Vrijednosti izmjerenih temperatura vanjskog zraka prikazane su na slikama u 3. poglavlju. Vrijednosti dovedene topline PTV-u, za svako od mjerenja tijekom zimskog perioda, prikazana je u tablici 3.

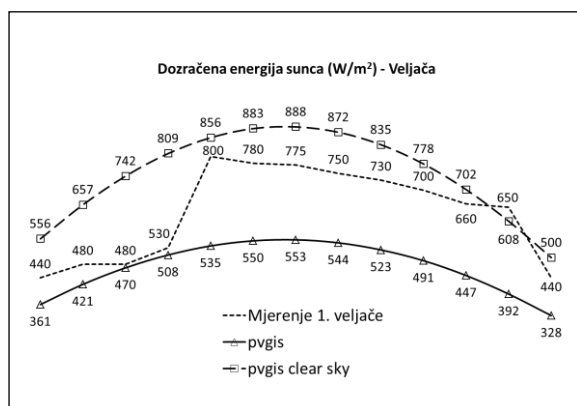
Tablica 3 Dovedena toplina potrošnoj toploj vodi – zimski period

	$t_{TM,max}$ (°C)	$t_{PTV,max}$ (°C)	Δt_{PTV} (°C)	Q_{PTV} (kJ)
mjerjenje 5 (1. veljače 2016.)	47,1	41,5	20,3	12.724
mjerjenje 6 (2. veljače 2016.)	37,0	31,5	13,0	8.148
mjerjenje 7 (5. veljače 2016.)	52,2	47,4	26,7	16.735
mjerjenje 8 (9. veljače 2016.)	39,2	34,4	13,5	8.462

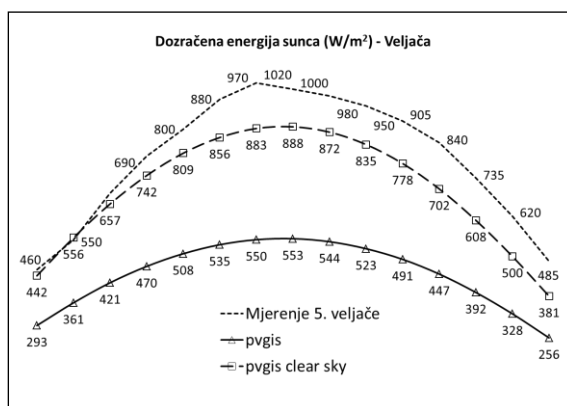
$t_{TM,max}$ – najviša postignuta temperatura toplinskog medija na ulazu u pločasti izmjenjivač topline (°C)

$t_{PTV,max}$ – najviša postignuta temperatura potrošne tople vode u spremniku (°C)

Kao što je bilo prikazano za mjerenja u ljetnom periodu, tako su upotrebom PVGIS-a i za veljaču prikazane vrijednosti dozračene energije sunca za plohu pod nagibom od 30° (slike 13 i 14) i to posebno za uvjete prosječne naoblake (pvgis) i uvjete čistog neba (pvgis clear sky).



Slika 13 Dozračena energija sunca (1. veljače 2016.)



Slika 14 Dozračena energija sunca (5. veljače 2016.)

Vrijednosti učinkovitosti i koeficijenta pokrivanja solarnog toplinskog sustava u zimskom periodu, a s obzirom na već navedene radne parametre sustava, prikazani su u tablici 4 (za mjerenja izvršena 1. veljače i 2. veljače 2016.).

Za razliku od ljetnog perioda, koeficijent pokrivanja solarnog toplinskog sustava za pripremu PTV-a u zimskom periodu niži je od potrebnih 100 %. Vrijednosti učinkovitosti i koeficijenta pokrivanja solarnog toplinskog sustava, prikazani u tablici 4, u skladu su s podacima iz stručne literature [5,8,9].

Tablica 4 Procjena učinkovitosti i koeficijenta pokrivanja solarnog toplinskog sustava – zimski period

	E_{SOL} (kWh)	E_{PTV} (kWh)	η_{SOL} (%)	Q_{POT} (kJ)	Q_{PTV} (kJ)	C (%)
mjerjenje 5 (1. veljače 2016.)	8,94	3,53	39,53	14.917,7	12.723,9	85,29
mjerjenje 6 (2. veljače 2016.)	4,30	2,26	52,54	16.610,0	8148,3	49,06

5. Zaključak

Dobiveni rezultati za učinkovitost i koeficijent pokrivanja solarnog toplinskog sustava za pripremu PTV-a u skladu su s podacima iz stručne literature, a uzimajući u obzir pretpostavljene potrebe za potrošnom toplom vodom. Na osnovu izračunatih koeficijenata pokrivanja proizlazi da u ljetnim mjesecima sustav u potpunosti zadovoljava pretpostavljene potrebe za toplinskom energijom (npr. 122,5 %), dok isti tijekom zimskog perioda u prosjeku nije dostatan. Učinkovitost sustava u terminima mjerenja iznosila je između 35 i 50 %.

Budući stručni rad trebao bi obuhvatiti utjecaje (1) procesa izmjene topline u dva stupnja (primarni krug s toplinskim medijem – sekundarni krug s vodom – potrošna topla voda), (2) konstantnog protoka toplinskog medija u primarnom krugu te (3) temperature okolnog zraka na radne parametre solarnog toplinskog sustava. Konačno, potrebno je vršiti kontinuirano mjerenje dozračene energije sunca na lokaciji postavljanja solarnog toplinskog pretvornika, a kako bi se dobili precizniji podaci o raspoloživoj energiji sunca za rad solarnog sustava.

Zahvala

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Operating Parameters of a Solar Thermal System for DHW Heating

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Abstract. The paper presents the results of measuring the operating parameters of a solar thermal system. The solar thermal system is used in the laboratory for heating domestic hot water (DHW). A solar thermal panel is placed at the location 43°31'21" N i 16°27'01" E, facing South at the fixed angle of 30°, in relation to the horizontal plane. The measurement of operating parameters was carried out over two specific periods of time (in summer and winter), in order to analyse the performance of solar system in different operating conditions. Based on the results measured, the efficiency and coverage ratios of the solar thermal system are estimated. Finally, the results were compared with the data available in the literature.

Key words: *solar energy, solar thermal system, efficiency, coverage ratio*

Digital economy and increasing trends of broadband network access in Europe and the Republic of Croatia

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Abstract. The first part of the paper deals with forecasts of the global growth of the required access speed for broadband networks in the next decade. Broadband access is one of the basic components of digital economy. This part of the article also describes other factors influencing the development of digital economy. The second part of the paper is a comparative analysis between main factors of the Croatian digital economy and the digital economy in the EU countries, and the movement of certain factors for the period between 2014 and 2015. One of the main factors is "Connectivity", but it is lagging behind in relation to movements in the EU. Furthermore, the article shows the comparison of the situation of individual broadband access technologies in the Republic of Croatia and the state of the EU average, indicating differences in the developmental trends. Finally, the paper proposes activities and stakeholders to further enhance the overall digital economy of the Republic of Croatia.

Key words: *digital economy and society index, connectivity, integration of digital technology*

1. Introduction

Eurostat gives a whole set of information about the state of the EU and each of its member states in its document Quality of life – Facts and views. The data presented in this article is taken from the 2015 yearly edition of the mentioned Eurostat document and the 2013 yearly report of the EU member states. Trough analysis a correlation between the state of a national economy (described with gross domestic product per capita) and certain social facts is presented [8], [9].

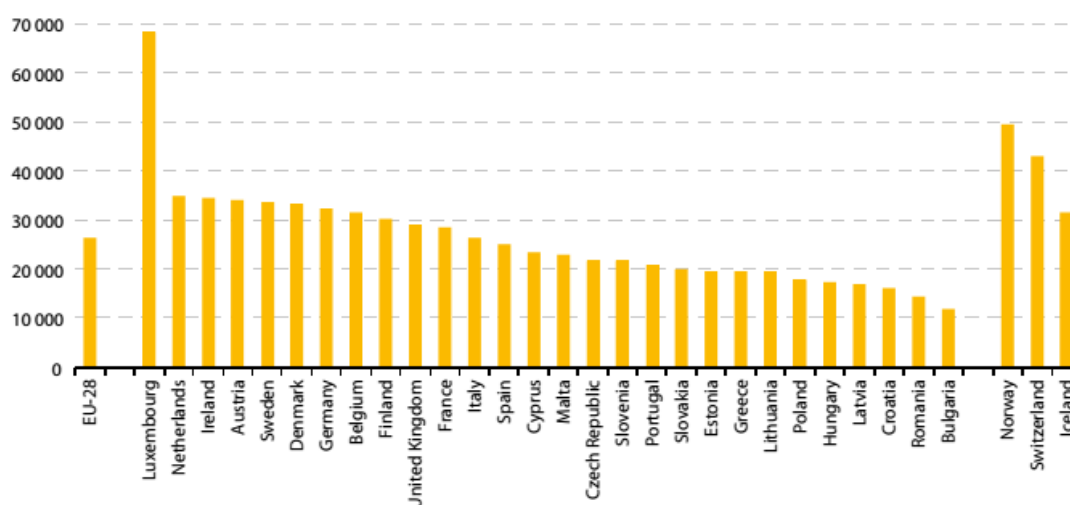


Fig. 1: Gross domestic product (GDP) at market prices, 2013 (Current prices, PPS per capita) [8]

From the graph presented in Fig. 1 it is visible that the Republic of Croatia is among the last in the EU when ordered by GDP per capita. When an analysis of the economic data found at the European Commission web pages is undertaken, it can be easily distinguished that the global economic crises that started in 2008 left its mark on the total economic growth of the EU and each of its member states. Perhaps that can be most obviously seen from the employment rate data during the years of crisis, presented in Table 1.

Table 1: Percent of employment in ages 20 to 64 [8]

	Year	2008	2011	2012	2013	2014	Values targeted for 2020
Percent of employment in ages 20 to 64	EU	70.3	68.6	68.4	68.4	69.2	75
	RH	64.9	59.8	58.1	57.2	59.2	62.9

The European Commission has defined EU development goals it wants to achieve by the year 2020. Among those development goals of the EU, there are a 75% employment rate for people ages 20 to 64 and a scientific and education investment at a 3% rate of the GDP per capita. The estimations for Croatia set the employment rate at 62.9% and investment in science and education at 1.4% of the GDP per capita (at the moment those investments are at 0.79% GDP per capita). It could be argued that the predictions of the European Commission for the Republic of Croatia are not very optimistic.

The European Union plans to base its further economic development on new technologies, protection of the environment, reduced electric energy consumption and, in general, on the idea known as Digital Economy.

The term Digital Economy first occurred in a best-seller book named “The Digital Economy” published in the year 1995. The author of the book is Canadian born statesman, businessman, consultant and author **Don Tapscott** (born 1. June, 1947). In the book he discusses how are the new technologies (especially computing and information technologies) going to change society and particularly business and economy.

In today’s world the term Digital Economy is widely accepted. The European Commission bases most of further EU development on and through that term. According to the strategic plans of the European Commission, further economic growth is not possible outside of the limits dictated by the term of Digital Economy.

In the year 2013 the European Commission has brought a whole series of strategic measures and plans connected with the term Digital Economy. It was additionally motivated to do so by the economic crises that started in the year 2008 and shook the global and European economies. One could say it is a strategic look at the possibilities of further economic growth in the European Union but also Europe in general.

According to the strategic guidelines of the European Commission, the development of Digital Economy also encourages the entrepreneurship development, development of new work places, total economy growth and especially growth of small and middle sized companies.

This very strategic plan, if implemented, should motivate further economic growth in the European Union, but also in Europe in general. If Croatia wants to achieve further economic growth, it has to harmonize and coordinate its strategic plans for development with the European trends in digital economy development. It has to develop its own complete strategy and determine its strategic goals.

2. Cloud computing and digital economy

One important activity through which positive changes in the economic environment can be observed is cloud computing [5].

The following questions need to be asked: Why is cloud computing important for further economic development? What is the connection between cloud computing and Digital Economy? In which aspects can cloud computing provide better possibilities than traditional forms of business based on Local area networks and bought applications? Why is cloud computing particularly motivating for small and middle size companies and how can it reduce operating costs of a business?

2.1. Work based on Local area network infrastructure

The traditional business model has demanded that companies have their own local area network and that they buy their business applications. After buying the business application, it was necessary to install the application on the internal company infrastructure. To ensure work continuity of the local area network, companies had to have their own IT specialists, who maintained the networks and also helped maintain compatibility with bought software. To ensure that the servers of the local area network (strong computers on which the business applications were installed) were continuously accessible, the servers needed to be placed in special air-conditioned rooms and provided with backup generators for power outs. As a consequence of traditional model demands, more sophisticated applications were not easily accessible or were completely inaccessible to small companies. Acquiring such applications demanded large initial investments from small companies which were then spent on:

- Buying the application
- Building the needed infrastructure
- Providing adequate storage for the needed IT equipment
- Employing IT and Network specialists for development and maintenance of the needed infrastructure

Also, it is important to mention that maintenance and further development of the bought applications were laborious to their sellers because they needed to reach out to all of their customers for each upgrade or fix patch.

2.2. The concept of cloud computing

The concept of cloud computing is based on the idea that applications are not sold but rented out to the end user for an agreed period of time.

Companies do not buy the application but rent its services for the time needed. This approach provides the possibility of starting a business with significantly smaller initial investments on IT support and infrastructure. Another benefit is that if a company realizes that it doesn't need a certain application, it can just terminate the lease of that application.

When applications are leased, they are accessed through the internet, which means there is no need for a company to have its own local area network infrastructure but a quality broadband internet access.

When companies had their own local area networks with central servers, which were then accessed by terminals in order to use a certain application, the demanded network speed was 100 Mbit/s. In cloud computing the server is not in a local area network but in a server center which can be located anywhere in the world. In order to have quality access to the needed application, the demanded speed is also 100 Mbit/s.

Companies no longer need their own local area networks, air-conditioned server storage rooms with backup generators, they no longer need their own network specialists to take care of the vital infrastructure or need fewer of them, and they no longer need to permanently buy applications.

Modern companies only need standard user computers, a fast internet access and to rent out the needed applications for a certain amount of time or certain amount of service.

By utilizing this concept, small and middle size companies avoid large initial investments, but even in general, the monthly cost of operations is lower, since there is no need to maintain an internal local area network, and thus the costs of IT support are significantly lower. This allows small and middle size companies to be more competitive in the market and the general price of services to be lower. Smaller initial investments motivate the economy which then reduces the unemployment rate.

In order to achieve cloud computing the following need to exist:

- Software centers which will provide the needed services
- A quality broadband internet access
- Network security in the software centers, on the network and at the end user

Because of this the European Union is willing to financially support the development of:

- Software centers
- Fast and super-fast internet access
- Network and software security

2.3. Software center development

According to all presented, development of software centers today is a global phenomenon which shows no sign of slowing down.

Software centers serve for storing and processing data through various applications. They are accessible through broadband internet access. Unfortunately, a large number of companies still fear of cloud computing because they are afraid of leaking or loosing fragile and sensitive strategic or personal information. They feel uneasy not knowing the exact physical location of their data which can be stored in software centers around the world and not knowing the steps taken to ensure the security of their data.

However, security mechanisms which exist today and which are implemented by large software centers provide significantly higher security level than most companies could hope to offer on their own. This is especially true for small companies that are just being set up. Data security in software centers is extremely high. Another vital security part of the architecture is the security of the network by which the data is being transferred. The security there is not as high as in software centers and there is room for improvement, which is why it is a field that's been constantly worked on. The weakest link in the security chain is the end user, who is also most often the target of attacks. Most attacks try to sabotage the communication and acquire vital information, such as user names and passwords. Since most of the attacks target the end user, the security level is the same or even higher when using cloud computing.

Companies can rent applications through online services. Software centers can and mostly are located all over the world, and often in colder parts of the world to reduce the costs of cooling the spaces for the servers.

When it comes to conducting business for companies it is not a big problem that the users do not know the exact physical location of where their data is stored. However, this is a problem when it comes to data which is of national importance. For instance, data related to and stored by applications such as e-citizen, e-government, e-healthcare and other public services work on and store data of national significance so they need to be protected on a national level.

The Croatian Republic, as well as other European countries, has to take the development of their own software centers as a part of their national strategy relating to digital economy into the account. These software centers would be used for storing applications and data of national importance, but could also have capacity which could be rented out to other countries or companies for safe storage of their application and data. It would not be a good idea to let this part of the digital market be developed by someone else and then rent out their services.

2.4. Development of fast and superfast Internet access

In order to develop cloud computing in its full capacity it is important that end users, be they physical users or companies, get access to fast and superfast internet. Without such internet access there is no cloud computing and without cloud computing there are no advantages that it brings with it, such as the expense reduction, increase in productivity and competitiveness.

In the modern world, running a company without it having a web page, e-mail or at least internet access is unthinkable. Companies that do not have access to internet do not exist in the modern economic sense. When consumers need anything, the first thing they do is search the web for information.

The basic economic capacity of a country comes from its people and its land. People are the ones performing the economic activity and land is the place where the activity is performed.

When it is said that approximately 70% of land in Croatia cannot get broadband internet access, it means that 70% of the national land is out of economic function. In Croatia there is a big difference between internet coverage in urban, suburban and rural areas. Only urban areas can be satisfied with the quality and the speed of internet access. Although over 57% of the population in Croatia lives in urban areas, urban areas make only 3% of the national territory. This leads to the conclusion that only 3% of the national territory has internet stable enough to be put to economic use.

The most developed countries in Europe such as Denmark, Belgium, The Nederland, and Germany have a balanced development of broadband internet access on their whole territory which means they can put their whole territory to economic use.

When it comes to ability of connectivity and the quality of connectivity, the Republic of Croatia is among the last in the European Union. It is important to point out that telecom operators cannot take the whole blame for this situation. The reasons of this problem are more complex, as is their solution.

3. European digital economy

3.1. Digital agenda

The European commission has presented its goals in digital economy through a document know as Digital agenda [1], [2], [7], [12]. These goals state that by the year 2020 the following needs to be achieved:

- Fast internet access (30 Mbit/s to 100 Mbit/s) for all European citizens
- Superfast internet access (100 Mbit/s or higher) for 50% of all European households

The agenda makes no difference based on the location inside the European Union. Reaching the goals set by the digital agenda is a key precondition for further economic and societal development.

3.2. Digital economy and DESI index

The European commission, as part of its digital agenda, keeps track of digital economy in European society through the so called DESI index (DESI-Digital Economy and Society index). This index is calculated for EU in general and for each of its member states. The DESI index is a complex indicator consisting of several components and subcomponents [7].

Five base DESI index components are:

- Connectivity
- Human Capital
- Use of Internet
- Integration of digital technology

- Digital Public Services

Each of the five base components is complex and made out of several subcomponents.

- Connectivity is calculated as a weighted average of its four subcomponents
 - Fixed broadband internet access
 - Mobile broadband internet access
 - Speed of internet access
 - Availability of internet access
- Human capital is calculated as a weighted average of its two subcomponents
 - Basic internet usage skills
 - Advances internet usage skills
- Use of internet is calculated as a weighted average of its three subcomponents
 - Content of use
 - Communication use
 - Business use
- Integration of digital technology is calculated as a weighted average of its two subcomponents
 - Digitalization of business
 - E-Shopping
- Digital Public Services is calculated as a weighted average of its two subcomponents
 - E-Government
 - E-Healthcare

Fig. 2. “Croatia's performance in the DESI 2015” graphically shows the state of digital economy in the Republic of Croatia. By the total DESI indicator the Republic of Croatia is with a normalized value of 0.38 (normalized on scale from 0 to 1) on the 24 place of the 28 European Union countries.

There are DESI indicators by which the Republic of Croatia is above the EU average. That is the DESI indicator of integration of digital technologies where 25% of all small and middle size companies in Croatia have online stores and 8.4% conduct overseas business (6.5% is the EU average). Small and middle size companies in Croatia make an average of 11% of its business online (8.8% is the EU average). Big companies make 14% of their business online (20% is the EU average).

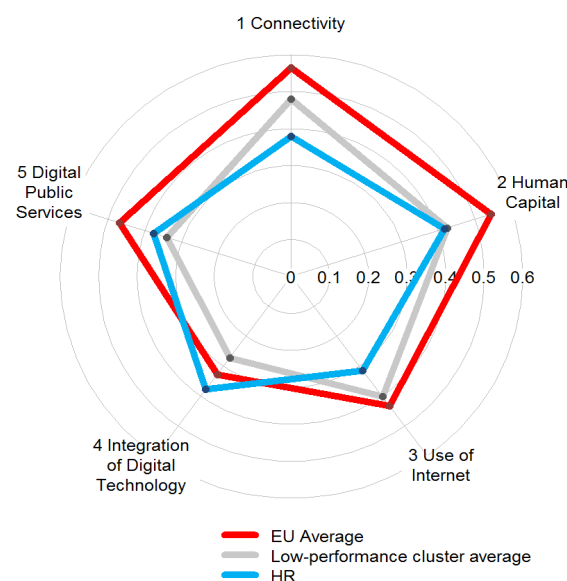


Fig. 2: Croatia's performance in the DESI 2015 [7]

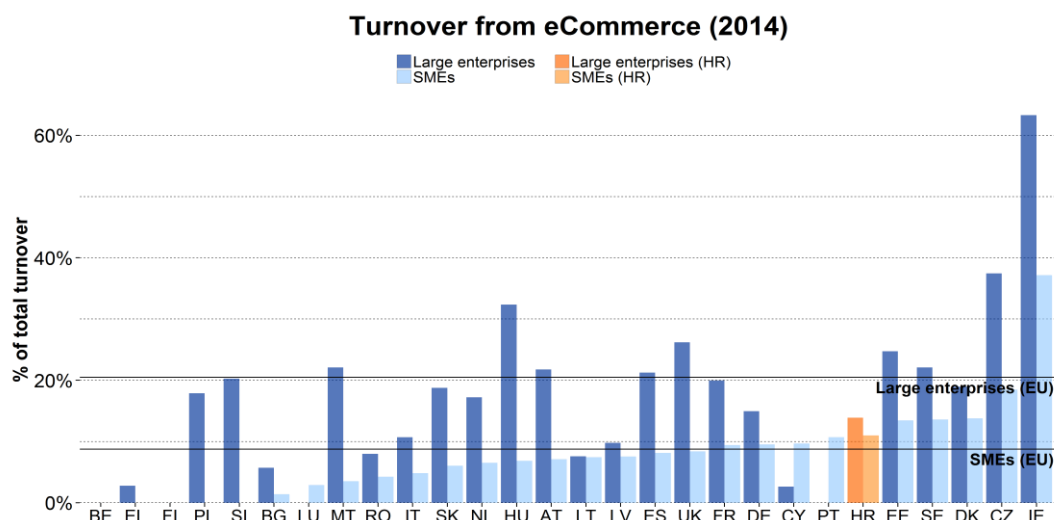


Fig. 3: Integration of Digital Technology, SME Turnover from eCommerce [7]

In the Republic of Croatia 25% of small and middle size companies conduct online sales (15% is the EU average). 8.4% of Croatian small and middle size companies conduct overseas online sales (6.5% is the EU average).

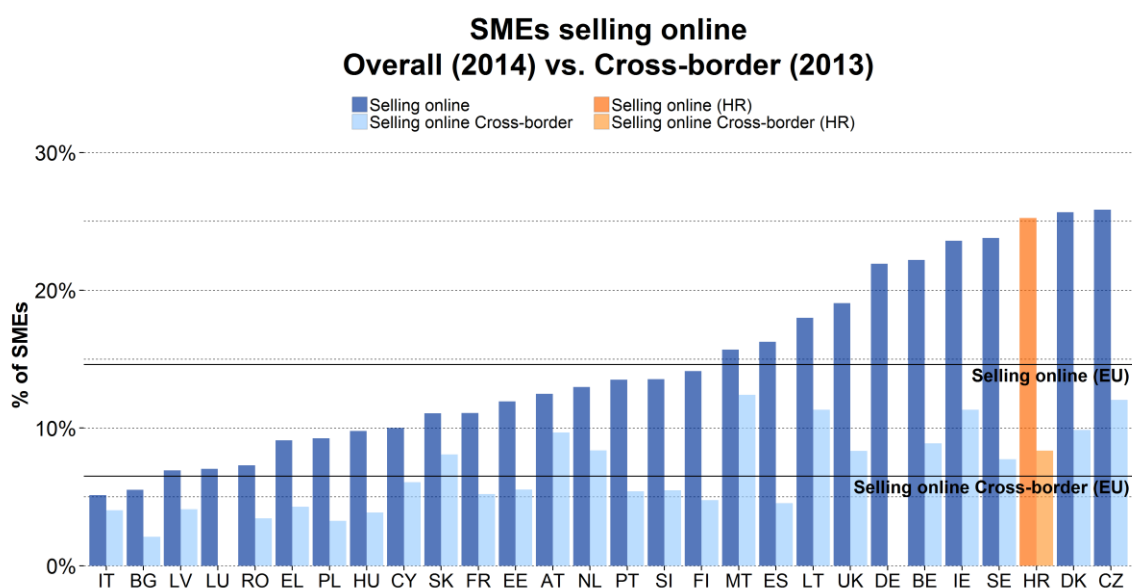


Fig. 4: Integration of Digital Technology, SMEs selling online [7]

The Croatian economy is not very advanced but the DESI indicator of Integration of digital technologies shows that it is heading in the right direction and that it can potentially achieve big growth. An obstacle in achieving that growth is the bad DESI index relating to Connectivity. Despite the fact that fixed broadband internet access is available in 97% of households only 61% of households take the advantage of the opportunity. By this index of the 30 European countries Croatia is the worst ranked.

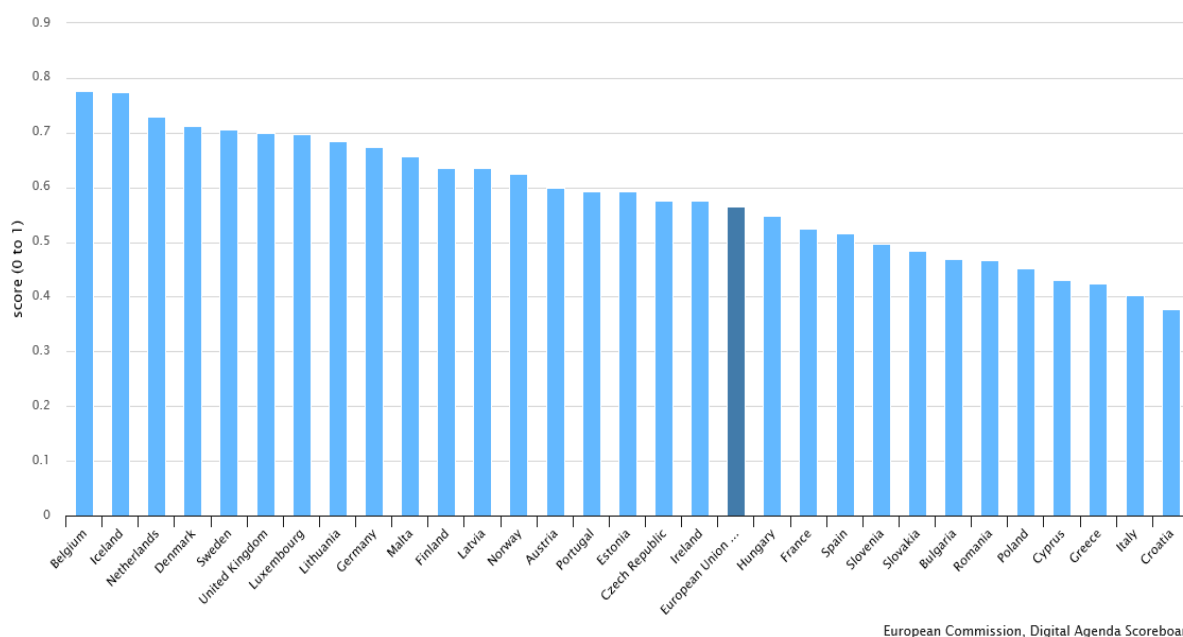


Fig. 5: Ranking in Connectivity [7]

Although 57% of households in Croatia have access to broadband internet of high speeds (NGA), only 1.1% of households use such access. It is important to notice two facts here:

- The reason why 57% of households have access to NGA internet is because 57% of the population lives in the four major urban areas which occupy only 3% of the national territory. Once more, this brings out the fact that only 3% of the national territory can be put to economic use because all of the adequately developed infrastructure is in densely populated urban areas.
- The fact that only 1.1% of households use a NGA connection points out two facts:
 - The price of such a connection is relatively high compare to an average household income
 - Low rate of informatics and information education

An average household in Croatia spends 2.5% of its gross income on an internet connection (12-30Mbps) while the average in the European Union is 1.4%. It can clearly be seen from this data that for citizens of Croatia an internet connection is quite expensive. However, the reason why it is so expensive for an average Croatian household is not the high price of internet service but the low average household gross income. This makes the problem more difficult to solve as there is no more room for further price reduction.

When ranked by the DESI indicator of Human capital, Croatia is 23rd in Europe with a modes 0.42 result. Croatia needs to work on achieving increasing the populations' digital qualities and abilities. A clear indication of their lack can be seen in the fact that 28% of the Croatian population has never used an internet connection (the European Union average is 18%). On the contrary, in states like Denmark 92% of the population use internet and the EU average is at 75%. Advanced countries have a culture of internet usage which still needs to develop in Croatia. However, there are some aspects in which Croatia is above the EU average. For instance, video communication over the internet is at 38%, while the EU average is 37%, and reading the news over the internet is at 79%, while the EU average is at 67%.

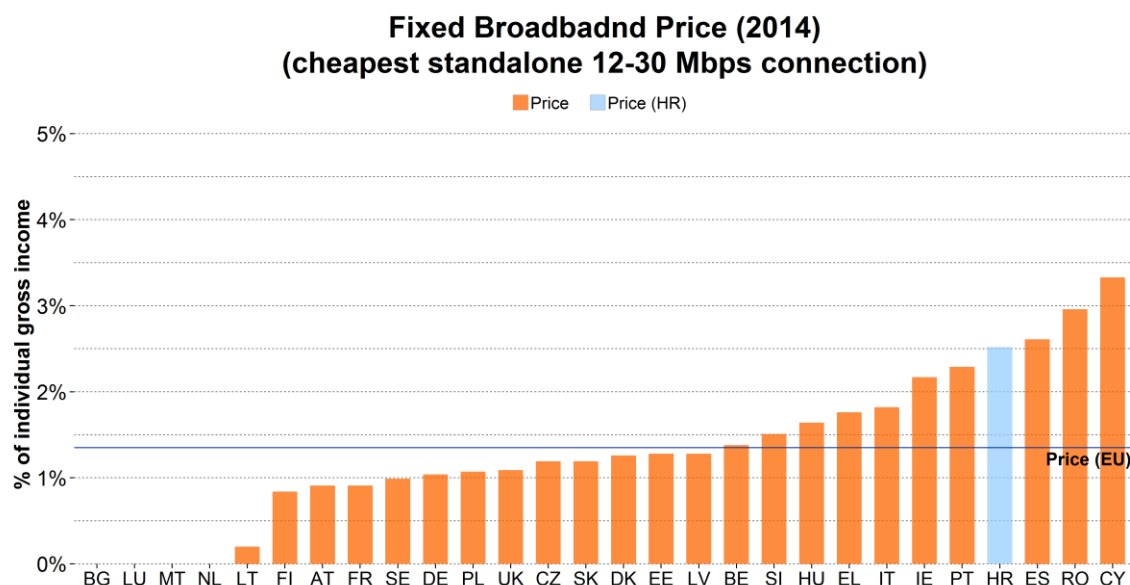


Fig. 6: Connectivity, Fixed Broadband Price. [7]

Further analysis of DESI indicators for Croatia (2014-2015) shows some positive, but also some negative trends.

Positive trends:

- Small and middle size businesses base their sales and management on modern communication technologies more than average in the EU and usage of such technologies is showing an increase.
- Online sales as well as cross border trade are above the EU average.
- In some of its public services such as e-Recipe (part of e-Healthcare), Croatia is among the leading in the EU (over 99% of all recipes are issued in this way).

Negative trends:

- Croatia is the worst in the EU when it comes to Connectivity and does not use all of the existing infrastructure.
- Fast and superfast internet access can only be achieved in highly urban areas which make only 3% of the national territory.
- Croatian citizens pay the highest price for internet access in relation to their income.
- When ranked by the amount of people who use the Internet Croatia is 21 out of 28 EU countries.

The European Union bases and will continue to base its further development on Digital economy. Croatia should do the same, but it lacks a complete strategy for further development based on Digital Economy. For years Croatia has been developing strategies such as the Strategy for increase of broadband internet access. Although these strategies are heading in the right direction, they are not a complete solution. Developing strategies without considering their implications and what they are trying to achieve is the reason Croatia is among the worst in the EU regarding the factors those strategies are trying to influence.

By taking into consideration the example of Italy which also has a strategy of just increasing the number of internet access points without a clear idea why that wants to be achieved, it can be seen that that is a bad approach, given that Italy is on the second last place in the European Union, only being better than Croatia.

Croatia has to take all of the DESI indicators into careful consideration and then develop a complete strategy regarding Digital economy. This strategy should produce well determined goals that should be reached through a set of strategic measures implemented in several iterations.

4. Future economic growth in Croatia based of Digital economy

As mentioned before, further economic growth in Croatia has to be based, among other things, on the development of Digital economy.

4.1. Investment in science and education

Modern society is a scientific one or, in other words, one based on education and knowledge. Therefore, it will come as no surprise that it is planned to increase investment in science and education. This investment should reach a European level of 3% of the country's GDP by the year 2020.

The educational system should take special care and make special effort in stimulating young people to enroll in areas of computer and information science. An estimate based on enrollment quotas shows that this profession will have a big lack of potential employees. It is also important to stimulate students to take part in the Erasmus and Erasmus+ program so they gain international and work experiences. This will not only make future employees more opened to international business, but will also help in creating more international business and thus benefit the economy. It is also important to simplify the process of establishing new firms and make the information on such activity easily accessible.

It is immensely important to continue developing public online services regarding education. Some ideas go as far as to suggest creating the available public service sites that would freely provide all the textbooks for primary school and high schools.

It is important to develop a culture of using communication and information technologies for online learning. Especially to establish online learning as a lifelong informal activity.

4.2. Development of informatics in society

As part of the national strategy regarding digital economics, it is important to define and encourage development of software centers which will serve as a basis for cloud computing and storing data of national interest. Also, special care needs to be given to development of online public services. By the year 2020 all interaction with state administration should be possible over the internet. This would make things not only more efficient but also less costly. Through the use of online public services citizens need to be able to save both time and money, need to be given a high quality service and thus to be stimulated to use such services.

4.3. Connectivity development

When ranked by DESI indicator for connectivity Croatia is the last in the European Union. It has the worst infrastructure, the highest prices and the least spared out broadband internet access coverage. The weight of infrastructure development cannot be solely placed on the market and existing telecom operators. Units of local government, with the help of EU funds, need to be stimulated to make development programs regarding broadband internet access infrastructure. Local government should be able to establish communal firms with the purpose of communication infrastructure development. A strategy is needed to ensure the possibility of broadband internet access all over the national territory. This is a needed precondition to further economic growth in Croatia. Every part of the national territory has to have access to water, electricity, roads and fast internet. This would not only make the whole territory economically usable, but would also motivate development of underdeveloped areas and thus motivate decentralization. In a communication sense it is important not only to motivate development of

fixed networks, but also mobile ones, such as is the 4G system network. Tax reduction on investments in infrastructure development should be carefully considered.

Future development of any economic activity will not be possible without high quality internet access.

4.4. Strategy of economic growth as a strategy of digital growth

The European commission has determined all strategic goals which should be reached by the year 2020. Croatia should do the same and also look into all the motivational funds Europe has prepared for such development.

In the year 2011 70% of GDP (around 9 trillion euros) was achieved in economic service activities. Cloud computing is a technological innovation, but also a modern form of continuous service providing. From this, it could be concluded that cloud computing is a representation of a modern form of conducting business and as such is the future of economic growth.

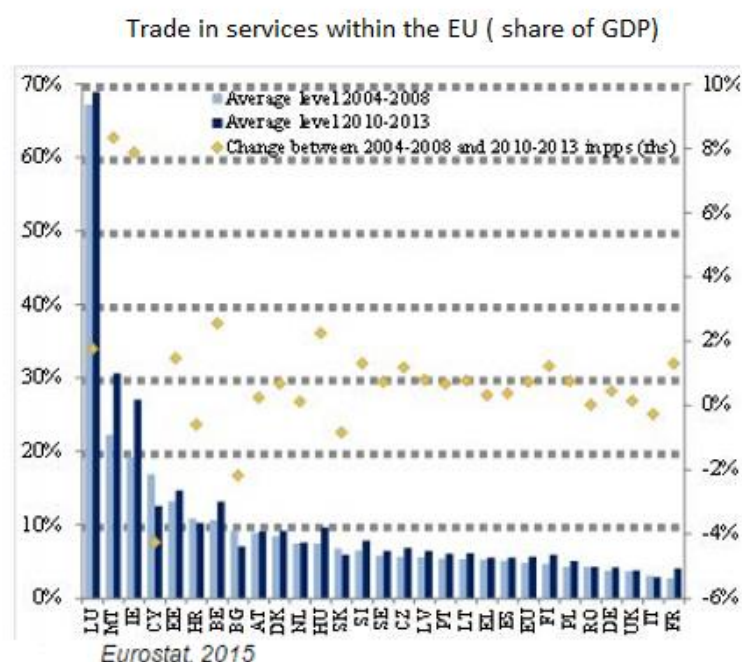


Fig. 7: Trade in service within the EU [13]

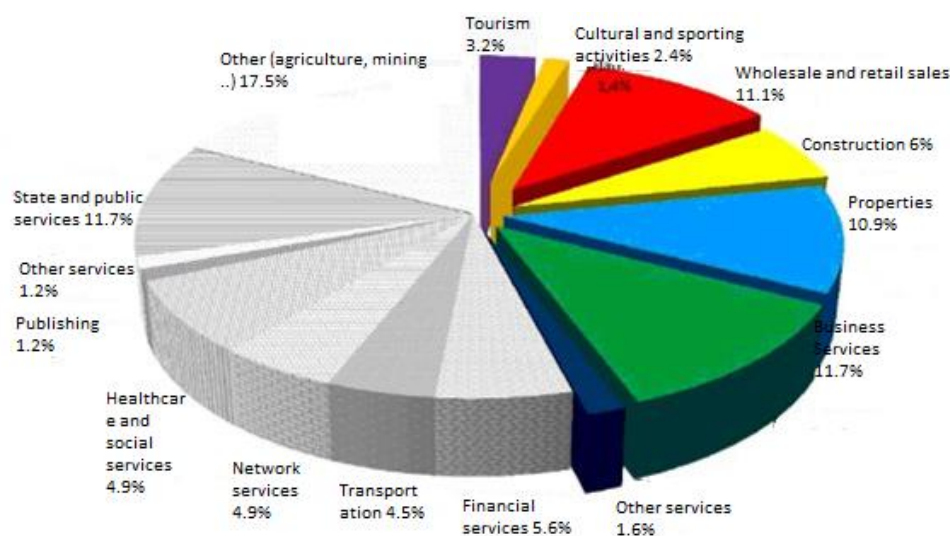


Fig. 8 Proportion of services in the modern economy [13]

Following the example set by the EU Croatia should develop a complete strategy regarding digital economy. There should be only one complete strategy not multiple strategies as there have been so far.

A country does not exist in an economic sense if it does not have stable and fast internet access. In the modern world many rural activities or, more precisely, activities of the primary economic sector increasingly use services and support of computer software to optimize their activity and thus make them more competitive on the market. Development of the primary economic sector will also depend on it using more and more of modern technologies, especially information and informatics technologies. Without this change in conducting business, the primary sector cannot survive, let alone grow.

Cloud computing and other modern IT technologies will reduce the number of needed government employees. A good example of this can be seen through the online public services provided to citizens in countries such as Estonia or Denmark. Such services reduce the need for government administration employees and consequently make the state more efficient and reduce its expenses.

From the DESI indexes it can be seen that although the Croatian economy is weak, it is healthy or, more precisely, it is heading in the right direction. The Croatian economy shows it can adapt to digital economy even more than the current state of connectivity allows. It could be said that Croatia deserves and is capable of a better economy than it has at the moment.

Unfortunately, whenever the bad economic state of Croatia is discussed, more time is spent on trying to find who to blame for such a situation than on developing a strategy to improve the state of the country's economy. It is vital to form a development strategy, to determine the goals of the strategy and the deadlines to achieve them, then to work on achieving the set goals. No goal can be reached by social division, but only by working towards it.

5. Conclusion

The European Union to a large extent bases further economic growth and employment rate growth on the service sector. The modern service sector is and will largely be based on modern technologies, especially computing and information technologies. Special stress is given to the development of software centers which will be the base for increasing the market of digital services. Another important part of development is increasing the access to fast and super-fast broadband internet. National territory can only be used if it has internet access and access to communication networks [3], [5], [6].

Further economic growth in Croatia, as in the European Union, will be based on digital economy. It is vital to create a full development strategy based on digital economy. The strategy needs to define goals, but also the dynamic of achieving the set goals. Concrete actions in mobilizing people, society and economic subjects in Croatia need to be defined and undertaken from the strategy.

According to DESI indicators, Croatia is good in some areas, even to a point that it is above EU average, but bad in other areas, sometimes even the worst in the EU. The European Union has development funds that can be used for broadband access development, software center development and cyber security development. These funds are available until the year 2020. Every year that passes without using these funds is a wasted year.

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Utjecaj udaljenosti od gnječene površine na svojstva termomehanički očvrsnute legure aluminija ASTM 2011

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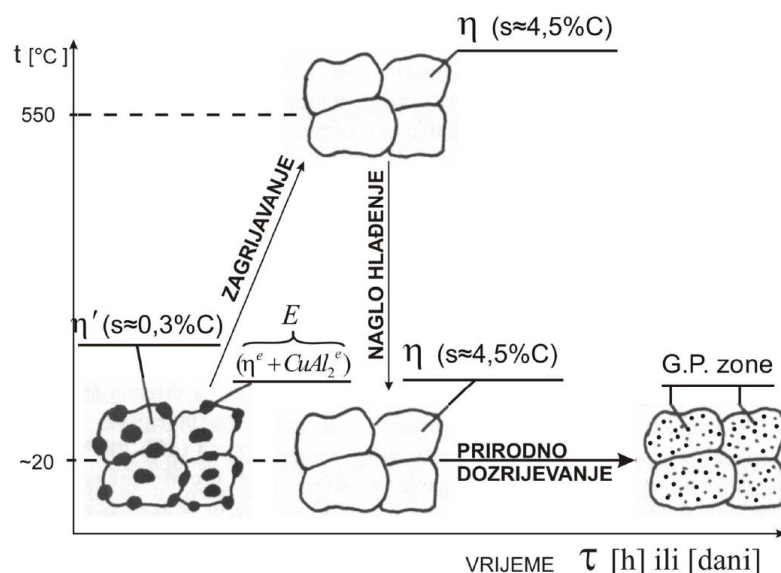
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Sažetak: Precipitacijski očvrstivim legurama aluminija dodatno povećanje otpornosti materijala, uz odgovarajuću toplinsku obradu, postiže se hladnim gnječenjem. Plastična deformacija vrši se kao međufaza toplinske obrade i to nakon rastvornog žarenja i gašenja, a prije umjetnog dozrijevanja. Gnječenje je obavljeno između tlačnih ploča hidrauličke prese. Cilj istraživanja odrediti je utjecaj udaljenosti od gnječene površine uzorka na postignuta svojstva (tvrdoću) nakon završene obrade. Odabrani su cilindrični uzorci, koji su nakon obrade izrezani uzduž simetrale te je određen profil tvrdoća između dvije gnječene površine. Korišten je centralni kompozitni plan pokusa, a rezultati ispitivanja statistički su obrađeni primjenom programa *Design-expert*. Promjenjive varijable pokusa su temperatura dozrijevanja, vrijeme držanja uzorka na temperaturi dozrijevanja i udaljenost od gnječene površine. Odzivna veličina pokusa je tvrdoća nakon provedene termomehaničke obrade.

Ključne riječi: *Alumijeve slitine, precipitacijsko očvršćivanje, tvrdoća, deformacija*

1. Uvod

Očvrstivost koja se postiže toplinskom obradom ne počiva na principu modifikacije rešetke već na promjeni rastvorivosti legiranih elemenata u rešetki aluminija. Zagrijavanjem legure i rastvaranjem maksimalne količine atoma bakra u rešetki aluminija te sprječavanje difuzije naglim hlađenjem u strukturi se dobivaju prezasićeni mješanci i veoma izvitoperene rešetke što dovodi do povećanja čvrstoće. Difuzijom nakon hlađenja dio atoma bakra napušta mjesta na kojima su gašenjem zadržana. Guinier-Prestonove zone, slika 1, nastaju zbog mikronehomogenosti unutar mješancaca, iako se sami mješanci mogu smatrati homogenima. Na područjima reda veličine stotinjak atoma znatne su razlike u koncentracijama. Difuzijom se stvaraju slojevi (pločice) bogati atomima bakra. Ovakve pločice, veličine nekoliko mikrona, gusto su raspršene u mješancima te remete pravilnost kliznih ravnina povećavajući čvrstoću legure (prirodno dozrijevanje). S obzirom na to da se difuzija dešava na nižim temperaturama, odvija se sporo i nepotpuna je pa nastaju samo Guinier-Prestonove zone. Nakon dozrijevanja (naknadna difuzija) od desetak dana legura dostiže konačna svojstva koja se više ne mijenjaju. Ako se dozrijevanje vrši na višim temperaturama 100 – 200 °C (umjetno dozrijevanje) dolazi do potpunije difuzije, tj. uspostavlja se ravnoteža. Dozrijevanjem u kraćem vremenskom periodu (do 100 sati) dobije se Θ'' faze (eutektički kristali intermetalnog spoja CuAl_2) kada je čvrstoća najviša [1].



Slika 1 Promjene faza pri toplinskoj obradi duraluminija

2. Plan pokusa

Polazna ideja je da se hladnom deformacijom, ako se ista obavi nakon gašenja, a prije dozrijevanja, povećava tvrdoća. Kako bi se ujednačili polazni parametri sve epruvete su rastvorno žarene.

Odabrani materijal je AlCuBiPb, odnosno ASTM 2011, kemijskog sastava prema tablici 1 [2]

Tablica 1 Kemijski sastav legure EN AlCuBiPb (ASTM 2011)

Al	Bi	Cu	Fe	Pb
91,2 – 94,6%	0,2 – 0,6%	5 – 6%	≤ 0,7%	0,2 – 0,6%
Ostali pojedinačno	Ostali ukupno	Si	Zn	
≤ 0,05%	≤ 0,15%	≤ 0,4%	≤ 0,3%	

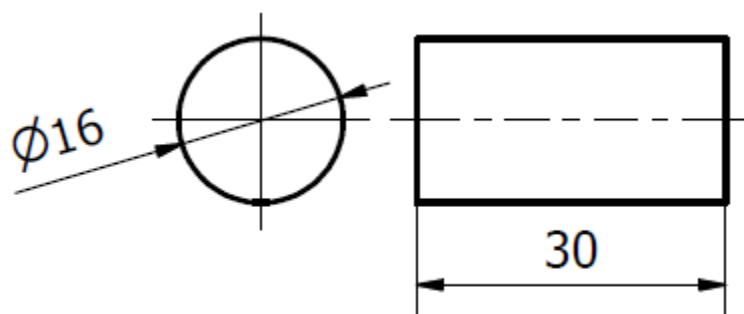
Nepromjenjivi parametri korišteni za obradu rastvornog žarenja su:

- temperatura rastvornog žarenja 525 ° C [3]
- trajanje rastvornog žarenja 75 min [4]
- maksimalno vrijeme izvan peći nakon rastvornog žarenja, a prije gašenja 15 s [4]
- gašenje u vodi sobne temperature
- temperatura dozrijevanja 165 ° C [3]

Faktori koji su varirani u pokusu su:

- udaljenosti od površine 0 – 10 mm
- stupanj ugnječenja 0 – 30 %
- vrijeme trajanja dozrijevanja 0 – 1200 min

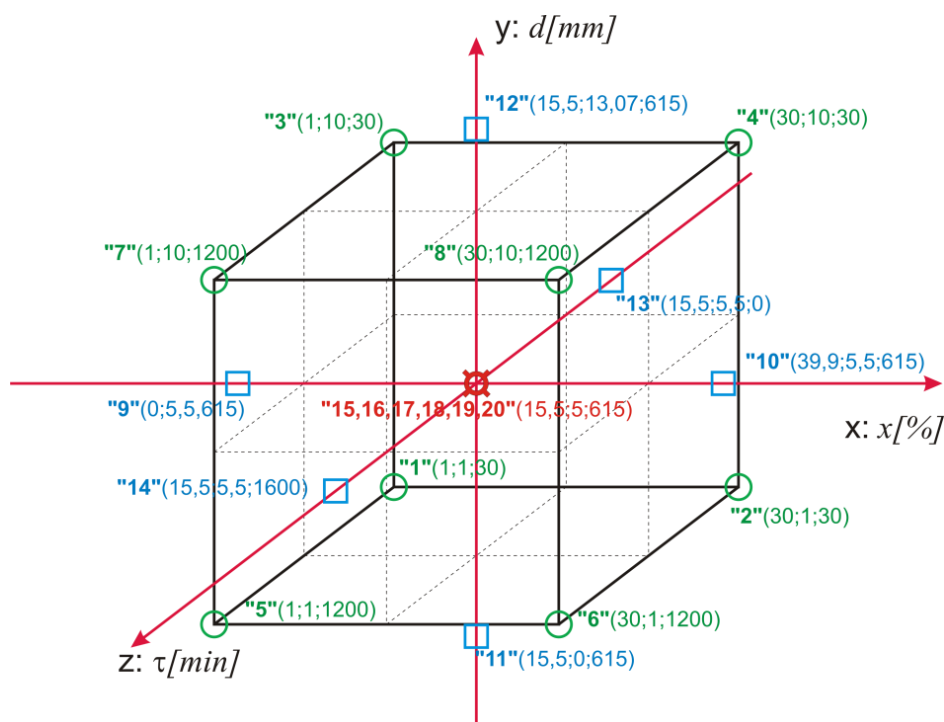
Dimenzije epruveta prema slici 2.



Slika 2 Dimenzije epruveta

3. Centralno kompozitni plan pokusa

U svrhu planiranja odabran je Centralni kompozitni plan pokusa [5] (*central composite design*, CCD). Svaki faktor mijenjan je na pet razina. Svrha ovakvog pristupa planiranju pokusa je pronalaženje matematičkog modela koji opisuje proces uz minimalan broj potrebnih pokusa. U ovom slučaju mijenjana su tri parametra (vrijeme dozrijevanja, udaljenost od površine i stupanj deformacije). Svaki parametar mijenjan je na pet nivoa ($+\alpha$; $-\alpha$; $+1$; -1 ; 0). Na slici 3 prikazana je shema eksperimentalnih točaka pokusa. Simbol \boxtimes označava centralnu točku gdje razina svakog faktora ima srednju vrijednost, a koja se ponavlja šest puta. Ovim ponavljanjem postiže se smanjenje varijance i dobra procjena čiste greške. Simbol \square označava šest aksijalnih točaka udaljenih α od središta, a simbol \circ označava osam vršnih točaka plana pokusa.



Oznaka:npr. "5"(1,1,1200) - epruveta br.5 (deformacija 1%, udaljenost od površine 1mm, dozrijevanje 1200 min)

Slika 3 Centralno kompozitni plan pokusa

Prvi korak kod statističke analize bio je određivanje vrste transformacije odzivne veličine. S obzirom na dobivene rezultate nije bilo potrebe za transformacijom. U sljedećem koraku program upućuje na funkciju koja najbolje opisuje pojavu – u ovom slučaju polinom 2. reda. Rezultati analize varijance prikazani su u tablici 2. Odzivna veličina dobivena pokusom je tvrdoća. Rezultati mjerenja tvrdoća su statistički obrađeni pomoću *Design Expert* [6] programa te je pomoću navedenog programa određen i matematički model [7].

Tablica 2 Analiza varijance

ANALIZA VARIJANCE						
izvor varijacije	suma kvadrata odstupanja	broj stupnjeva slobode	srednji kvadrat odstupanja	F vrijednost	P vrijednost prob>F	značajnost
MODEL	2551,0543	9	283,4505	14,0483	0.0001	značajan
A	15,7681	1	15,7681	0,7815	0.3974	
B	9,1327	1	9,1327	0,4526	0.5163	
C	1259,7800	1	1259,7800	62,4369	< 0.0001	
A ²	76,3463	1	76,3463	3,7839	0.0804	
B ²	25,0794	1	25,0794	1,2430	0.2910	
C ²	484,6594	1	484,6594	24,0205	0.0006	
AB	0,1067	1	0,1067	0,0053	0.9435	
AC	910,2222	1	910,2222	45,1122	< 0.0001	
BC	6,8718	1	6,8718	0,3406	0.5724	
Ostatak	201,7687	10	20,1769			
Odstupanje od modela	136,0082	5	27,2016	2,0682	0.2221	neznačajan
Čista greška	65,7604	5	13,1521			
	2752,8229	19				

F vrijednost modela od 14,05 ukazuje na značajnost modela jer vjerojatnost da se pojavi tako velika vrijednost odstupanja od modela uslijed šuma manja je od 0,1 %. Vrijednost „Prob > F“ manja od 0,05 %, za pojedine članove predloženog matematičkog modela govori u prilog značajnosti njihovog utjecaja. U ovom modelu značajna su vrijednost faktori C, C² i AC (temperatura, kvadrat temperature i umnožak stupnja ugnječenja i temperature). F vrijednost veličine odstupanja od modela od 14,05 znači da ova veličina nije značajna u odnosu na čistu grešku. Postoji vjerojatnost od 22,22 % tako velike F vrijednosti. Odstupanje od modela nastaje zbog šuma. S obzirom na to da odstupanje od modela nije značajno, model je prihvaćen i dalje analiziran.

Matematički model s stvarnim faktorima dan je izrazom:

$$HB = +94,41872 + 1,27153 \cdot \varepsilon + 0,90572 \cdot h + 0,062075 \cdot \tau - 0,013732 \cdot \varepsilon^2 - 0,086615 \cdot h^2 - 2,13104 \cdot 10^{-5} \cdot \tau^2 + 1,98708 \cdot 10^{-3} \cdot \varepsilon \cdot h - 1,25749 \cdot 10^{-3} \cdot \varepsilon \cdot \tau + 3,95266 \cdot 10^{-4} \cdot h \cdot \tau$$

gdje je:

- HB – tvrdoća u Brinellima
- ε – stupanj ugnječenja

- h – udaljenost od površine, mm
- τ – vrijeme progrijavanja, sat h

Pomoću *Design-expert* programa generirano je 20 stanja pokusa prikazanih u tablici 3 i na slici 3.

Tablica 3 Stanja pokusa i odzivne veličine (izmjerena i očekivana tvrdoća)

Uzorak	Test broj	Stupanj ugnječenja %	Udaljenost od površine mm	Trajanje dozrijevanja na temperaturi 165°C min	Izmjerena tvrdoća HB 2,5/62,5/15	Očekivana tvrdoća HV
19	1	15,5	5,5	615	128,67	132,83
20	2	15,5	5,5	615	127,67	132,83
4	3	30	10	30	124,00	122,03
14	4	15,5	5,5	1600	130,25	130,42
9	5	0	5,5	615	134,67	128,23
3	6	1	10	30	94,00	98,02
12	7	15,5	13,07	615	130,00	129,58
5	8	1	2	1200	137,00	140,39
11	9	15,5	0	615	130,75	128,96
2	10	30	2	30	119,75	122,53
13	11	15,5	5,5	0	118,67	113,36
15	12	15,5	5,5	615	135,67	132,83
1	13	1	2	30	98,17	98,97
8	14	30	10	1200	123,50	124,47
6	15	30	2	1200	124,38	121,27
16	16	15,5	5,5	615	131,25	132,83
17	17	15,5	5,5	615	136,25	132,83
7	18	1	10	1200	144,63	143,13
10	19	39,89	5,5	615	126,00	126,69
18	20	15,5	5,5	615	129,75	132,83

4. Provedba pokusa

Uzorci su rastvorno žareni i dozrijevani u laboratorijskoj peći, slika 4, prema podacima za leguru ASTM 2011.



Slika 4 Progarnibilna laboratorijska peć DEMITERM EASY 9

Deformacija, odnosno gnječenje epruveta između ploča hidraulične prese, slika 5, izvršeno je prema podacima za stupanj ugnječenja epruveta iz tablice 3.



Slika 5 Plastična deformacija uzoraka između ploča hidraulične prese

Prije mjerenja tvrdoće izvršena je obrada epruvete rezanjem u ravni okomito na čelo epruvete (slika 6). Na slici 7 (lijevo) prikazane su epruvete pripremljene za mjerenje odzivne veličine – tvrdoće po Brinellu.



Slika 6 Priprema epruveta za mjerenje tvrdoće

Mjerenje tvrdoće vršilo se u tri točke, a srednja vrijednost tvrdoće izračunata je kao aritmetička sredina očitanih tvrdoća, tablica 4. Kako bi se izbjegao utjecaj ruba na mjerenje, minimalna udaljenost od ravnih površina cilindričnih uzoraka bila je 2 mm. Na slici 7 (desno) prikazano je mjerenje tvrdoće pomoću univerzalnog tvrdomjera.

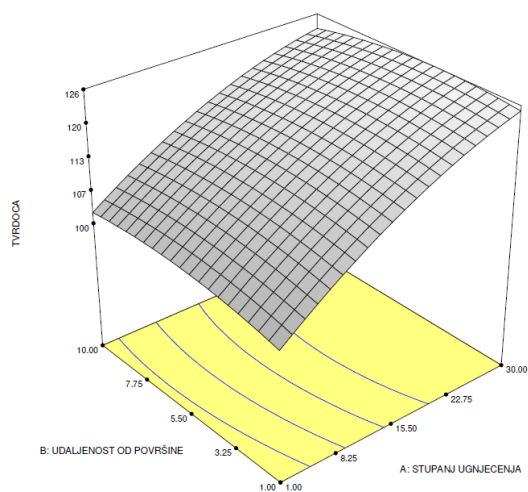


Slika 7 Epruvete pripremljene za mjerenje tvrdoće HB 2,5/62,5/15 (lijevo) i mjerenje tvrdoće epruveta pomoću univerzalnog tvrdomjera (desno)

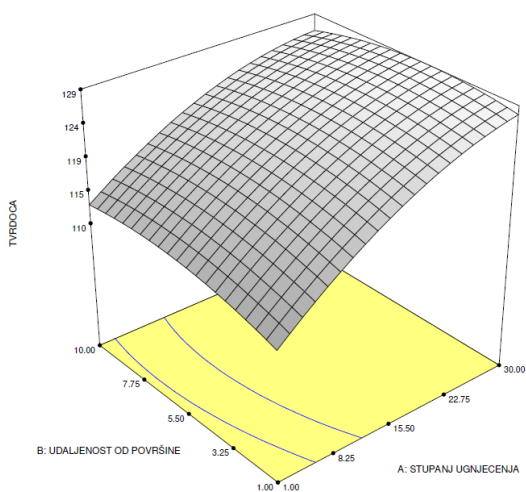
Tablica 4 Izmjerene i srednje vrijednosti tvrdoće

Uzorak broj	Tvrdoća HB 2,5/62,5/15 mjerjenje 1	Tvrdoća HB 2,5/62,5/15 mjerjenje 2	Tvrdoća HB 2,5/62,5/15 mjerjenje 3	Tvrdoća HB 2,5/62,5/15 srednja vrijednost
9	134	135	135	135
1	95	96	98	96
5	135	137	129	134
3	93	94	95	94
7	150	143,5	142	145
11	133	129	133	131
13	118	118	120	119
14	128	135	131	130
15	136	135	136	136
16	128	136	133	131
17	135	135	138	136
18	137	124	123	130
19	129	129	128	129
20	128	127	128	128
12	132	129	129	130
2	123	123	121	121
6	123	126	126	126
4	123	124	125	124
8	125	122	118	124
10	127	124	127	126

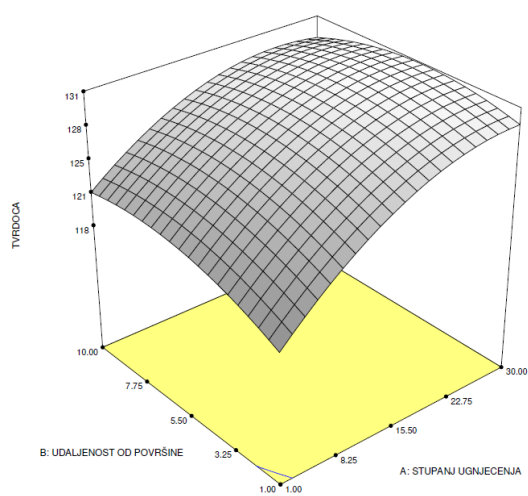
Rezultati dobiveni ovim ispitivanjem obrađeni programom *Desing-Expert* [6] prikazani su na slici 8.



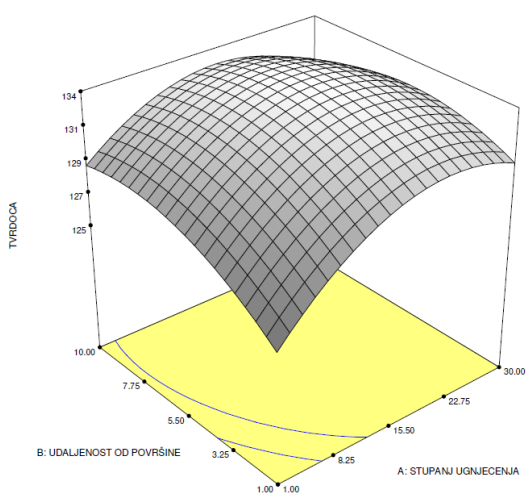
Trajanje dozrijevanja: 90 minuta



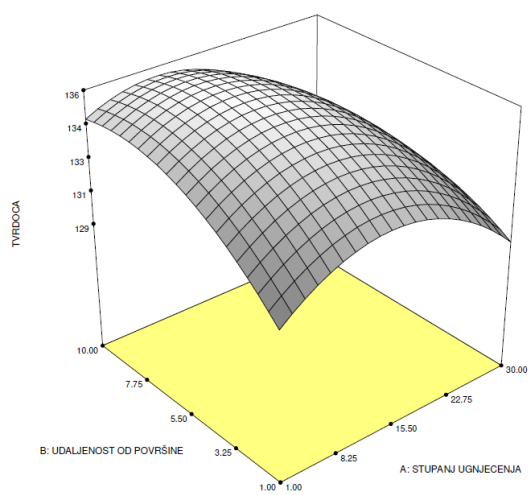
Trajanje dozrijevanja: 270 minuta



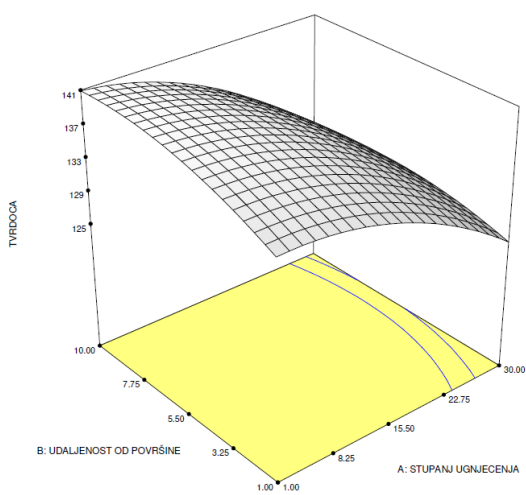
Trajanje dozrijevanja: 450 minuta



Trajanje dozrijevanja: 630 minuta



Trajanje dozrijevanja: 810 minuta

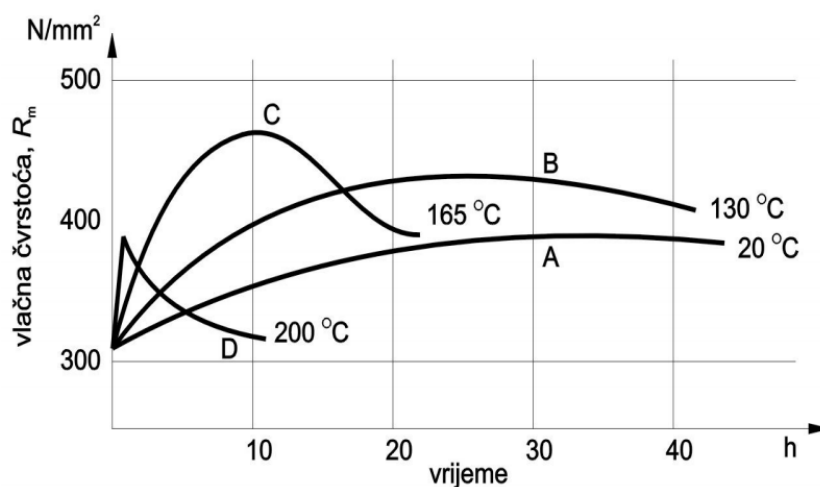


Trajanje dozrijevanja: 1080 minuta

Slika 8 Rezultati ispitivanja

5. Zaključak

Promjenom vremena trajanja dozrijevanja primjetna je promjena tvrdoće tako da uzorci s najvećim stupnjem ugnječenja ($\varepsilon = 30\%$) nakon kratkog vremena dozrijevanja postižu najveće vrijednosti tvrdoće. Produljivanjem vremena trajanja dozrijevanja uočava se pomicanje područja maksimalnih vrijednosti tvrdoće od područja visokog stupnja ugnječenja na područje srednjih vrijednosti stupnja ugnječenja ($\varepsilon = 15\%$). Za uzorke tretirane srednjm vrijednostima stupnja ugnječenja, najveće vrijednosti tvrdoće postižu se ako je trajanje dozrijevanja između 540 i 720 minuta. Daljnim produljenjem trajanja dozrijevanja maksimalnu tvrdoću postižu epruvete s najmanjim stupnjem ugnječenja. Također se može uočiti da se s produljenjem trajanja dozrijevanja područje maksimalne tvrdoće udaljava od površine. U slučaju velikog stupnja ugnječenja i dugog trajanja dozrijevanja dolazi do nastajanja Θ' faze, odnosno pojave krupnih polukoherentnih precipitata, i smanjenja tvrdoće. Budući da je temperatura dozrijevanja za sve uzorke ista, unutarne napetosti na granicama zrna (unutarne elastične energije unešene hladnim gnječenjem) pospješuju pojavu dozrijevanja. Tretirana legura hladnim deformiranjem očvršćuje. Rezultati ispitivanja u potpunosti svojstvima slijede krivulju C (slika 9). S povećanjem udaljenosti od gnječene površine uzorka uočava se blagi porast tvrdoće materijala zbog očito većeg ugnječenja uzrokovanog pojavom bačvanja uzoraka. Rezultati dobiveni ispitivanjem preliminarni su. Za pouzdanu primjenu navedenih rezultata potrebno je proširiti opseg ispitivanja. S obzirom na to da je stupanj ugnječenja u funkciji udaljenosti od čela duž osi uzorka, u daljnjim ispitivanjima trebalo bi odrediti stvarni stupanj ugnječenja na mjernim mjestima.



Slika 9 Ovisnost vlačne čvrstoće o trajanju i temperaturi dozrijevanja za leguru aluminija ASTM2011 [8]

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(https://www.fsb.unizg.hr/usb_frontend/files/1396606447-0-ni-al-ti-mg_2012.pdf)

Influence of distance of deformed surface on properties of heat and mechanical hardened aluminum alloy ASTM 2011

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Abstract Precipitation-hardened aluminium alloys can be further strengthened by heat treatment as well as by cold deformation. Plastic deformation is performed during the heat treatment phase, after annealing and quenching but before artificial aging. Deformation is performed between pressure plates of a hydraulic press. The aim of this experiment is to determine the influence of distance from a deformed surface of a specimen on the properties of material (hardness) after treatment. A cylindrical specimen is chosen, and is cut lengthwise after treatment. The profile of hardness is determined between two deformed surfaces. A central composite plan of the experiment is used, and the results are statistically processed by Desin-Expert software. Alternate variables in the experiment are the temperature of aging, the duration of aging, and the distance from the deformed surface. Response value of the experiment is the hardness after completion of the aging process.

Key words: *Aluminium alloys, precipitation hardening, hardness, deformation*

Online processing of microscopic images

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Abstract. In this paper we present the concept and prototype for online automatic processing of microscopic images. The idea behind the system is based on the needs of different scientific and professional areas for automation of image processing. There are many tasks in these areas that can take advantage of computer vision (CV) and machine learning (ML) techniques for image segmentation and classification. Advances in ML area of deep neural networks enable us to use the same models for many different recognition tasks. The problem is that image processing usually requires particular skills in CV and ML for successfully building these models. With this system, all models would be supervised by independent ML experts while other users could set up systems through simplistic wizards. Another problem is obtaining and preparing large quantities of data for training and testing CV and ML models. Manual sampling and labelling of large quantities of images is necessary for building good automatic models. This problem can be mitigated by online collaboration between interested parties through sharing image databases.

Key words: *online, microscopic, image processing*

1. Introduction

Image processing is one of most difficult problems in artificial intelligence field. Specialized computer vision (CV in further text) subfield has developed with idea of enabling software to mimic the different phenomena of human vision. From early on, scientist understood that most of mechanisms can't be clearly described and programmed and tools from field of machine learning (ML in further text) are becoming most successful approach for many computer vision tasks. Even simple tasks as discriminating between images of cats and dogs can be rather involving but can be solved with high accuracy using machine learning models [1]. Similar models can be used for processing of scientific images that are usually simpler since we can control some aspects of image acquiring (e.g. perspective and lighting). Yet, these models usually require large quantity of manually labelled images that are expensive to produce. In this paper we present the concept and prototype for online automatic processing of microscopic images.

During last 50 years, image processing was moving from manual feature construction and rules-based evaluation towards automatic feature discovery and evaluation using approaches from ML field. Early CV was focused on using filters and rules for specific tasks. This approach had little success since digital images are very complex source of information where single pixels have no real meaning while meaningful image segments are hard to extract and

describe. Use of complex ML models (like neural networks) was also limited both by computing power, limitations of current ML models and quantity of available data. Over the last several years, use of graphical processing units for building ML models has significantly increased in conjunction with some theoretical breakthroughs in deep learning. Currently deep neural networks (DNN in further text) are dominating approach in domain of image processing as well as in some other domains like natural language processing. This approach allows researchers to train “end-to-end” DNN architecture for image processing tasks with very little human intervention. These advances resulted in different online services that allow us train and use DNN models but they usually require expert knowledge in both programming and ML field since they usually offer only raw computing power. Proposed online system is an attempt to minimize required expert knowledge for automatic processing of microscopic image. In addition, online system could mitigate labelled data bottleneck trough sharing of datasets and/or models for standardized tasks. We have developed a prototype for specific problem of recognising Foraminifera species. Foraminiferal species are morphospecies, defined according to their external morphological characteristics, primarily by wall structure, chamber and test shape, and the position of the aperture. Classification was developed in collaboration with micropaleontologists, following generic classification of Loeblich and Tappan [2] and Cimerman and Langer [3].

In this paper we describe typical DNN architecture for image classification task (section 2) and architecture of possible online service for building, using and sharing of such models between scientists in other fields (section 3). As use-case we present a prototype for microscopic images segmentation and classification of marine microorganisms (Foraminifera).

2. Image processing with deep neural networks

In this section we describe typical deep neural network (DNN in further text) approach for image classification task. Only recently some important research breakthroughs were made that enabled to train them effectively for many different image processing problems. We begin with digital image representation and typical low-level operations, then we describe feed-forward neural network and in the end we describe deep neural networks with convolutional and dense layers for image classification task.

Digital images are represented by a grid of pixels, each pixel describing intensity of image in that point. Pixels form three matrixes (Figure 1) that separately describe red, green and blue brightness (sometimes called channels). Other representations of image are possible, but this is most commonly used with convolutional neural networks since they can learn any other representation directly from RGB channels.

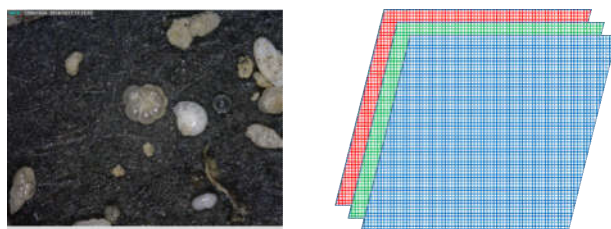


Figure 1 Representation of an image as separate RGB channels. Intensities of single pixels are limited to range 0-255. Each pixel is represented with 3 intensities.

Since individual pixels are usually meaningless it is hard to use them as predictors for simpler ML models. For this reason researchers have constructed different methods for extracting meaningful features from images. Besides global image statistics, different feature descriptors

have been proposed, like SIFT [4] or SURF [5] descriptors. These descriptors are applied at points of interest in image and can be used both for recognising particular images, objects or classes of objects. Another solution is to convolve image with features (filters) of interest to obtain statistics of feature presence or to obtain dense maps of features. Both solutions imply manual creation and selection of features appropriate for particular task. Also, these operations are expensive and usually only the beginning of some image processing task and some model still has to be built to operate on results of this operation.

Feed forward neural networks are one possible ML model that could theoretically provide “end-to-end” learning from raw pixels to image class and in past there has been many attempts to use them. Feed-forward neural networks (FFNN in further text) are composed of many small units (neurons) interconnected in a way to form flow of information in one direction. Basic unit is composed of weighted sum over inputs and non-linear activation function f (Figure 2). Weights are part of network parameters that have to be determined through training.

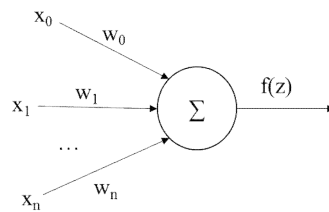


Figure 2 Single neuron is composed of weights and activation function. One of the weights is usually bias that always has input 1.0. Output of the neuron is the result of activation function applied on weighted sum of inputs.

In FFNNs neurons can be organized in layers and neurons in each layer usually receive input only from neurons in previous layer. First layer is receiving input vector, computes its output and passes it to the next layer. Last layer usually implements some regression or classification model (Figure 3).

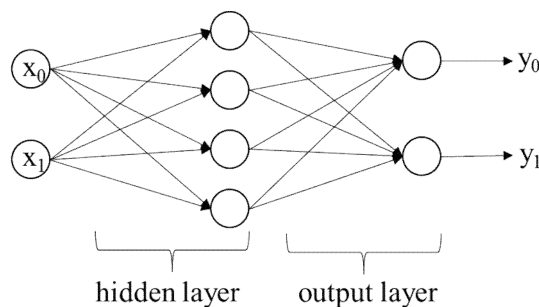


Figure 3 Two-layer feed-forward neural network with two inputs and two outputs.

In image processing first layers of DNN are often convolution layers, thus forming convolutional neural network (CNN). These layers basically consist of small FFNNs that are applied (and trained) across all pixels of single image. This operation equals to convolution of image with different filters. Highest responses to convolutions within small pixel neighbourhood are pulled and passed to next layer. This operation reduces amount of data that is processed by further layers while also enabling small spatial invariance. It was determined that these first few convolutional layers usually describe some simple image features (e.g. edges or corners) and vary little between different image domains. This opens possibility of reusing convolutional layers between different image processing tasks (transfer learning [6]). These networks usually have dozens of different hyperparameters (e.g. number of

convolutional and dense layers, convolution window width, learning parameters, etc.) that have to be determined in advance before training the final network. These hyperparameters can be determined by cross-validation but that usually requires extensive search in hyperparameters space and many training iterations. However, for large DNNs, any set of reasonable hyperparameters can usually produce acceptable model in terms of accuracy.

Training of FFNN consists of showing it samples of input-output pairs from some unknown distribution. For each pair we can calculate error $E(input)$ as squared difference between output of the network and desired output or some other convenient function of error. For hidden layers we propagate error backwards according to the estimate of how much each parameter contributed to the error. This process I known as backpropagation. Estimate of parameter contribution to the error is given by gradient with respect to model parameters: $dE(input)/dw$. So the algorithm for learning consists of choosing samples from true distribution that we're trying to model, showing it to the network and minimizing the error by moving in opposite direction of error gradient. This process is known as gradient descent and there are numerous variations of this basic algorithm (stochastic gradient descent). Most common variations repeatedly iterate trough some set of input-output pairs and adjust network parameters by some fraction of the error (standard gradient descent). This can be done by using small batches (like 100 samples) to calculate more stable mean gradient. Exact training regime depends on domain but in image classification domain it is usually done on fixed training set that is prepared and labelled in advance.

Gradient descent is also used to train deep neural networks but some practical problems arise. Since most neural networks use sigmoid output function, error that is backpropagated can vanish because of limited computer precision and first network layers learn slowly or don't learn at all. This problem was addressed in [7] and ReLU activation was proposed as solution. ReLU activation has simple form:

$$f(x) = \begin{cases} x & \text{for } x > 0 \\ 0 & \text{for } x \leq 0 \end{cases} \quad (1)$$

ReLU is still nonlinear activation function but its gradient is conserved better then with *sigmoid* or *tanh* functions. Another problem is that these deep models have high variance and thus can easily overfit the training data and perform poorly on new data points. This problem was addressed in different ways in the past. Usually this required to carefully choose model size and hyperparameters using cross-validation. Today, advice is to use model as large as time and hardware constraints permit and rely on other means to address overfitting. Most common ways are to add additional constraints to network parameters (e.g. regularization). For some domains (like image recognition) generation of additional training samples by distorting original samples can help also (data augmentation). Another method (dropout) to prevent overfitting was proposed in [8]. Core idea is to randomly disable parts of the network during training. This training regime effectively results in an ensemble of smaller networks that share some parameters. During prediction this network has much lower variance and this usually results in much better final model. In the end, aggregating several of these final models can also be aggregated in even larger, more robust model.

In conclusion, we can say that these recent findings allowed to train models more easily and with less human intervention. Another important factor that makes DNN models viable is widespread use of GPU units for execution of heavy calculations needed for training. Also, transferred learning enables us to reuse parts of the pre-trained DNN and fine-tune them for another similar problem. All of these findings can be incorporated in a system for automatic image processing with some limitations that we describe in next section.

3. Online image processing architecture

Manual processing of microscopic images can be very time consuming and repetitive. In many cases, results of such processing are summarized in statistic that describes some given sample. Good examples are identifying and counting foraminiferal species in samples of marine sediment, blood cell counting or mitosis detection on histology images. Manual processing can have serious drawbacks both in cost and accuracy (one of the problems faced by those studying foraminifera is inconsistent use of species and generic names). This leads to limited size of samples that can be processed. Automatic processing on other hand can be much faster but it can be expensive to develop a system for smaller specific domains. As it was described in previous section, DNNs offer couple of ways for reusing models in similar domains. While such models could be less accurate, if trained on small number of samples, they can compensate it with size of the test sample if task permits it. Centralizing and sharing models and image datasets could also improve accuracy for more common tasks. Basic architecture would be composed of web API accessible by browser based or desktop client application, image storage, models storage and computing instances for training and applying models (Figure 4).

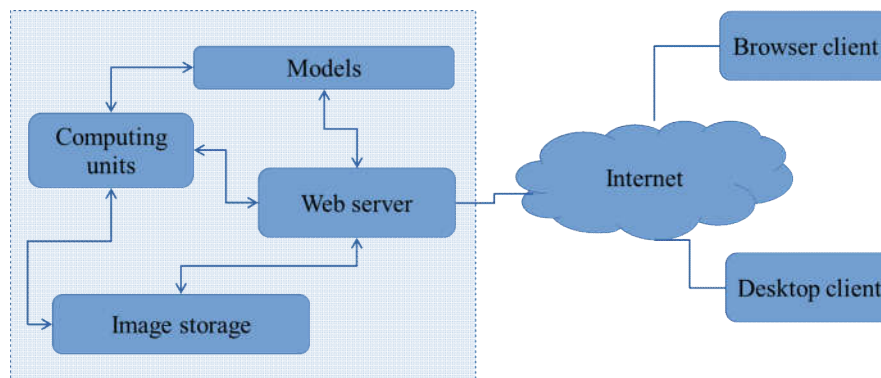


Figure 4 Proposed online image processing architecture.

Online nature of this architecture is essential for collaboration between users. Sharing trained models can be done by creating ensembles for specific tasks or by transferred learning. Sharing of datasets for training models could resolve one of the most serious bottle-neck of ML systems: scarcity of data. This collaboration could also lead to establishing standards for image acquisition and creation of new benchmark datasets. This wouldn't compromise privacy of datasets, since they would be only shared for training new models as extra data. Hardware requirements for such system in production would include GPU computing units to make CNN/DNN training viable. Since exact computing needs can be hard to anticipate in advance, we propose to rely on 3rd party resources like Amazon's GPU EC2 instances and S3 storage [9]. Since most of computing power is required only during model training, these instances could be allocated only occasionally while most of computing for applying models can be done on dedicated machines. Limitation of this approach is the need to transfer large quantities of data between server and clients. While this still remains an inconvenience, today this is not a large problem and can be mitigated with better client applications.

As a proof of concept, similar architecture was developed consisting of a single server machine relying on ad-hoc segmentation and simple linear model for classification task. Main goal was to build intuitive interface and workflow, while use of DNN models and managing more realistic quantities of data is left for future implementation. To test the usability of such interface we developed a prototype of this architecture specialized for segmentation and classification of foraminiferal species. It was developed in collaboration with micropaleontologists with no experience in ML and CV. Most of requirements were

concentrated on user interface for samples labelling and reporting results. Remained obstacle is still automatic acquisition of images since it would require specialized equipment (like in [10]). Task was to identify, classify and count foraminiferal individuals from microscopic images of marine sediment extracted from some area of interest. The results obtained in this way could be used for different purposes, like in petroleum exploration. Images were obtained by simple 5 megapixel CCD camera pointed at microscope ocular (Figure 5).



Figure 5 Microscopic image of foraminiferal specimens.

Images contained different foraminiferal specimens that were classified according to the wall type into three primary groups: agglutinated, calcareous porcelaneous and calcareous hyaline group (Figure 6). Training and testing samples (single foraminiferal individuals) were extracted automatically by ad-hoc algorithm. Extraction was done by thresholding and segmenting connected areas of appropriate size and shape. Several global shape and texture features were extracted and training and validation sets were created. For wall type classifications, linear model was trained on 100 images of single foraminiferal individuals. Other classifications were implemented but not largely tested. This simple model with relatively small training set was able to achieve above 60% accuracy.

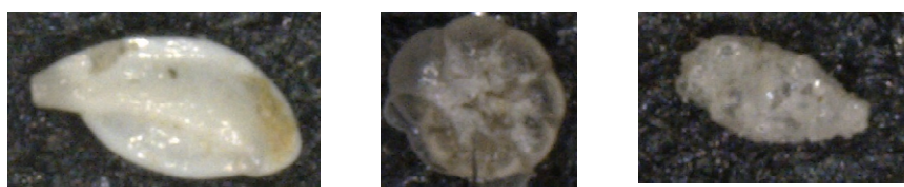


Figure 6 Three classes of foraminiferal wall type: porcelaneous, hyaline and agglutinated.

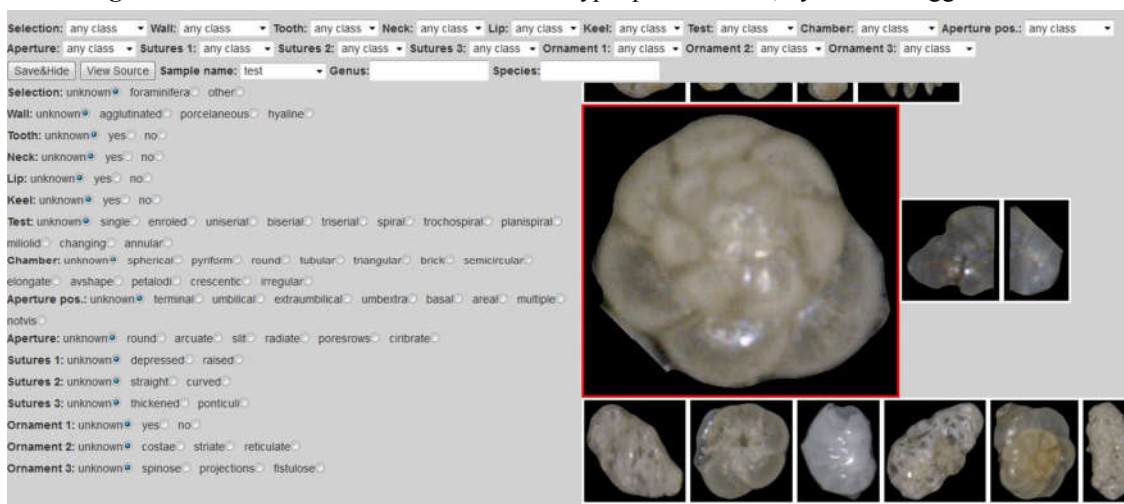


Figure 7 Inspection/manual correction of foraminiferal classification.

Agreed workflow consisted of uploading images, sending them for automatic segmentation, manually labelling images and training initial model. After training of initial model (on some smaller quantity of data), we can replace manual labelling of new data with automatic labelling and manual inspection of these labels. We implemented a simple interface tailored for that task but concluded that it should be replaced with more flexible design for general tasks. Inspection and correction of labels automatically increases training set and better model can be trained (Figure 7). Finally, simple statistical reports were made for datasets.

4. Conclusion and further work

We presented an online microscopic images processing architecture that relies on current advancements in ML and CV fields. Major breakthroughs in DNN enable us to (re)build different models with minimum adjustments. Datasets and models sharing is central for this architecture. Simplicity of use is one of primary concerns since system is intended for use in research outside ML and CV. Online nature of this architecture also facilitates assistance of ML experts. Simple prototype was developed as proof-of-concept for this architecture while DNN models were presented as a possible solution for more realistic implementation. Currently, we're implementing more general prototype that would rely on external services for DNN models training. Prototype will implement separate workflows for image segmentation, classification and detection tasks.

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Modeliranje koncepata i podataka za nastavni plan područja računarstva

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Sažetak. Planiranje i izrada kurikuluma važan su dio obrazovnog procesa. Kurikulum za područje računarstva treba biti osmišljen tako da studentima pruži znanja iz više područja, poput operacijskih sustava, programskih jezika, informacijskih sustava, inteligentnih sustava, sigurnosti mreža i komunikacije i slično. Kroz obrazovni proces studente treba pripremiti za razna zanimanja. Tako su, osim osnovnih informatičkih zanimanja poput programiranja, danas aktualna i zanimanja vezana za računalnu kemiju, ekoinformatiku ili bioinformatiku. Stoga kurikulum mora pružiti jasne i primjenjive ciljeve obrazovnog procesa uz mogućnost fleksibilnih programa obrazovanja koji se mogu prilagoditi stalnim promjenama na tržištu rada. Uz to, nastavni planovi moraju pripremiti studente za cjeloživotno obrazovanje, moraju sadržavati elemente stručne prakse i iskustva u komunikaciji, timskom radu i etici te moraju naučiti studente da prepoznaju važnost apstrakcije kako bi bili u stanju objediniti teoriju i praksu.

U ovom radu prikazan je postupak raščlanjivanja osnovnih koncepata područja računarstva kao što su: područja znanja i njihovi dijelovi, kolegiji i nastavne jedinice, ishodi učenja te radna mjesta i potrebne vještine. Dizajniran je model podataka i implementiran ogledni skup podataka kurikuluma računarstva. Izrađeno je nekoliko primjera upita kojima se mogu dobiti informacije o ciljevima i ishodima učenja, traženim kompetencijama na tržištu rada te mogućnosti studenata da se zaposle i mogućnosti poslodavaca da dobiju kandidate s potrebnim znanjem i vještinama. Model koncepata oblikovan je pomoću alata za prikaz znanja preko konceptualnih grafova, a podaci i upiti oblikovani su i izrađeni u relacijskoj bazi podataka.

Ključne riječi: modeliranje koncepata, modeliranje podataka, kurikulum, područje računarstva

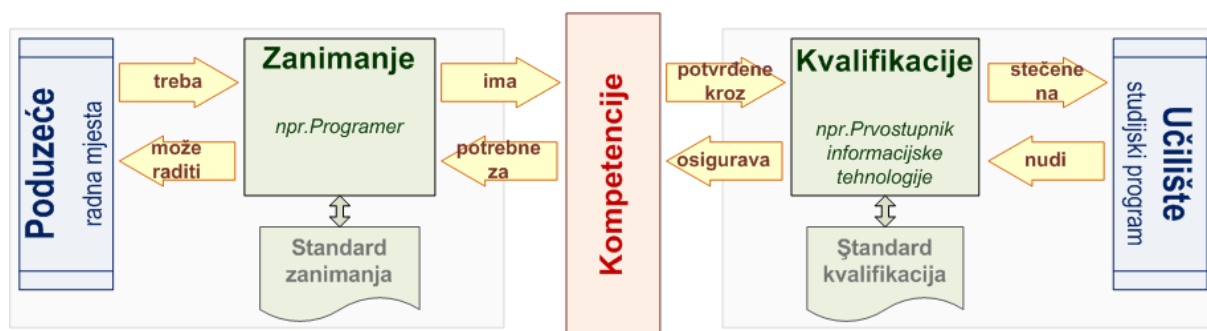
1. Uvod

Obrazovanje i znanost u RH su od posebnog javnog interesa. Obrazovanje je jedan od najvažnijih razvojnih prioriteta s obzirom na dinamičnost promjena u društvu, gospodarstvu i kulturi, a naročito globalizaciju i primjene novih tehnologija koji se s uspjehom mogu rješavati samo uz pomoć znanosti [1]. Obrazovni sustav i tržište rada moraju međusobno surađivati jer će jedino tako pridonijeti razvoju gospodarstva, odnosno društva. Na slici 1 opisan je koncept povezivanja tržišta rada i procesa obrazovanja [2]. Hrvatski kvalifikacijski okvir¹ - HKO ima zadatak osigurati povezivanje između kompetencija koje opisuju zanimanja pojedinih radnih mjesta u poduzeću i kvalifikacija koje se stječu u obrazovnim programima. Kvalifikacija je naziv za objedinjene skupove ishoda učenja² određenih razina, obujma, profila, vrste i kvalitete, a dokazuje se svjedodžbom, diplomom ili drugom javnom ispravom

¹ Hrvatski kvalifikacijski okvir je reformski instrument kojim se uređuje cjelokupni sustav kvalifikacija na svim obrazovnim razinama u Republici Hrvatskoj kroz standarde kvalifikacija temeljene na ishodima učenja i usklađene s potrebama tržišta rada, pojedinca i društva u cjelini. <http://www.kvalifikacije.hr/>

² Ishodi učenja su kompetencije koje je osoba stekla učenjem i dokazala nakon postupka učenja. [3]

koju izdaje ovlaštena pravna osoba [3]. Stoga je težnja da obrazovni programi stvaraju ishode učenja koja su temelj za podršku ključnim poslovima na odgovarajućim radnim mjestima.



Slika 1. Povezivanje potreba tržišta rada i obrazovanja [1]

Treba napomenuti kako proces izrade standardnih kvalifikacija (a što je zadatak HKO-a) započinje od definiranja zanimanja po sektorima u privredi i ispitivanja u kojim djelatnostima se zapošljavaju osobe s tim zanimanjima (uz anketiranje poslodavaca) [2]. Zatim se definiraju kompetencije³ i skupovi kompetencija potrebne za prepoznata zanimanja na temelju kojih se izrađuju ishodi učenja i skupovi ishoda učenja⁴ koji postaju dijelom obrazovnih programa. Standardi bi trebali osigurati kvalitetu i garantirati iste ishode učenja za iste kvalifikacije [2].

Drugo poglavlje ovog rada opisuje ukratko osnovne elemente obrazovnog procesa i potreba tržišta rada s naglaskom na kvalifikacije koje povezuju ova dva subjekta. Izrađen je konceptualni model s primjerima koncepata i veza među konceptima za studij informacijske tehnologije (računarstva).

U trećem poglavlju prezentiran je model podataka sustava obrazovanja vezano za nastavni plan (kurikulum). Za neke segmente organiziranja i praćenja uspješnosti obrazovnog procesa osmišljen je prototip s upitima nad podacima. Rezultat upita prikazuje odnos nastavnih cjelina i područja znanja koje je u njima zastupljeno, a također i razinu odgovarajućih ishoda učenja.

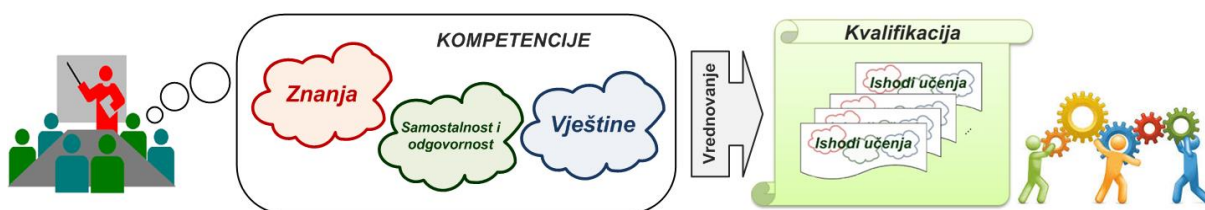
U četvrtom zaključnom poglavlju dan je osvrt na pojavljivanje ishoda učenja u procesu obrazovanja i potreba tržišta rada. Cilj je ukazati na potencijal programskih rješenja (jednog ili više informacijskih sustava) koji se mogu povezati preko odgovarajućih standarda kvalifikacija i radnih mjesta i tako pravovremeno pomoći svim sudionicima u donošenju kvalitetnih poslovnih odluka.

2. Koncepti obrazovnog procesa i njihova veza s tržištem rada

Prema slici 1, kompetencije su točka u kojoj se susreću kvalifikacije koje je osoba stekla učenjem i završenim obrazovanjem s jedne strane te s druge strane zanimanja koja su potrebna poduzećima, a za koja se traže određene kompetencije. Na slici 2 prikazan je s lijeva na desno proces obrazovanja u kome se stječu kompetencije poput određenih znanja i vještina koje se vrednuju preko ishoda učenja koji su, nadalje, sastavni dio potvrde (dokumenta) o kvalifikacijama nakon završenog obrazovanja s kojom osoba može tražiti posao na tržištu rada.

³ Kompetencije su znanja i vještine te pripadajuća samostalnost i odgovornost. [3]

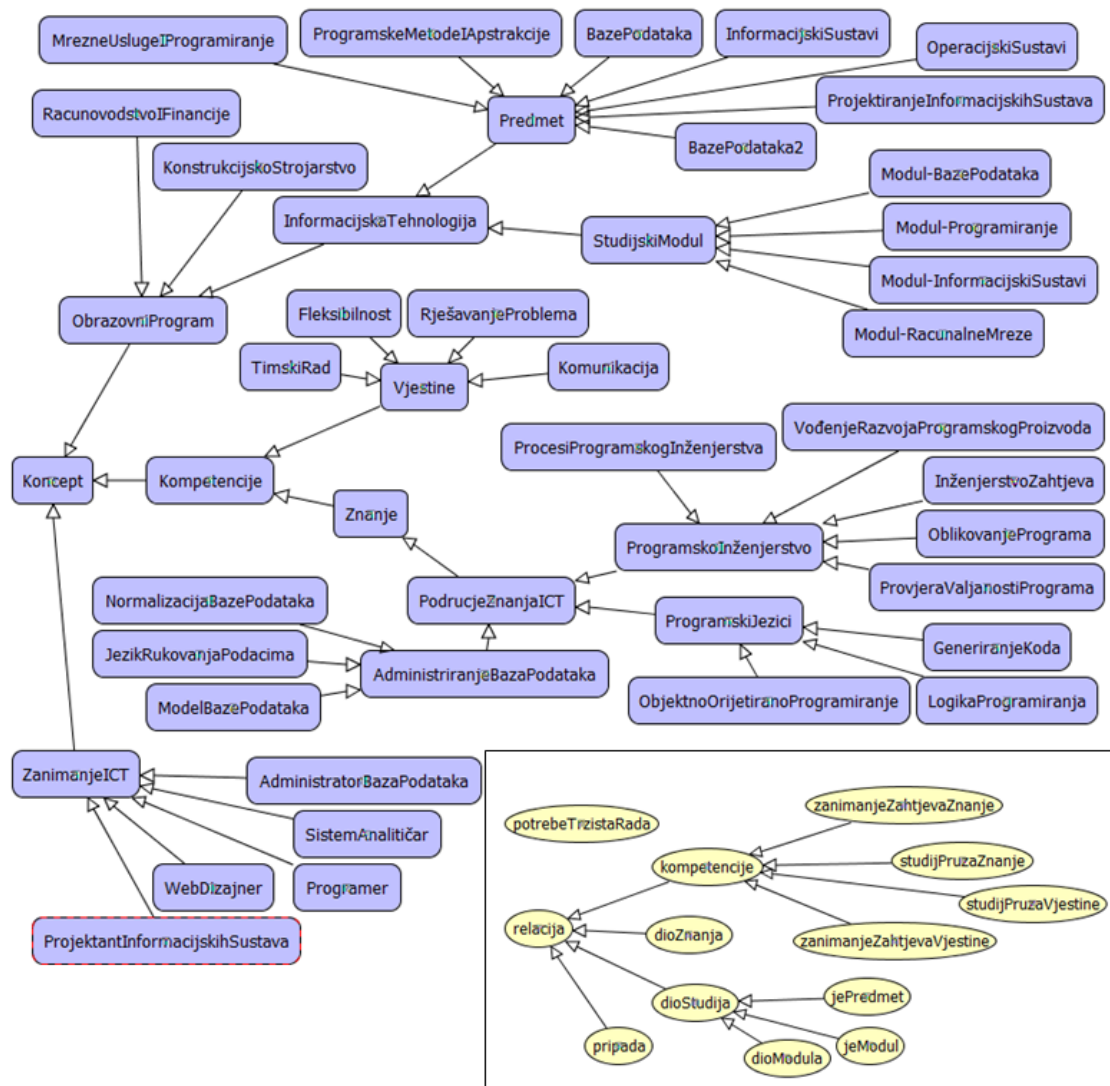
⁴ Skup ishoda učenja je najmanji cjelovit skup povezanih ishoda učenja iste razine, obujma i profila. [3]



Slika 2. Osnovni elementi kvalifikacija [5]

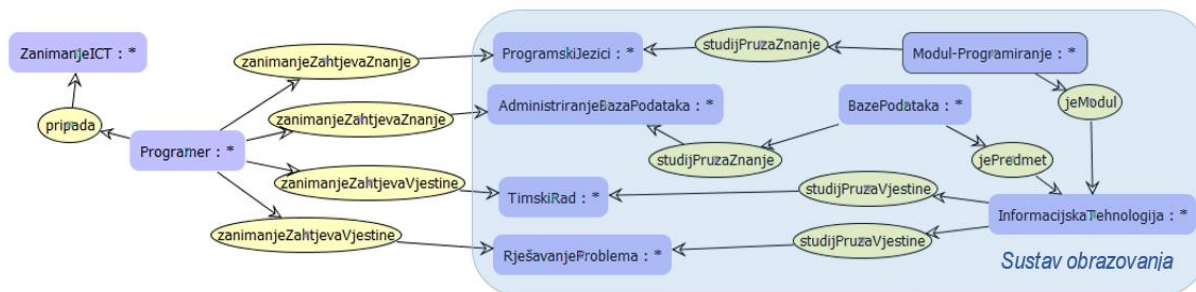
2.1 Konceptualno modeliranje obrazovanja i potreba tržišta rada

Model sustava obrazovanja i njegovih osnovnih elemenata poput studijskih programa, pripadajućih predmeta i kompetencija prikazan je na primjeru studija informacijske tehnologije (IT), studijskih modula i nekoliko oglednih predmeta (slika 3). Model je izrađen tehnikom modeliranja koncepata u alatu Cogui [6]. Da bi priča bila zaokružena, u modelu je nabrojano i nekoliko osnovnih zanimanja iz područja IT. Uz model koncepata (naziva se i taksonomija koncepata) nužno je modelirati i relacije među konceptima koje opisuju prirodu njihove povezanosti (slika 3).



Slika 3. Koncepti sustava obrazovanja i pripadajuće relacije

Na temelju taksonomije konceptata i taksonomije relacija mogu se graditi pravila povezanosti, poput konceptualnog grafa [7] na slici 4. Ovaj graf opisuje odnos između obrazovanja, kompetencija i zanimanja (slika 1.) povezano preko primjera studija *Informacijske tehnologije* i zanimanja *programera*.



Slika 4. Konceptualni graf za primjer studija IT i znanja i vještina koje pruža za zanimanje *programera*

U nastavku rada predložen je prototip modela podataka za opseg promatranog područja, a to je sustav obrazovanja (desni dio slike 4). Prepoznati su osnovni dijelovi tog sustava: nastavni planovi studijskog programa, eventualno modula unutar studija i pojedinačnih predmeta. Nastavni plan treba povezati s kompetencijama, a prema dosadašnjoj analizi to povezivanje treba ostvariti preko ishoda učenja. Pogledajmo kako je to zadano u dokumentu *Strategije obrazovanja, znanosti i tehnologije*.

2.2 Ciljevi obrazovnog sustava

Strategija obrazovanja, znanosti i tehnologije [1] u domeni visokog obrazovanja navodi nekoliko ciljeva koje treba implementirati u nastavni proces, prvenstveno kroz prilagodbu nastavnog plana i proširenje elementima ishoda učenja. Evo primjer dva zanimljiva cilja (djelomično izdvojeno iz originala [1]) koji se mogu implementirati u programsko rješenje za poboljšanje obrazovnog sustava:

- 1) Prilagoditi sadržaje studijskih programa jasno definiranim ishodima učenja – treba zadati jasne i provjerljive ishode učenja na svim razinama studijskog programa koji trebaju biti potvrđeni odgovarajućom kvalifikacijom.
- 2) Utemeljiti razlikovanje sveučilišnih, odnosno stručnih studijskih programa isključivo na transparentnim verificiranim kompetencijama – na stručnim studijima prevladavaju stručni nastavni sadržaji kojima se usvajaju vještine, a na sveučilišnim studijima prevladavaju sveučilišni nastavni sadržaji kojima se pretežno usvajaju (teorijska) znanja. Stručni bi studiji trebali biti fleksibilniji tako da mogu brzo odgovarati na kratkoročne zahtjeve tržišta.

Razmišljajući kao informatičari, ova dva cilja možemo protumačiti kao glavne korisničke zahtjeve visoke razine koji definiraju skup funkcionalnosti programskog rješenja. Prvi cilj je temeljni za modeliranje baze podataka u koju bi se evidentirali svi elementi obrazovnog procesa. Drugi cilj je više strateškog karaktera jer je potrebno realizirati prvi cilj da bi se kroz lepezu upita nad osnovnim podacima dobila pregledna izvješća koja bi služila za poboljšanje obrazovnog procesa i donošenje strateških odluka. Pogledajmo prijedlog realizacije ova dva navedena cilja.

3. Model prototipa nastavnog plana studija Informacijske tehnologije

Modeliranje podataka započinje definiranjem osnovnih entiteta poput popisa predmeta i oblika održavanja nastave, popisa kategorija znanja (područja i pripadajuće jedinice znanja⁵) i slično. Nakon toga će biti zadana glavna skupina podataka koja prikazuje nastavne cjeline za pojedini predmet podijeljene po tjednima održavanja nastave. Nastavnim cjelinama će se dodijeliti jedinice znanja pomoću kojih će biti moguće praćenje nastavnog plana po područjima znanja za pojedini predmet, ali i na razini studija (ili neke druge podjele). Na kraju će ishodi učenja povezati jedinice znanja i nastavne cjeline. Tako se otvara niz mogućnosti praćenja obrazovnog procesa i njegovih dijelova kroz ishode učenja i pripadajuća područja znanja (kompetencija). U nastavku su detaljnije opisani elementi modela podataka i preglednih izvješća.

3.1 Osnovni entiteti nastavnog plana

Osnovni entiteti baze podataka nastavnog plana (za područje računarstva, odnosno informacijske tehnologije *Sveučilišnog odjela za stručne studije Sveučilišta u Splitu*) prikazani su na slici 5. To su podaci o: predmetima, području znanja i jedinicama znanja, oblicima nastave i razinama ishoda učenja.

Predmet				
ID_predmeta	naziv_predmeta	Kratki	ECTS	ID_studija
SIT010	Uvod u programiranje	UPROG	8 RC	
SIT013	Programske metode i apstrakcije	PMA	8 RC	
SIT014	Baze podataka	BP	6 RC	
SIT015	Informacijski sustavi	INFS	6 RC	
SIT022	Mrežne usluge i programiranje	MUP	5 RC	
SIT025	Projektiranje informacijskih sustava	PIS	5 RC	

Oblik_nastave	
ID_oblik	naziv_oblika_nastave
1	Predavanja
2	Auditorne vježbe
3	Laboratorijske vježbe
4	Seminarski rad
5	Terenska nastava

Jedinica_znanja		
ID	ID_podrucja_znanja	naziv_jedinice_znanja
1	Programski jezici	Objektno-orijentirano programiranje
2	Programski jezici	Generiranje koda
3	Programski jezici	Logika programiranja
4	Programski jezici	Formalna semantika
5	Programski jezici	Funkcijsko programiranje
6	Programski jezici	Sekvencijalno programiranje
7	Programski jezici	Proceduralno programiranje
8	Programsko inženjerstvo	Inženjerstvo zahtjeva
9	Programsko inženjerstvo	Procesi programskog inženjerstva
10	Programsko inženjerstvo	Vođenje razvoja programskog proizvoda
11	Programsko inženjerstvo	Oblikovanje programa
12	Programsko inženjerstvo	Izrada programa
13	Programsko inženjerstvo	Provjera valjanosti programa
14	Programsko inženjerstvo	Pouzdanost programa
15	Baze podataka	Sustav za upravljanje bazom podataka
16	Baze podataka	Jezik rukovanja podacima
17	Baze podataka	Normalizacija baze podataka
18	Baze podataka	Model baze podataka

Područje_znanja		
ID_pr	podr	podrucje_znanja_naziv
1	ASP	Algoritmi i strukture podataka
2	PJ	Programski jezici
3	PI	Programsko inženjerstvo
4	AR	Arhitektura računala
5	BP	Baze podataka
6	UI	Umjetna inteligencija
7	RG	Računalna grafika
8	ICR	Interakcija čovjeka i računala
9	PDS	Paralelni i raspodijeljeni sustavi

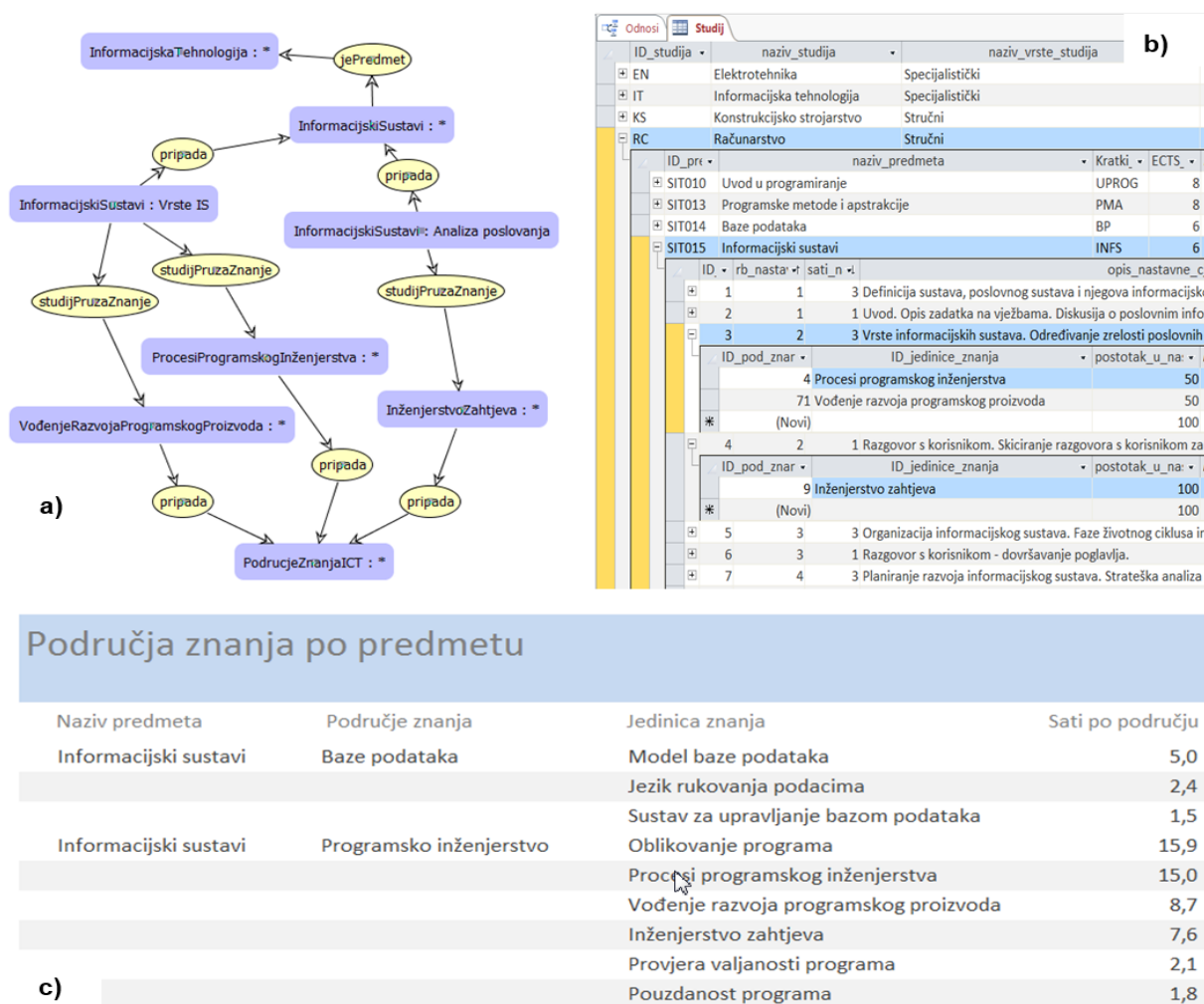
Razina_ishoda_učenja		
ID	naziv_razine	opis_razine_ishoda_učenja
1	Pamćenje	pamćenje i dosjećanje informacija, prisjećanje
2	Razumijevanje	shvaćanje, sposobnost organiziranja i uređivanja, razumijevanje onoga što je pročitano, slušano
3	Primjenjivanje	upotrebljavanje čeg koncepta za rješenje problema
4	Analiziranje	raščlamba na sastavnice u svrhu prilagodbe novim informacijama
5	Sintetiziranje	povezivanje dijelova ili ideja u cjelinu, iskazivanje originalnosti
6	Vrednovanje	ocjena vrijednosti nečega/nekoga
7	Kreiranje	kao 5. Sintetiziranje - misli sa na novo

Slika 5. Osnovni entiteti i primjeri podataka nastavnog plana

⁵ U ovom primjeru prototipa programskog rješenja za kompetencije je, radi jednostavnosti, uzeta samo kategorija znanja.

3.2 Praćenje važnih funkcionalnosti obrazovnog procesa

Na slici 6a) zadan je konceptualni graf koji povezuje predmet *Informacijski sustavi* na studiju IT s odgovarajućim kompetencijama; to je područje znanja *Programskog inženjerstva*. Desni dio slike 6b) prikazuje primjer podataka u bazi gdje se uz zadane koncepte vodi i podatak o postotku udjela pojedinog područja znanja u jednoj nastavnoj cjelini. Uz pomoć takve mjere moguće je kroz izvješće *Područja znanja po predmetu* dobiti udio pojedinog područja znanja u održanim satima, slika 6c). Naravno da je uz odgovarajući algoritam moguće taj podatak prevesti u ECTS bodove. Kada bi se nastavne cjeline i znanje u ostalim predmetima mjerili na isti način mogli bi na kraju obrazovanja dobiti udio pojedinog područja znanja u cjelokupnom studiranju. To je prvi korak k postizanju kompetencija koje se traže na tržištu rada jer se lako može usporediti koje kompetencije pruža studij, a koje se traže na tržištu rada.



Slika 6. Povezivanje nastavnih cjelina i područja znanja

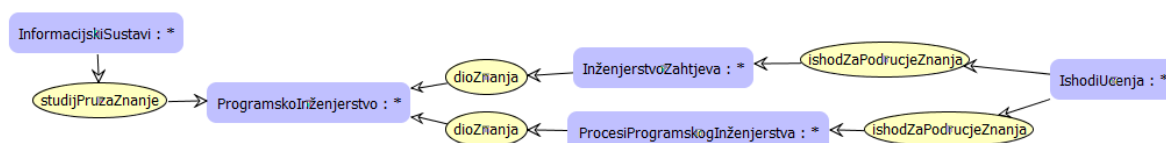
3.2.1 Proširenje podataka s ishodima učenja

Daljnja usporedba dobiva još jednu dimenziju proširenjem postavljenog modela s ishodima učenja. Ako se definiraju ishodi učenja na razini predmeta onda se može dobiti pregled kao na slici 7. Ako grupiramo predmete prema područjima znanja pa kažemo da se predmet *Informacijski sustavi* i *Projektiranje informacijskih sustava* nalaze uglavnom u području znanja *Programskog inženjerstva* onda možemo pomoću izvješća sa slike 7 usporediti koliko su ishodi učenja usklađeni.

Ishodi učenja po predmetu			
Šifra predmeta	Naziv predmeta	Razina ishoda učenja	Ishodi učenja za predmet
SIT015	Informacijski sustavi	Pamćenje	1-Definirati temeljne pojmove, modele i oblike upravljanja unutar procesa razvoja informacijskog sustava.
		Razumijevanje	2-Opisati i oblikovati načine prepoznavanja i specifikacije zahtjeva za programskim rješenjem.
		Primjenjivanje	3-Prikazati slijed i namjenu procesa modela informacijskog sustava.
		Analiziranje	4-Povezati područja i pristupe u oblikovanju arhitekture informacijskog sustava.
		Sintetiziranje	5-Izabranim aktivnostima razvoja informacijskog sustava pridijeliti uloge i područja izrade programskog rješenja.
			5-Predložiti model i aktivnosti životnog ciklusa razvoja informacijskog sustava.
SIT025	Projektiranje informacijskih sustava	Pamćenje	1-Definirati temeljne pojmove, modele i oblike ciklusa projektiranja informacijskog sustava.
		Razumijevanje	2-Opisati i oblikovati načine prepoznavanja i specifikacije zahtjeva cilja i opsega informacijskog sustava, te njegovih funkcionala
		Primjenjivanje	3-Prikazati vrste i namjenu modela razvoja i projektiranja informacijskog sustava.
		Analiziranje	4-Povezati područja i pristupe u projektiranju i izradi informacijskog sustava.
		Sintetiziranje	5-Izabranim aktivnostima projektiranja informacijskog sustava pridijeliti područja izrade programskog rješenja.
			5-Predložiti metodu i modele i razvoja i projektiranja informacijskog sustava.

Slika 7 Ishodi učenja za pojedini predmet

Predložena usporedba je prihvatljiva ako pregledavamo ograničenu količinu informacija, poput ovo primjera koji se odnosi na dva predmeta. Pregledi koji bi nam pružili usporedbu znanja i/ili ishoda učenja na razini cijelog studija, modula na koje je studij podijeljen, godina studiranja i slično, zahtijevaju međusobno povezivanje elemenata obrazovnog procesa i unošenje velikog broja podataka. Složenost takvog programskog rješenja nadilazi opseg ovog rada. Ipak, možemo pogledati primjer povezivanja područja znanja i ishoda učenja na razini koncepata kao na slici 8.



Slika 8. Primjer povezivanja koncepata znanja i ishoda učenja

Ako se povezivanje među konceptima na slici 8. realizira preko nastavnih cjelina za pojedini predmet onda se mogu dobiti pregledi strukturirani u raznovrsnim hijerarhijama, ovisno o potrebi analiziranja elemenata sustava obrazovanja. Jedan primjer je i izvješće na slici 9, koje pokazuje ishode učenja grupirane prema područjima znanja.

Znanje i ishodi učenja za predmet		
Šifra i naziv predmeta	Područje i jedinice znanja	Ishodi učenja predmeta i po jedinici znanja
SIT01	Informacijski sustavi	
	Programsko inženjerstvo	
	Inženjerstvo zahtjeva	<p>1-Definirati temeljne pojmove, modele i oblike upravljanja unutar procesa razvoja informacijskog sustava.</p> <p>Navesti ključne komponente kod opisa poslovanja potrebne za model IS-a</p> <p>Prepoznati funkcionalne i nefunkcionalne zahtjeve u primjeru specifikacije zahtjeva</p> <p>3-Prikazati slijed i namjenu procesa modela informacijskog sustava.</p> <p>Primijeniti ključne elemente i zajedničke metode u fazi analize kako bi se izradili zahtjevi za SW srednje veličine</p> <p>Provesti reviziju skupa funkcionalnih zahtjeva kako bi se odredila kvaliteta novog programa</p>
	Procesi programskog inženjerstva	<p>1-Definirati temeljne pojmove, modele i oblike upravljanja unutar procesa razvoja informacijskog sustava.</p> <p>Opisati komunikaciju programskog rješenja s ostalim funkcionalnostima poslovanja</p> <p>2-Opisati i oblikovati načine prepoznavanja i specifikacije zahtjeva za programskim rješenjem.</p> <p>Opisati važne prednosti i nedostatke nekoliko osnovnih modela razvoja (vodopadni, iterativni, agilni)</p> <p>3-Prikazati slijed i namjenu procesa modela informacijskog sustava.</p> <p>Navesti razlike među fazama razvoja IS-a</p> <p>Usporediti nekoliko zajedničkih modela procesa obzirom na njihovu važnost u razvoju pojedinih vrsta programa</p> <p>4-Povezati područja i pristupe u oblikovanju arhitekture informacijskog sustava.</p> <p>Objasniti ulogu modela zrelosti procesa u poboljšanju procesa</p> <p>Usporediti nekoliko modela poboljšanja procesa poput CMM, CMML, ISO9000</p>

Slika 9. Izvješće pregleda znanja i ishoda učenja za predmet *Informacijski sustavi*

3.2.2 Nastavne cjeline, ishodi učenja i područja znanja

Područjima i jedinicama znanja pridijeljeni su ishodi učenja razrađeni prema osnovnim razinama ishoda učenja [9] [10]. Slika 10. prikazuje razradu pojedine cjeline znanja na očekivane ishode učenja. Taj popis ishoda učenja zadan je za cijeli studij (eventualno za studijski modul). Pojedinom predmetu se po područjima znanja pridružuju podskupovi odgovarajućih ishoda učenja. Na kraju te ishode učenja pridružimo nastavnim cjelinama (i njihovim područjima znanja, slika 11) i tada dobivamo temelj za pretraživanje i zaključivanje na osnovu svih važnih elemenata procesa obrazovanja.

Područje znanja			
ID_	podr_	podrucje_znanja_naziv	ID_koncepta
1	ASP	Algoritmi i strukture podataka	Rac
2	PJ	Programski jezici	Rac
3	PI	Programsko inženjerstvo	Rac
ID_jedinice_znanja naziv_jedinice_znanja			
8 Inženjerstvo zahtjeva			
ID_	opis_ishoda_po_jed_znanja		
3	Opisati temeljne i zajedničke tehnike koje se koriste za prikupljanje zahtjeva		
4	Navesti ključne komponente modela podataka (ER model)		
5	Prepoznati funkcionalne i nefunkcionalne zahtjeve u primjeru specifikacije zahtjeva		
6	Provesti reviziju skupa funkcionalnih zahtjeva kako bi se odredila kvaliteta novog programa		
7	Primijeniti ključne elemente i zajedničke metode u fazi analize kako bi se izradili zahtjevi za SW srednje veličine		
8	Usporediti planski pristup i agilni pristup specifikaciji zahtjeva i opisati prednosti i rizike za svaki od njih		
9	Prevesti u prirodni jezik (pseudokod) specifikaciju korisničkih zahtjeva		

Slika 10. Povezivanje područja znanja i ishoda učenja

Nastavna cjelina					
ID_	ID_pretr_	rb_nast_	sat_	opis_nastavne_cjeline	
1	SIT015	1	3	Definicija sustava, poslovnog sustava i njegova informacijskog sustava. Organizacija poslovnog sustava.	
2	SIT015	1	1	Uvod. Opis zadatka na vježbama. Diskusija o poslovnim informacijskim sustavima u poduzećima i odabir teme projekta z	
3	SIT015	2	3	Vrste informacijskih sustava. Određivanje zrelosti poslovnih procesa i uspješnost informacijskog sustava.	
ID_pc_				ID_jedinice_znanja	postotak_u_nast_jedinici
				4 Procesi programskog inženjerstva	50
				ID_	ID_ishoda_po_jed_znanja
				7 Usporediti nekoliko modela poboljšanja procesa poput CMM, CMMI, ISO9000	
				8 Objasniti ulogu modela zrelosti procesa u poboljšanju procesa	
				* #####	
				71 Vođenje razvoja programskog proizvoda	50
				ID_	ID_ishoda_po_jed_znanja
				17 Koristiti alate za upravljanje razvojem IS-a te pratiti zadatke i resurse	
				* #####	
				(Novi)	100
4	SIT015	2	1	Razgovor s korisnikom. Skiciranje razgovora s korisnikom za pojedini projekt.	
				ID_pc_	ID_jedinice_znanja
				9 Inženjerstvo zahtjeva	100
				ID_	ID_ishoda_po_jed_znanja
				9 Prepoznati funkcionalne i nefunkcionalne zahtjeve u primjeru specifikacije zahtjeva	
				10 Primijeniti ključne elemente i zajedničke metode u fazi analize kako bi se izradili zahtjevi za SW srednje veličine	

Slika 11. Nastavne cjeline razrađene na područja znanja kojima se pridružuju odgovarajući ishodi učenja

Na slici 11 razrađene su nastavne cjeline predmeta na područja znanja (od prije slika 6b) kojima se onda dodatno pridružuju upravo oni ishodi učenja koji se odnose na ta područja znanja. Razrada ishoda učenja po područjima znanja trebala bi sadržavati potpuni skup ishoda učenja koja na kraju studija definiraju kompetencije završenog studenta. Kada bi cijeli nastavni plan bio razrađen do detalja onda bi se mogla pratiti evolucija svakog područja znanja i konačni rezultat bi definirao završene kvalifikacije (slika 2).

U nastavku su prikazani: (1) primjer pregleda znanja i pripadajućih ishoda učenja u odnosu na nastavne cjelina pojedinog predmeta (slika 12) i (2) primjer pregleda znanja i nastavnih cjelina pojedinog predmeta u odnosu na očekivane ishode učenja (slika 13).

Znanje - Ishodi učenja - Nastavne cjeline			
Šifra i naziv predmeta	Područje i jedinica znanja	Ishodi učenja po jedinici znanja	Nastavne cjeline predmeta
SIT015 Informatički sustavi	Programsko inženjerstvo		
	Inženjerstvo zahtjeva		
		1. Pamćenje - Navesti ključne komponente kod opisa poslovanja potrebne za model IS-a	1 Definicija sustava, poslovnog sustava i njegova informacijskog sustava. Organizacija poslovnog sustava.
		1. Pamćenje - Prepoznati funkcionalne i nefunkcionalne zahtjeve u primjeru specifikacije zahtjeva	2 Razgovor s korisnikom. Skiciranje razgovora s korisnikom za pojedini projekt.
		3. Primjenjivanje - Primijeniti ključne elemente i zajedničke metode u fazi analize kako bi se izradili zahtjevi za SW srednje veličine	2 Razgovor s korisnikom. Skiciranje razgovora s korisnikom za pojedini projekt.
		3. Primjenjivanje - Provesti reviziju skupa funkcionalnih zahtjeva kako bi se odredila kvaliteta novog programa	3 Razgovor s korisnikom - dovršavanje poglavlja.
	Procesi programskog inženjerstva		
		1. Pamćenje - Opisati komunikaciju programskog rješenja s ostalim funkcionalnostima poslovanja	1 Definicija sustava, poslovnog sustava i njegova informacijskog sustava. Organizacija poslovnog sustava.
		1 Uvod. Opis zadatka na vježbama. Diskusija o poslovnim informacijskim sustavima u poduzećima i odabir teme projekta za svakog st	
		2. Razumijevanje - Opisati važne prednosti i nedostatke nekoliko osnovnih modela razvoja (vodopadni, iterativni, agilni)	3 Organizacija informacijskog sustava. Faze životnog ciklusa informacijskog sustava.
		3. Primjenjivanje - Navesti razlike među fazama razvoja IS-a	3 Organizacija informacijskog sustava. Faze životnog ciklusa informacijskog sustava.
		3. Primjenjivanje - Usporediti nekoliko zajedničkih modela procesa obzirom na njihovu važnost u razvoju pojedinih vrsta programa	1 Definicija sustava, poslovnog sustava i njegova informacijskog sustava. Organizacija poslovnog sustava.
		4. Analiziranje - Objasniti ulogu modela zrelosti procesa u poboljšanju procesa	1 Uvod. Opis zadatka na vježbama. Diskusija o poslovnim informacijskim sustavima u poduzećima i odabir teme projekta za svakog st
		2 Vrste informacijskih sustava. Određivanje zrelosti poslovnih procesa i uspješnost informacijskog sustava.	
		4. Analiziranje - Usporediti nekoliko modela poboljšanja procesa poput CMM, CMMI, ISO9000	2 Vrste informacijskih sustava. Određivanje zrelosti poslovnih procesa i uspješnost informacijskog sustava.
	Vođenje razvoja programskog proizvoda		
		1. Pamćenje - Prepoznati i opravdati nužne uloge u timu razvoja IS-a	4 Planiranje razvoja informacijskog sustava. Strateška analiza poslovanja i preoblikovanje poslovnih procesa.
		3. Primjenjivanje - Koristiti alate za upravljanje razvojem IS-a te pratiti zadatke i resurse	4 Planiranje razvoja informacijskog sustava. Strateška analiza poslovanja i preoblikovanje poslovnih procesa.
		5. Sintetiziranje - Provesti analizu troškova i dobiti kako bi se umanjili rizici	4 Planiranje razvoja informacijskog sustava. Strateška analiza poslovanja i preoblikovanje poslovnih procesa.

Slika 12. Podjela znanja na ishode učenja te pridružene nastavne cjeline, po predmetima

Znanje - Nastavne cjeline - Ishodi učenja			
Šifra i naziv predmeta	Područje i jedinica znanja	Nastavne cjeline	Ishodi učenja po znanju i cjelinama
SIT015 Informatički sustavi	Programsko inženjerstvo		
	Inženjerstvo zahtjeva		
		1 Definicija sustava, poslovnog sustava i njegova informacijskog sustava. Organizacija poslovnog sustava.	
		1. Pamćenje - Navesti ključne komponente kod opisa poslovanja potrebne za model IS-a	
		2 Razgovor s korisnikom. Skiciranje razgovora s korisnikom za pojedini projekt.	
		1. Pamćenje - Prepoznati funkcionalne i nefunkcionalne zahtjeve u primjeru specifikacije zahtjeva	
		3. Primjenjivanje - Primijeniti ključne elemente i zajedničke metode u fazi analize kako bi se izradili zahtjevi za SW srednje veličine	
		3 Razgovor s korisnikom - dovršavanje poglavlja.	
		3. Primjenjivanje - Provesti reviziju skupa funkcionalnih zahtjeva kako bi se odredila kvaliteta novog programa	
	Procesi programskog inženjerstva		
		1 Definicija sustava, poslovnog sustava i njegova informacijskog sustava. Organizacija poslovnog sustava.	
		1. Pamćenje - Opisati komunikaciju programskog rješenja s ostalim funkcionalnostima poslovanja	
		3. Primjenjivanje - Usporediti nekoliko zajedničkih modela procesa obzirom na njihovu važnost u razvoju pojedinih vrsta programa	
		1 Uvod. Opis zadatka na vježbama. Diskusija o poslovnim informacijskim sustavima u poduzećima i odabir teme projekta za svakog studenta / grupu studenata	
		1. Pamćenje - Opisati komunikaciju programskog rješenja s ostalim funkcionalnostima poslovanja	
		4. Analiziranje - Objasniti ulogu modela zrelosti procesa u poboljšanju procesa	
		2 Vrste informacijskih sustava. Određivanje zrelosti poslovnih procesa i uspješnost informacijskog sustava.	
		4. Analiziranje - Objasniti ulogu modela zrelosti procesa u poboljšanju procesa	
		4. Analiziranje - Usporediti nekoliko modela poboljšanja procesa poput CMM, CMMI, ISO9000	
		3 Organizacija informacijskog sustava. Faze životnog ciklusa informacijskog sustava.	
		2. Razumijevanje - Opisati važne prednosti i nedostatke nekoliko osnovnih modela razvoja (vodopadni, iterativni, agilni)	
		3. Primjenjivanje - Navesti razlike među fazama razvoja IS-a	
	Vođenje razvoja programskog proizvoda		
		4 Planiranje razvoja informacijskog sustava. Strateška analiza poslovanja i preoblikovanje poslovnih procesa.	
		1. Pamćenje - Prepoznati i opravdati nužne uloge u timu razvoja IS-a	
		3. Primjenjivanje - Koristiti alate za upravljanje razvojem IS-a te pratiti zadatke i resurse	
		5. Sintetiziranje - Provesti analizu troškova i dobiti kako bi se umanjili rizici	

Slika 13. Podjela znanja po nastavnim cjelinama predmeta i pridruženi ishodi učenja

Složene usporedbe svih elemenata sustava obrazovanja koji su u ovom radu opisani mogu pružiti preglede sintetizirane na razini studija i stečenih kvalifikacija. Primjerice, u baznim predmetima nekog studija ishodi učenja mogu biti nižih razina (takozvani *lower order thinking* [11]), a onda se u predmetima viših godina uče detalji nekog područja uz povezivanje i korištenje znanja i tada se postižu više razine ishoda učenja po područjima (takozvani *higher order thinking* [11]). Pregledom područja znanja i dostignutih razina ishoda učenja moglo bi se zaključiti za koje kvalifikacije je student više, a za koje manje obrazovan. Dodavanjem dimenzije ECTS bodova dostignute razine mogu biti mjerene i u postotku.

Nadalje, iz literature [11], zanimljivo je kako se nad ovom dimenzijom kognitivnog procesa (*Cognitive Process Dimension*, odnosno podjela prema Bloomovoj taksonomiji, kakvu poznajemo u ovom radu [4]) može dodati takozvana dimenzija znanja (*Knowledge Dimension*). Tako se dimenzija znanja može klasificirati u četiri stanja: činjenično, konceptualno, proceduralno i metakognitivno znanje. Načelno bi se moglo reći da ta dimenzija znanja odvaja stručne sadržaje od teorijskih znanja. Sigurno bi bilo zanimljivo napraviti dodatnu analizu primjera u ovom radu uključivanjem i dimenzije znanja u praćenje obrazovnog procesa.

4. Zaključak

Za zaključak bi se mogli osvrnuti na pojavljivanje ishoda učenja u procesu obrazovanja i potreba tržišta rada [4]. Na početku procesa obrazovanja u nastavnom planu svrha praćenja ishoda učenja je utvrditi očekivanja od svake aktivnosti učenja. U postupku ocjenjivanja, ishodi učenja bi trebali osigurati homogenost u procjeni uspješnosti studenata. Sve ove elemente, zajedno s pružanjem informacija poslodavcu o kvalifikacijama kandidata na osnovu ishoda učenja opisali smo kroz jednostavni primjer/prototip programskog rješenja u ovom radu. Potreba i plan da se dobro definiraju kvalifikacije na razini cijelog sustava obrazovanja RH osnovni je cilj HKO-a [3], ali ne samo u Republici Hrvatskoj nego i na razini EU. I najvažniji zadnji korak u ovoj priči, ali prvi u procesu izrade HKO je standard zanimanja koji se može koristiti pri utvrđivanju kvalifikacija, prvenstveno u strukovnom obrazovanju. Time je još jednom naglašena povezanost s obrazovnim procesom koji treba biti u stanju brzo odgovoriti na potrebe tržišta rada prilagođavanjem svog nastavnog plana.

Primjer prototipa programskog rješenja razrađenog u ovom radu ukazuje na mogućnost povezivanja (jednog ili više) informacijskih sustava obrazovanja koji bi se mogli povezati preko odgovarajućih standarda kvalifikacija i radnih mjesta i tako pravovremeno pomoći svim sudionicima u donošenju kvalitetnih poslovnih odluka.

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Conceptual and Data Modeling for a Computer Science Curriculum

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Abstract. The stage of planning and creation of a Curriculum is an important step in the educational process. A Curriculum in Computer Sciences must be conceptualized in such a way that students acquire knowledge from various areas such as operational systems, programming languages, information systems, intelligent systems, communications and network security, etc. The educational process must prepare students for various professions. In addition to classical IT professions, today's IT related jobs include EcoInformatics or BioInformatics. Therefore the curriculum must offer a clear and applicable purpose of the educational process, including flexible educational programs that can be easily adjusted to the continuous changes in the job market. In addition, the curriculum must prepare students for life-long learning, including the on-hand work experience and communication skills, team work and ethics and teach them to appreciate the importance of abstraction in order to unify their theoretical and practical knowledge.

This paper describes the decomposition of key concepts of the field of Computing such as: knowledge domains and their parts, academic courses, learning objects and outcomes, as well as work places and required skills. A data model has been designed together with an experimental set of data describing the Computer Science Curriculum. Several queries have been constructed that can be used to obtain information on learning aims and outcomes, required competencies on the job market, and the ability of students to find employment, as well as the possibility that the employers find candidates that match the required skills and competencies. The conceptual model was designed with a tool for knowledge representation that uses conceptual graphs. Data and queries were designed and built in a relational database.

Key words: *conceptual modeling, data modeling, curriculum, Computer science*

Zelene metalne konstrukcije

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Sažetak. Razvoj današnjih metalnih konstrukcija, koje su sastavni dio modernih sve zahtjevnijih građevinskih konstrukcija, bazira se na tzv. zelenoj tehnologiji. Odgovarajući odabir materijala modernih građevinskih konstrukcija, te njihov utjecaj na energetske učinkovitost, a da se pri tome pridonosi zaštiti i očuvanju okoliša, svjetski je trend. Sve navedeno ima i svoju ekonomsku opravdanost. Naime, moderne građevinske konstrukcije na pojedinim objektima čine i 100% vanjske ovojnice. Kako je osnovni, tj. nosivi dio modernih građevinskih konstrukcija, metalna konstrukcija, ovim radom dat je njen značajan utjecaj na navedeno. Prikazan je postupak formiranja metalne konstrukcije statičkim proračunom, tj. odabir vrste materijala, najpovoljnijeg oblika poprečnog presjeka i njegovih geometrijskih karakteristika, tj. presjeka profila. Osim čelika kao osnovnog materijala metalnih konstrukcija, ovaj rad posebnu pažnju daje prednostima aluminija. Kako profili metalnih konstrukcija u arhitekturi moraju zadovoljiti i estetske kriterije tražene od strane glavnih projekatara građevinskih objekata, aluminij kao materijal je posebno zahvalan. U radu je prikazan i veliki utjecaj profila metalnih konstrukcija na toplinsku zaštitu objekta. Različiti materijali i profili imaju različite toplinske karakteristike. U završnom dijelu rada, na konkretnom primjeru, prikazano je sve navedeno, od statičkog proračuna, pa do odabira materijala i profila metalne konstrukcije. Posebno je prikazan utjecaj različitih vrsta materijala i profila na toplinsku zaštitu objekta. Prikazani rezultati pokazuju energetske učinkovitost i ekonomsku opravdanost. U radu su korišteni specijalizirani programi, Schuco Statik i SchuCal+. Korišteni su i rezultati laboratorijskih ispitivanja ovlaštenih ustanova.

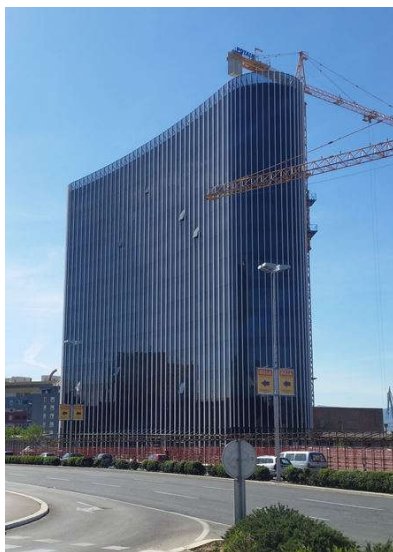
Ključne riječi: *metalna konstrukcija, zelena tehnologija, aluminij, profil, statika, toplinske karakteristike*

1. Uvod

Metalnu konstrukciju i sve njezine komponente, kao i vanjsku oblogu, treba dimenzionirati na način da može izdržati sva eksploatacijska opterećenja. Statički proračun metalne konstrukcije obuhvaća: nosivost vertikalnih nosača (profila), nosivost oslonaca (čeličnih sidara ugrađenih u AB konstrukciju), dimenzioniranje sidrenih vijaka, dimenzioniranje nastavaka nosača, proračun metalne konstrukcije AB parapeta atike i proračun obloge. U nastavku je prikazan odabir nosivog vertikalnog nosača, tj. odabir vrste materijala, najpovoljnijeg oblika poprečnog presjeka i njegovih geometrijskih karakteristika.

Kako se rad bazira na metalnim konstrukcijama koje pretežno za nosive vertikalne nosače imaju profile izrađene iz aluminija, a obloga je ostakljenje, ove konstrukcije u praksi imaju naziv aluminijske ostakljene fasadne konstrukcije. S obzirom na navedeno, aluminijska ostakljena fasadna konstrukcija često je i vanjska ovojnica modernih građevinskih konstrukcija (slika 1.).

Aluminijski profili koji se koriste za nosive vertikalne nosače modernih građevinskih konstrukcija dobivaju se procesom ekstrudiranja. Ekstrudirani aluminijski proizvodi čine više od 30% tržišta aluminijskih proizvoda u Europi, od čega se najveći dio pored građevinske koristi i u auto, željezničkoj, avio i brodo industriji. Ekstrudiranje je proces kojim se zagrijani cilindrični komad aluminija (tzv. trupac) presa kroz oblikovanu čeličnu matricu koja daje proizvod (profil) traženog poprečnog presjeka. Glavna prednost ekstrudiranja je široka mogućnost ponude različitih oblika i presjeka profila bez dodatne mehaničke obrade. Najveći udio na tržištu ekstrudiranih aluminijskih profila zauzimaju legure serije EN AW 6000 (AlMgSi). Legirani aluminij ima bolja mehanička svojstva, čvrstoća je 150-350 MPa, a sve sa dobrom žilavošću i sposobnošću oblikovanja. Široku primjenu imaju i legure serija EN AW 6060 i EN AW 6063 koje se mogu lako prešati. Sadrže nizak % Si i Mg, pa se prešaju brzinama i do 100 m/min sa dobrom kvalitetom površine. Profili mogu imati veliku složenost u kombinaciji sa veoma malim debljinama stjenki poprečnog presjeka. Lakoća s kojom se aluminijske legure mogu ekstrudirati u vrlo složene oblike glavna je prednost u odnosu na čelične profile koji zahtijevaju dodatnu mehaničku obradu. Ova prednost omogućuje projektantima da postignu željenu estetiku konstrukcije, uz uštedu materijala. Postignuta fleksibilnost u dizajnu u mnogim slučajevima nadvladava glavni nedostatak aluminijskih legura u odnosu na čelik, a to je čvrstoća. Međutim, kako čvrstoća ne ovisi samo o modulu elastičnosti E ($E_{Al \text{ legure}} = 1/3 E_{\text{č}}$), već i o geometriji poprečnog presjeka, moguće je npr. pažljivim projektiranjem poprečnog presjeka postići s aluminijskim nosačem koji ima samo 1,5 puta veći poprečni presjek, istu nosivost kao i s čeličnim nosačem 2 puta veće težine, s obzirom na otpornost konstrukcije deformiranju. Uz malo veće troškove za složeniju matricu, dobiva se oblik profila koji ima bolju uvojnu krutost. Dakle, osim što imaju nisku specifičnu težinu koja pruža velike prednosti u mnogim industrijskim aplikacijama, i ostale karakteristike idu u prilog aluminijskim legurama u odnosu na čelik, kao što su: dugi životni vijek, otpornost na koroziju (prirodni sloj zaštitnog oksida može biti povećan anodiziranjem, eloksiranjem - sloj oksida je 5-25 μm), dobra obradivost i oblikovanje, mogućnost zavarivanja..., a naknadnom toplinskom obradom poboljšavaju se mehanička svojstva. Aluminijske legure široko su dostupne i relativno jeftine.



Slika 1 West Gate (vanjska ovojnica)

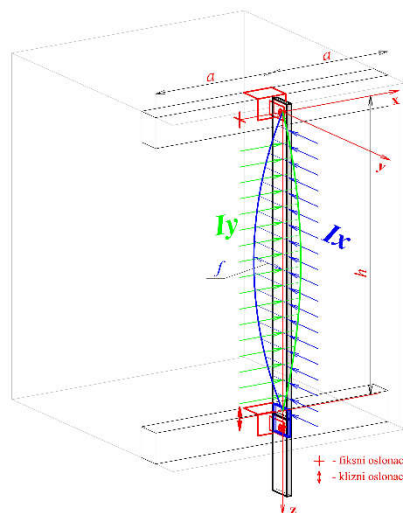
U današnjoj arhitekturi aluminijski profili čine osnovni dio modernih građevinskih konstrukcija. Zahtjevi za energetske učinkovitosti uz zaštitu i očuvanje okoliša sve su veći.

Europski cilj za građevinske objekte, tzv. 20/20/20 je: 20% manja potrošnja energenata direktno vezanih uz emisiju CO₂, 20% potrošnje energije pokrivati kroz obnovljenu energiju i 20% redukcija ukupne potrošnje energije, dok je za novogradnje 2020. godina, godina proizvodnje vlastite energije. Postavljeni cilj ima veliki utjecaj na svakodnevni razvoj novih sistema aluminijskih ostakljenih fasadnih konstrukcija. Novi sistemi imaju veliki doprinos u uštedi energije (poboljšavaju toplinsku zaštitu objekta) i smanjenju emisije CO₂. Veliki značaj u tome ima nova generacija nosivih aluminijskih profila. Zbog sve većeg doprinosa ovih metalnih konstrukcija na navedeno nazivamo ih zelene metalne konstrukcije.

2. Statički proračun vertikalnog nosača

Proračun vertikalnog nosača podrazumijeva odabir vrste materijala, najpovoljnijeg oblika poprečnog presjeka i njegovih geometrijskih karakteristika. Da bi to bilo moguće potrebno je izvršiti proračun opterećenja, koji za nosive vertikalne nosače aluminijskih ostakljenih fasadnih konstrukcija ima sljedeći redoslijed (slika 2.):

- Proračun promjenjivog opterećenja – momenta inercije I_x (savijanje), i
- Proračun stalnog opterećenja – momenta inercije I_y (izvijanje).



Slika 2 Opterećenje vertikalnog nosača

2.1 Proračun promjenjivog opterećenja

Proračun promjenjivog opterećenja obuhvaća:

- proračun opterećenja djelovanjem vjetra (prema HRN ENV 1991-2-4, EN 1991-1-4), i
- proračun opterećenja djelovanjem snijega (prema HRN ENV 1991-2-3, EN 1991-1-3).

Radom je obuhvaćen proračun opterećenja djelovanjem vjetra (tlak i podtlak). Za krovne konstrukcije proračun opterećenja morao bi se proširiti na proračun opterećenja djelovanjem snijega.

Djelovanje vjetra uz potresno djelovanje čini dominantno horizontalno djelovanje kojima su izložene konstrukcije ili građevine u svom vijeku trajanja [8]. Prihvatanjem europskih norma za projektiranje konstrukcija, Republika Hrvatska je prihvatila i načelo da u pojedine norme ugradi nacionalne specifičnosti koje se ponajprije odnose na prirodne pojave, tj. da izradi posebne dodatke za pojedinu normu s definiranim nacionalnim parametrima, pa je 2005. u

okviru pred norme „HRN ENV 1991-2-4:2005 Djelovanja na konstrukcije - Opterećenje vjetrom“ definirala „Nacionalni dokument za primjenu“ - NAD, tzv. Nacionalne dodatke. Ovo se posebno odnosi na priobalje i otoke.

Istraživanje fenomena djelovanja vjetra na konstrukcije zasniva se na više znanstveno inženjerskih disciplina kao što su dinamika konstrukcija, mehanika fluida i aeroelastičnost.

2.1.1 Osnovni tlak izazvan brzinom vjetra i brzina vjetra

Osnovni tlak izazvan brzinom vjetra q_b definiran je u dijelu 7.1. HRN ENV 1991-2-4, te odgovara osnovnoj brzini vjetra v_b i određuje se izrazom [4]:

$$q_b = \frac{\rho}{2} \cdot v_b^2 \quad [\text{N/m}^2] \quad (1)$$

gdje je: v_b - osnovna brzina vjetra [m/s], ρ - gustoća zraka koja ovisi o nadmorskoj visini, temperaturi i tlaku zraka koji se očekuje u određenom vjetrovnom području za oluje (preporučena vrijednost prema HRN EN 1991-1-4:2012/NA $\rho = 1,25 \text{ kg/m}^3$).

Brzina vjetra sastoji se od dviju komponentata - prosječne i promjenljive komponente.

Prosječna komponenta brzine vjetra

Prosječna komponenta brzine vjetra $v_m(z)$ na visini z definirana je prema jednadžbi [8]:

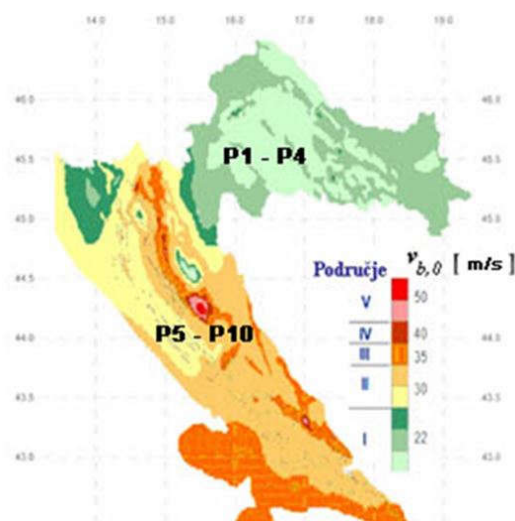
$$v_m(z) = v_b \cdot c_r(z) \cdot c_o(z) \quad [\text{m/s}] \quad (2)$$

gdje je: v_b - osnovna brzina vjetra, definirana kao funkcija smjera i godišnjeg doba na visini od 10 m iznad terena II. kategorije hrapavosti [m/s], $c_r(z)$ - koeficijent hrapavosti terena, $c_o(z)$ - koeficijent orografije terena.

Osnovna brzina vjetra v_b definirana je jednadžbom:

$$v_b = v_{b,0} \cdot c_{dir} \cdot c_{season} \quad [\text{m/s}] \quad (3)$$

gdje je: $v_{b,0}$ - temeljna vrijednost osnovne brzine vjetra, definirana kao karakteristična 10 minutna prosječna brzina vjetra na visini 10 m iznad terena II. kategorije hrapavosti [m/s], c_{dir} - koeficijent smjera vjetra (obično se uzima vrijednost 1,0), c_{season} - koeficijent ovisan o godišnjem dobu (obično se uzima vrijednost 1,0).



Slika 3 Zemljovid područja opterećenja vjetrom i raspodjele temeljne vrijednosti osnovne brzine vjetra $v_{b,0}$ za Republiku Hrvatsku

Temeljne vrijednosti osnovne brzine vjetra $v_{b,0}$ dane su po područjima unutar svake države koja se koristi Eurokodom. Vrijednost $v_{b,0}$ jedan je od najvažnijih podataka za proračun konstrukcija na opterećenje djelovanjem vjetra. Zemljovid raspodjele temeljne vrijednosti osnovne brzine vjetra $v_{b,0}$ prema područjima koji propisuje naš Državni zavod za normizaciju i mjeriteljstvo u okviru Državnog dokumenta za primjenu (DDP), a koji je sastavni dio Nacionalnog dodatka (za Republiku Hrvatsku HRN EN 1991-1-4:2012/NA), dan je na slici 3.

Koeficijent hrapavosti terena $c_r(z)$ uzima u obzir promjenu prosječne brzine vjetra $v_m(z)$ na mjestu konstrukcije ili građevine zbog visine iznad tla i hrapavosti zemljišta s privjetrene strane konstrukcije ili građevine u promatranom smjeru vjetra. Vrijednost koeficijenta hrapavosti određuje se na temelju logaritamske raspodjele brzine vjetra po visini (profilu), a definirana je jednadžbama (4) i (5) koje vrijede ako je privjetrena udaljenost dovoljno duga da stabilizira profil brzine vjetra:

$$c_r(z) = k_r \cdot \ln\left(\frac{z}{z_0}\right) \quad \text{za} \quad z_{\min} \leq z \leq z_{\max}, \quad (4)$$

$$c_r(z) = c_r(z_{\min}) \quad \text{za} \quad z \leq z_{\min}, \quad (5)$$

gdje je: k_r - koeficijent terena ovisan o visini hrapave površine z_0 , prema izrazu:

$$k_r = 0,19 \cdot \left[\frac{z_0}{z_{0,II}} \right]^{0,07}, \quad (6)$$

dok je: z_0 - visina hrapave površine ($z_0 = 0,3$ m - za kategoriju terena III), $z_{0,II}$ - visina hrapave površine terena II. kategorije ($z_{0,II} = 0,05$ m), z_{\min} - najmanja visina prema tablici 1., z_{\max} - uzima se 200 m ako nije drugačije određeno Nacionalnim dodatkom.

Hrapavost terena za dani smjer vjetra ovisi o hrapavosti tla i udaljenosti s jednolikom hrapavosti terena u kutnom isječku oko smjera vjetra. Mala područja s promjenljivom hrapavosti mogu se zanemariti. Vrijednosti veličina z_0 i z_{\min} potrebnih za određivanje koeficijenta terena k_r prikazane su u tablici 1. (Tablica 4.1 EN 1991-1-4:2005).

Koeficijent orografije terena $c_o(z)$ predstavlja povećanje brzine zbog utjecaja brežuljaka, stijena itd..., a uzima su u obzir tamo gdje se zbog orografije brzina vjetra povećava više od 5%. Učinci orografije mogu se zanemariti kada je prosječan nagib privjetrenog zemljišta manji od 3° .

Tablica 1 Kategorije terena

KATEGORIJA TERENA		z_0 [m]	z_{\min} [m]
0.	More ili priobalna područja izložena otvorenom moru	0,003	1
I.	Jezera ili ravna i horizontalna područja sa zanemarivom vegetacijom i bez prepreka	0,01	1
II.	Područja s niskom vegetacijom poput trave i izdvojenih prepreka (drveće, kuće) s razmacima od najmanje 20 visina prepreka	0,05	2
III.	Područje s jednolikim pokrovom vegetacije, zgrade ili izdvojene prepreke s razmacima od najviše 20 visina prepreka (šume, predgrađa, sela)	0,3	5
IV.	Područja u kojima je najmanje 15% površine izgrađeno i čija prosječna visina zgrada prelazi 15 metara	1,0	10

Promjenjiva komponenta brzine vjetra

Promjenjiva komponenta brzine vjetra određuje se uz pomoć intenziteta turbulencije $I_v(z)$ na visini z , koji je definiran kao standardna devijacija turbulencije σ_v , podijeljena s prosječnom brzinom vjetra $v_m(z)$ na visini z .

Promjenjiva komponenta brzine vjetra ima prosječnu vrijednost jednaku 0 i standardnu devijaciju σ_v , određenu jednadžbom [8]:

$$\sigma_v = k_r \cdot v_b \cdot k_I \quad (7)$$

gdje je: k_I - koeficijent turbulencije.

Intenzitet turbulencije $I_v(z)$ na visini z definiran je jednadžbama:

$$I_v(z) = \frac{\sigma_v}{v_m(z)} = \frac{k_I}{c_o(z) \cdot \ln\left(\frac{z}{z_0}\right)} \quad \text{za} \quad z_{\min} \leq z \leq z_{\max}, \quad (8)$$

$$I_v(z) = I_v(z_{\min}) \quad \text{za} \quad z \leq z_{\min}. \quad (9)$$

2.1.2 Vršni tlak izazvan brzinom vjetra

Vršni tlak izazvan brzinom vjetra $q_p(z)$ na visini z uključuje prosječne i kratkotrajne promjene brzine vjetra. Ovaj se tlak može definirati Nacionalnim dodatkom, a preporučena vrijednost prema normi EN 1991-1-4:2005 određena je jednadžbom [8]:

$$q_p(z) = [1 + 7 \cdot I_v(z)] \cdot \frac{\rho}{2} \cdot v_m^2(z) = c_e(z) \cdot q_b \quad [\text{N/m}^2] \quad (10)$$

gdje je: $c_e(z)$ - koeficijent izloženosti vjetru.

Koeficijent izloženosti vjetru $c_e(z)$, definira vjetrene prilike na promatranom području određene zemljopisnim položajem. Prijašnja istraživanja djelovanja vjetra na nekoliko priobalnih lokacija pokazala su određena odstupanja od standardnih europskih vrijednosti prema ENV 1991-2-4:1995 i potvrđuju vrijednosti koeficijenta izloženosti $c_e(z)$ koje su bile predložene u „Nacionalnom dokumentu za primjenu“ - HRN ENV 1991-2-4:2005.

Glavna zadaća je daljnje istraživanje stvarnih vrijednosti koeficijenta izloženosti vjetru $c_e(z)$ na priobalnom i otočnom području Republike Hrvatske. Nužno je raspolagati podacima mjerenja smjera i brzine vjetra na velikom broju lokacija, posebno pošto se radi o orografski složenom području (izloženost, konkavnost i konveksnost reljefa, nadmorska visina,...), te utjecaju mora i kopnenog zaleđa u različitim vremenskim intervalima. Ove spoznaje i promišljanja bili su povod da se izrade nove podloge za nacionalni dodatak za buduću normu HRN EN 1991-1-4, pa se za koeficijent izloženosti $c_e(z)$ predlažu različite vrijednosti za pojedina područja Republike Hrvatske u odnosu koje se nalaze u europskoj normi (slika 4.).

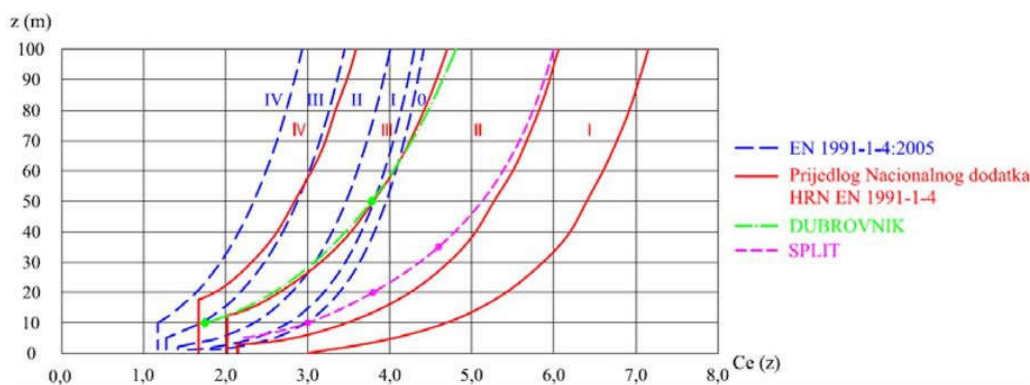
Tablica 2 Vrijednosti temeljne $v_{b,0}$ i trenutne $v_{ref,x}$ brzine vjetra na području Republike Hrvatske

Područja	$v_{b,0}$ [m/s]	$v_{ref,x}$ [m/s]
I	22	35
II	30	45
III	35	55
IV	40	65
V	50	75

Za regije P1-P4 (kontinentalno područje) intenzitet turbulencije $I_v(z)$ računa se prema izrazu (8) uz preporučenu vrijednost $k_I = 1,0$ (EN 1991-1-4:2005).

Za regije P5-P10 (priobalno i otočno područje - područja II., III., IV., i V. brzina vjetra) intenzitet turbulencije $I_v(z)$ posebno se računa [8], bazirajući se kako je navedeno na daljnja istraživanja, uzimajući u obzir trenutačnu brzinu vjetra $v_{ref,x}$ (tablica 2.). Sve navedeno prikazano je na slici 4. kao Prijedlog Nacionalnog dodatka HRN EN 1991-1-4.

Za ravan teren prema EN 1991-1-4:2005 [4], što uglavnom i je za konstrukcije, koeficijent orografije $c_o(z) = 1,0$, pa se koeficijent izloženosti vjetru $c_e(z)$ određuje ovisno o visini konstrukcije z iznad tla i kategoriji terena (tablica 1.), kako je prikazano na slici 4.



Slika 4 Koeficijent izloženosti vjetru $c_e(z)$

2.1.3 Tlak vjetra na površine konstrukcije

Tlak vjetra w_e koji djeluje na vanjske površine konstrukcije određuje se jednadžbom [4]:

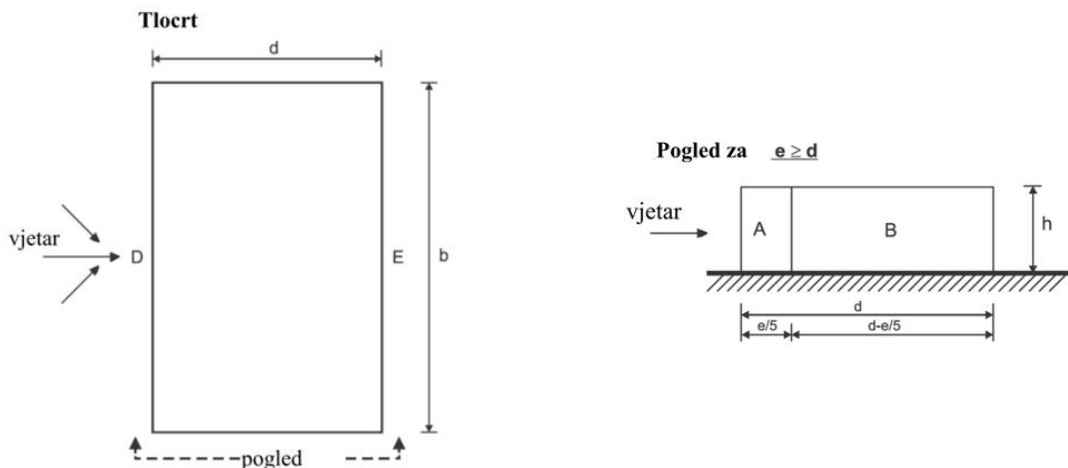
$$w_e = q_p(z_e) \cdot c_{pe} \quad \left[\text{N/m}^2 \right] \quad (11)$$

gdje je: $q_p(z_e)$ - vršni tlak izazvan brzinom vjetra (peak velocity pressure) na visini z_e , z_e - usporedna (referentna) visina za vanjski tlak, c_{pe} - koeficijent tlaka za vanjski tlak (koeficijent vanjskog tlaka).

Tlak vjetra w_i koji djeluje na unutarnje površine konstrukcije određuje se jednadžbom [4]:

$$w_i = q_p(z_i) \cdot c_{pi} \quad \left[\text{N/m}^2 \right] \quad (12)$$

gdje je: $q_p(z_i)$ - vršni tlak izazvan brzinom vjetra (peak velocity pressure) na visini z_i , z_i - usporedna (referentna) visina za unutarnji tlak, c_{pi} - koeficijent tlaka za unutarnji tlak (koeficijent unutarnjeg tlaka).



Slika 5 Koeficijent vanjskog tlaka c_{pe} za vertikalne površine konstrukcija pravokutnog tlocrta

Za ravne djelove konstrukcija do 200 m visine, djelovanje vjetra uzima se kao zamjenjujuće statičko opterećenje. Tlakovi vjetra djeluju okomito na površine konstrukcija. Neto tlak na površinu je algebarski zbroj unutarnjeg i vanjskog tlaka (djeluju istodobno) $w_e \pm w_i$. Koeficijent vanjskog tlaka vjetra c_{pe} za konstrukcije i dijelove konstrukcija ovisi o obliku i veličini površine opterećene zone konstrukcije. Za $A \geq 10 \text{ m}^2$ vrijedi $c_{pe} = c_{pe,10}$. Određivanje vrijednosti koeficijenta vanjskog tlaka c_{pe} za vertikalne površine konstrukcija pravokutnog tlocrta prikazano je na slici 5. i u tablici 3. prema 7.1 EN 1991-1-4., pri čemu je $e = b$ ili $2h$ (manja vrijednost) [4].

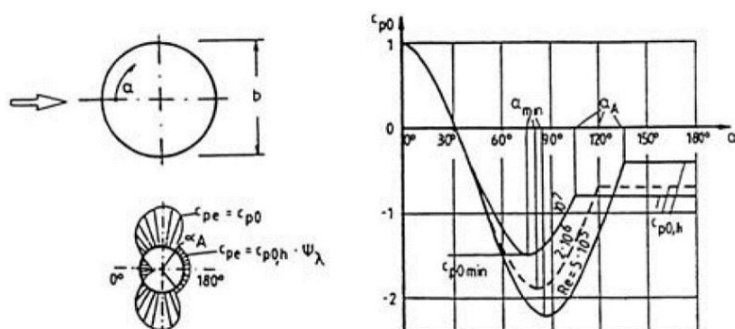
Tablica 3 Koeficijent vanjskog tlaka c_{pe} za vertikalne površine konstrukcija pravokutnog tlocrta

Područje	A		B		C		D		E	
h/d	$c_{pe,10}$	$c_{pe,1}$	$c_{pe,10}$	$c_{pe,1}$	$c_{pe,10}$	$c_{pe,1}$	$c_{pe,10}$	$c_{pe,1}$	$c_{pe,10}$	$c_{pe,1}$
5	-1,2	-1,4	-0,8	-1,1	-0,5		+0,8	+1,0	-0,7	
1	-1,2	-1,4	-0,8	-1,1	-0,5		+0,8	+1,0	-0,5	
$\leq 0,25$	-1,2	-1,4	-0,8	-1,1	-0,5		+0,7	+1,0	-0,3	

Koeficijent vanjskog tlaka c_{pe} za konstrukcije u obliku valjka, dakle kružnog poprečnog presjeka, definiran je u dijelu 10.8. ENV 1991-2-4 i ovisi o Reynoldsovu broju Re (slika 6.) [3]:

$$Re = \frac{b \cdot v_m(z_e)}{v} \quad (13)$$

gdje je: $v = 15 \cdot 10^{-6}$ - kinematska viskoznost zraka [m^2/s], b - promjer kružnog poprečnog presjeka konstrukcije [m].



Slika 6 Raspodjela tlaka c_{pe} za kružni poprečni presjek konstrukcije

U tablici 4. prikazane su tipične vrijednosti krivulja sa slike 6. (međuvrijednosti se smiju linearno interpolirati), gdje je: α_{min} - mjesto najmanjeg tlaka, $c_{p,o,min}$ - vrijednost najmanjeg koeficijenta tlaka, α_A - mjesto odvajanja strujanja, $c_{p,o,h}$ - koeficijent tlaka zavjetrenog dijela valjka.

Tablica 4 Tipične vrijednosti krivulja sa slike 6.

Re	α_{min}	$c_{p,o,min}$	α_A
$5 \cdot 10^5$	85	-2,2	135
$2 \cdot 10^6$	80	-1,9	120
10^7	75	-1,5	105

Koeficijent unutarnjeg tlaka vjetra c_{pi} za konstrukcije i dijelove konstrukcija ovisi o veličini i raspodjeli otvora po oplošju konstrukcije. Ukoliko u određenom slučaju nije moguće odrediti raspodjelu otvora, ili se ne smatra opravdanim, i ako su svi otvori konstrukcije zatvoreni pri opterećenju djelovanjem vjetrom, c_{pi} se može uzeti s vrijednostima $c_{pi} = 0,2$ i $c_{pi} = -0,3$ [4].

2.1.4 Sila vjetra na čitavu konstrukciju ili konstrukcijski element

Globalna sila vjetra F_W određuje se prema dijelu 6.1 ENV 1991-2-4, a proizlazi iz tlaka vjetra i sila trenja vjetra na površinu konstrukcije. Sila vjetra zbog tlaka na površinu konstrukcije određuje se na dva načina:

- proračunom sile vjetra s pomoću koeficijenata sila,
- proračunom sile vjetra s pomoću tlakova vjetra na površine.

Proračun sile vjetra F_W na konstrukciju ili konstrukcijski element pomoću koeficijenata sila može se odrediti izravno jednadžbom [5]:

$$F_W = c_s c_d \cdot c_f \cdot q_p(z_e) \cdot A_{ref} \quad [\text{N}] \quad (14)$$

gdje je: $c_s c_d$ - koeficijent konstrukcije (koeficijent veličine i dinamički koeficijent), c_f - koeficijent sile za konstrukciju ili konstrukcijski element, A_{ref} - usporedna (referentna) površina konstrukcije ili konstrukcijskog elementa za c_f (općenito projicirana ploha pročelja izložena vjetru) $[\text{m}^2]$.

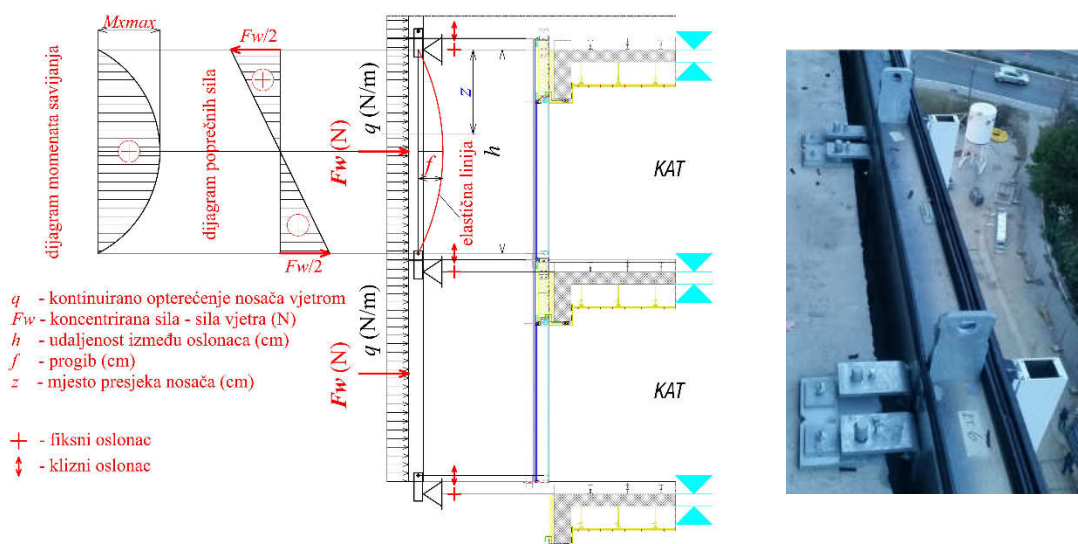
Za ovaj rad proračun koeficijenta sile c_f za konstrukciju ili konstrukcijski element dat je izrazom [5,10]:

$$c_f = c_{pe} + c_{pi} \quad (15)$$

Koeficijent konstrukcije $c_s c_d = 1$, za [10] konstrukcije visine $h < 15$ m, odnosno za konstrukcije s okvirima i konstruktivnim elementima visine $h < 100$ m, uz uvjet da je $h < 4d$ (d - širina konstrukcije u smjeru djelovanja vjetra).

Sila vjetra F_W na konstrukciju ili konstrukcijski element može se odrediti i vektorskim zbrojem sila $F_{w,e}$, $F_{w,i}$ i F_{fr} proračunanih iz vanjskih w_e i unutarnjih w_i tlakova vjetra i trenja vjetra c_{fr} (koeficijent trenja) usporedo na vanjske površine [8].

2.1.5 Dimenzioniranje vertikalnog nosača - momenta inercije I_x (savijanje)



Slika 7 Opterećenje vertikalnog nosača na savijanje s prikazom oslonca

Rješavanjem diferencijalne jednadžbe elastične linije za vertikalni nosač [1,9]:

$$\frac{d^2 f}{dz^2} = -\frac{M_x}{E \cdot I_x} \quad (16)$$

gdje je: M_x - moment savijanja [Ncm], E - modul elastičnosti ($E = 70 \text{ GPa} = 70 \cdot 10^5 \text{ N/cm}^2$ za aluminij), I_x - momenti inercije [cm^4], dolazi se do izraza za progibnu funkciju $f=f(z)$ na mjestu maksimalnog progiba $z = h/2$ (opasni presjek) prema slici 7., odnosno do izraza za potrebni moment inercije I_x poprečnog presjeka vertikalnog nosača koji je zglobo oslonjen [7]:

$$I_x = \frac{F_w \cdot 5 \cdot h^3}{E \cdot f \cdot 384} \quad [\text{cm}^4] \quad (17)$$

gdje je: F_w - sila vjetra (sila koja zamjenjuje kontinuirano opterećenje q) [N], f - progib [cm]. Progib f za vertikalne nosače koji su zglobo oslonjeni (uvjet krutosti) [9]:

$$f \leq \frac{h}{250} \leq 1,5 \text{ cm} \quad (18)$$

2.2 Proračun stalnog opterećenja

Proračun stalnog opterećenja obuhvaća proračun izvijanja, tj. kontrolu stabilnosti vertikalnog nosača na bočno izvijanje uslijed djelovanja vlastite težine nosača i obloge (prema HRN ENV 1991-2-1, EN 1991-1-1).

Vertikalni nosač je stabilan ako je zadovoljen uvjet da je $\sigma_{kr} > \sigma$, gdje je: σ_{kr} - kritično naprezanje, σ - stvarno naprezanje.

Kritično naprezanje σ_{kr} definirano je jednačinom

$$\sigma_{kr} = \frac{F_{kr}}{A} \quad [\text{MPa}] \quad (19)$$

gdje je: F_{kr} - sila izvijanja (najmanja sila pri kojoj se pojavljuje izvijanje) [N], A - površina poprečnog presjeka vertikalnog nosača [mm^2], ili prema Eulerovoj jednačini za elastično izvijanje:

$$\sigma_{kr} = \pi^2 \cdot \frac{E}{\lambda^2} \quad [\text{MPa}] \quad (20)$$

ako vrijedi da je $\lambda > \lambda_p$, gdje je: λ - vitkost nosača, a λ_p - granična vitkost nosača.

Sila izvijanja F_{kr} i kritično naprezanje σ_{kr} ovise o vitkosti nosača λ , koje je definirano jednačinom:

$$\lambda = \frac{h_0}{i_{\min}} \quad (21)$$

gdje je: h_0 - slobodna duljina izvijanja [cm], i_{\min} - polumjer tromosti [cm].

Slobodna duljina izvijanja h_0 za slučaj opterećenja vertikalnog nosača koji je zglobo oslonjen, prikazanog na slici 2. iznosi: $h_0 = h$.

Polumjer tromosti i_{\min} definiran je jednačinom:

$$i_{\min} = \sqrt{\frac{I_{\min}}{A}} \quad (22)$$

gdje je: I_{\min} - najmanji aksijalni moment inercije ($I_{\min} = I_y$) [cm^4].

Stvarno naprezanje σ u vertikalnom nosaču definirano je jednačinom:

$$\sigma = \frac{F}{A} \quad [\text{MPa}] \quad (23)$$

gdje je: F - stvarna sila kojom je opterećen vertikalni nosač [N] (vlastita težina nosača i obloge).

Stvarna sila F je koncentrirana uzdužna sila koja zamjenjuje kontinuirano uzdužno opterećenje vertikalnog nosača zbog vlastite težine konstrukcijskog elementa, te je definirana izrazom:

$$F = \frac{a \cdot h}{2} \cdot F_q \quad (24)$$

gdje je: F_q - vlastita težina konstrukcijskog elementa, koja je jednaka zbroju vlastitih težina nosača $F_{q,n}$ i obloge (staklo) $F_{q,o}$, $F_q = F_{q,n} + F_{q,o}$,
 a - širina konstrukcijskog elementa [m], i h - visina konstrukcijskog elementa (udaljenost između oslonaca) [m].

Granična vitkost λ_p nosača definirana je jednadžbom:

$$\lambda_p = \pi \cdot \sqrt{\frac{E}{\sigma_p}} \quad (25)$$

gdje je: σ_p - granica proporcionalnosti [MPa].

Granica proporcionalnosti σ_p definirana je jednadžbom [1]:

$$\sigma_p = 0,8 \cdot \sigma_T \quad [\text{MPa}] \quad (26)$$

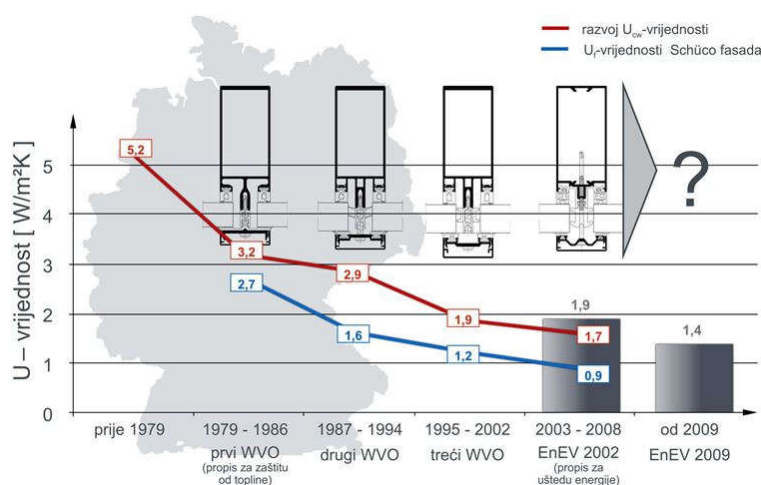
gdje je: σ_T - donja granica tečenja [MPa].

Za one materijale gdje granica tečenja nije jasno određena, pa tako i za aluminijske legure, donja granica tečenja σ_T je određena onim naprezanjem pri kojem nastaju trajne deformacije od 0,2 % u odnosu na prvobitnu duljinu, tj. $\sigma_T = \sigma_{0,2} = R_{p0,2}$ [7], gdje je:

$R_{p0,2}$ - konvencionalno naprezanje tečenja u plastičnom području deformacija od $\varepsilon = 0,2 \%$.

3. Utjecaj profila metalnih konstrukcija na toplinsku zaštitu objekta

Na slici 8. prikazan je razvoj aluminijskih profila obzirom na njihov utjecaj na toplinsku zaštitu objekta, tj. prikazan je utjecaj koeficijenta prolaska topline aluminijskog profila U_f na ukupni koeficijent prolaska topline aluminijskih ostakljenih fasadnih konstrukcija U_{cw} . Obzirom da moderne građevinske konstrukcije na pojedinim objektima čine i 100% vanjske ovojnice, kao na objektu prikazanom na slici 1. utjecaj profila na navedeno je značajan. Kontinuirano se razvijaju energetske učinkovitiji sistemi aluminijskih fasadnih konstrukcija, tj. energetski učinkoviti omotači objekata. Certifikati EnEV 2009. i certifikati pasivne kuće potvrđuju usklađenost metalnih konstrukcija s novim odredbama štednje energije [2].



Slika 8 Razvoj i utjecaj toplinskih vrijednosti aluminijskih profila na toplinsku zaštitu objekta

Danas su na tržištu prisutne novo razvijene SI varijante (Super Insulation) aluminijske fasadne konstrukcije, kao npr. Schüco sistemi. Schüco aluminijske konstrukcijske sisteme odlikuju

detalji usmjereni prema budućnosti, a to su novi izolacijski koncept, te prema unutrašnjosti usmjerene refleksijske površine pritisknih profila koje reduciraju gubitak energije na minimum i pridonose odličnoj U_f vrijednosti od 0,78 W/m²K. PHI (Passivhaus Institut iz Darmstadt-a) potvrdio je izolativnu vrijednost prema standardu pasivne kuće u pogledu pridržavanja referentnih vrijednosti toplinske ugodnosti od $U_{cw} \leq 0,8$ W/m²K. Ova vrijednost je izračunata i certificirana od strane PHI-a prema najnovijim kriterijima certificiranja fasadnih konstrukcijskih sistema, pod uvjetom primjene obloge čiji je $U_g = 0,7$ W/m²K. Isto vrijedi i za čelične konstrukcije s izolacijskom jezgrom od pjene čiji profili danas postižu čak $U_f = 0,74$ W/m²K.

Navedeni profili imaju utjecaja na energetske certifikat. Energetski učinkovito projektirani objekti razvrstavaju se prema godišnjoj potrebnoj toplini za grijanje Q_h na: niskoenergetske zgrade $\leq 40(50)$ kWh/m²a, pasivne zgrade $\leq 10(15)$ kWh/m²a i nulenergetske zgrade 0 kWh/m²a.

Oko 33% svih količina CO₂ nastaju zbog potrebe za toplinskom energijom, dok 50% svih toplinskih gubitaka su ventilacijski zbog loše ili dotrajale vanjske ovojnice objekta.

Da bi se globalno zagrijavanje Zemlje ograničilo na 2°, nužno je emisiju CO₂ smanjiti za 60 - 80 %. Na slici 9. prikazan je dio mogućnosti u metalu gradnji koji može pridonijeti energetske učinkovitosti uz zaštitu i očuvanje okoliša. Razvoj zelene tehnologije je naša obveza za buduće naraštaje. Racionalna rješenja u ovom segmentu industrije (metalne konstrukcije) data su u tablici 5.



Slika 9 Razvoj i utjecaj toplinskih vrijednosti aluminijskih profila na toplinsku zaštitu objekta

Tablica 5 Razvoj zelene tehnologije u metalogradnji

Energetska klasa	Opis	Funkcije
	Energy³ Buildings Pozitivna energetska bilanca Energetska autonomnost	Uštediti energiju Dobiti energiju Umrežiti energiju Sakupljati, upravljati, koristiti
	Energy² Buildings Minimalna primarna energetska potreba (≤ 40 kWh/m ² a)	Uštediti energiju Dobiti energiju Korištenje solarne energije, hibridna ventilacija, solarno hlađenje, automatizacija
	Energy Buildings Ispuniti minimalno sve svjetske standarde	Uštediti energiju Toplinska izolacija sa prozorima, vratima, fasadama; zaštita od sunca

4. Primjer proračuna za objekt West Gate

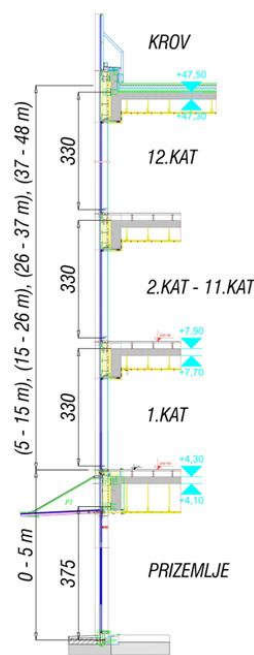
U nastavku rada prikazan je postupak proračuna vertikalnog nosača za objekat West Gate u Splitu. Objekt West Gate je osnovnih dimenzija: $b = 60$ m, $d = 23$ m i $h = 48$ m [10].

4.1 Statički proračun vertikalnog nosača

4.1.1 Proračun promjenjivog opterećenja - savijanje I_x

Vertikalni nosač je ekstrudirani (prešani) profil aluminijske legure EN AW 6060 T66. Kemijski sastav navedene legure prema EN 573-3 je AlMgSi, pri čemu je Al 98,85%. Oznaka T66 ukazuje na vrstu toplinske obrade profila aluminijske legure EN AW 6060, dakle rastopno žarenje na temperaturi od 500-570 °C, pa brzo hlađenje i naknadno umjetno starenje pri povišenoj temperaturi od 165-195 °C u vremenskom periodu od 10-50 h. Ovom toplinskom obradom s posebnom kontrolom (T66) dobivena su bolja mehanička svojstva profila nego kod toplinske obrade oznake T6. Mehanička svojstva vertikalnog nosača dobivenog procesom ekstrudiranja aluminijske legure EN AW 6060 kroz geometrijski oblikovane matrice za debljine stjenki profila do 3 mm, te s toplinskom obradom oznake T66, prema EN 755-2 su [6] $R_{p0,2} = 160$ MPa konvencionalno naprezanje tečenja u plastičnom području deformacija od $\varepsilon = 0,2$ % i $R_m = 215$ MPa vlačna čvrstoća.

Aluminijska ostakljena fasadna konstrukcija objekta West Gate u Splitu zbog statičkog proračuna vertikalnog nosača podijeljena je na 5 karakterističnih dijelova po visini, kako je prikazano na slici 10 [10].



Slika 10 Podjela vertikalnih nosača na objektu West Gate u Splitu

Odabrane (referentne) visine za usporedbu su: $z_1 = 5$ m, $z_2 = 15$ m, $z_3 = 26$ m, $z_4 = 37$ m, $z_5 = 48$ m.

Temeljna vrijednost osnovne brzine vjetra $v_{b,0}$ prema slici 3. je: $v_{b,0} = 35$ m/s. Osnovna brzina vjetra v_b prema izrazu 3. je: $v_b = 35$ m/s.

Osnovni tlak izazvan brzinom vjetra q_b prema izrazu 1. je: $q_b = 765,62$ N/m², za gustoću zraka $\rho = 1,25$ kg/m³.

U tablici 6. prikazane su dobivene vrijednosti za intenzitet turbulencije $I_v(z)$ (prema izrazu 8.), prosječnu komponentu brzine vjetra $v_m(z)$ (prema izrazu 2.), i za vršni tlak izazvan brzinom vjetra $q_p(z_e)$ (prema izrazu 10.). Kako se radi o vanjskom dijelu konstrukcije $z = z_e$.

Za izračun inteziteta turbulencije $I_v(z)$ prema EN 1991-1-4:2005 uzima se da je: $k_I = 1,0$, $c_o(z) = 1,0$ - ravan teren ($< 3^\circ$) i $z_0 = 0,3$ m - za kategoriju terena III.

Za izračun prosječne komponente brzine vjetra $v_m(z)$ uzima se da je za $c_r(z)$, $k_r = 0,215$ (dobiven prema izrazu 6.).

Tablica 6 Vršni tlak $q_p(z_e)$ prema EN 1991-1-4:2005

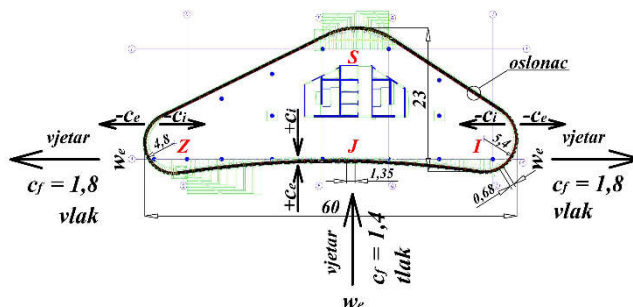
dio	referentne visine z_e [m]	intenzitet turbulencije $I_v(z)$ za: $k_I = 1,0$ $c_o(z) = 1,0$	prosječna komponenta brzine vjetra $v_m(z)$ [m/s]	vršni tlak izazvan brzinom vjetra $q_p(z_e)$ [N/m ²]
1	5	0,355	21,175	976,6
2	15	0,256	29,435	1511,9
3	26	0,224	33,565	1808,2
4	37	0,208	36,225	2014,3
5	48	0,197	38,185	2168,0

Do približno istih rezultata za vršni tlak izazvan brzinom vjetra $q_p(z_e)$ (prema izrazu 10.) dolazimo i putem dijagrama prikazanog na slici 4. prema EN 1991-1-4:2005.

Ipak, do različitih rezultata dolazimo ako koristimo dijagrame prikazane na slici 4. prema Prijedlogu Nacionalnog dodatka HRN EN 1991-1-4 za kategoriju terena III (Split). Rezultati su prikazani u tablici 7. i mjerodavni su u nastavku proračuna.

Tablica 7 Vršni tlak $q_p(z_e)$ prema Prijedlogu Nacionalnog dodatka HRN EN 1991-1-4

dio	referentne visine z_e [m]	osnovni tlak izazvan brzinom vjetra q_b [N/m ²]	koeficijent izloženosti vjetru $c_e(z)$	vršni tlak izazvan brzinom vjetra $q_p(z_e)$ [N/m ²]
1	5	765,62	$\approx 2,0$	1531,2
2	15	765,62	$\approx 2,3$	1760,9
3	26	765,62	$\approx 2,9$	2220,3
4	37	765,62	$\approx 3,4$	2603,1
5	48	765,62	$\approx 3,7$	2832,8



Slika 11 Tlocrt objekta West Gate u Splitu - izračun koeficijenta sile c_f konstrukcije

Na slici 11. prikazan je tlocrt objekta West Gate u Splitu [10]. U tablici 8. prikazane su dobivene vrijednosti za silu vjetra F_w na konstrukciju ili konstrukcijski element (prema izrazu 14.) za J - južni dio konstrukcije, dok su u tablici 9. prikazane vrijednosti za Z/I - zapadni i istočni dio konstrukcije. Za potrebe izračuna sile vjetra F_w analizirano je glavno djelovanje vjetra na J -

južni dio konstrukcije (tlačno opterećenje - pozitivan tlak), te njegovo posljedično djelovanje na Z/I - zapadni i istočni dio konstrukcije (vlačno opterećenje - negativan tlak).

Koeficijent sile c_f za J - južni dio konstrukcije (tlak) je: $c_f = c_{pe} + c_{pi} = 1,4$, gdje je za $h/d = 48/23 = 2,09$ i $e = b = 60 \text{ m} > d = 48 \text{ m}$ ($e/5 = 60/5 = 12 \text{ m}$ - područje A prema slici 5. i tablici 3.), te s obzirom na specifičnost izgleda tlocrta konstrukcije vrijedi da je $c_{pe} = 1,2$, a $c_{pi} = 0,2$.

Koeficijent sile c_f za Z/I - zapadni i istočni dio konstrukcije (vlak) je: $c_f = c_{pe} + c_{pi} = -1,8$, gdje je za $R_e = 2,75 \cdot 10^7$ (prema izrazu 13., $b = 2 \cdot 5,4 \text{ m}$) i s obzirom na tlocrtnu poziciju konstrukcije u obliku valjka (kružni poprečni presjek prema slici 6. i tablici 4.) vrijedi da je $c_{pe} = c_{p,o,min} = -1,5$, a $c_{pi} = -0,3$.

Referentna površina konstrukcijskog elementa: $A_{ref} = a \cdot h \text{ [m}^2\text{]}$, gdje je: a - širina konstrukcijskog elementa [m] i h - visina konstrukcijskog elementa (udaljenost između oslonaca) [m].

Tablica 8 Sila vjetra F_w za J - južni dio konstrukcije

dio	referentne visine z_e [m]	vršni tlak izazvan brzinom vjetra $q_p(z_e)$ [N/m ²]	$c_s c_d$	c_f	referentna površina konstrukcije ili k. elementa $A_{ref} = a \cdot h \text{ [m}^2\text{]}$	sila vjetra F_w [N]
1	5	1531,2	1,0	1,4	$1,35 \cdot 3,75 = 5,06$	10847,3
2	15	1760,9	1,0	1,4	$1,35 \cdot 3,30 = 4,45$	10970,6
3	26	2220,3	1,0	1,4	$1,35 \cdot 3,30 = 4,45$	13832,5
4	37	2603,1	1,0	1,4	$1,35 \cdot 3,30 = 4,45$	16217,4
5	48	2832,8	1,0	1,4	$1,35 \cdot 3,30 = 4,45$	17648,3

Tablica 9 Sila vjetra F_w za Z/I - zapadni i istočni dio konstrukcije

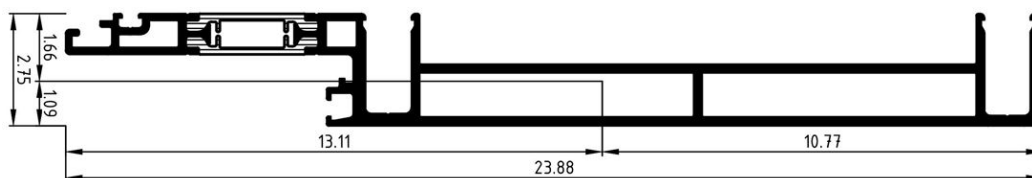
dio	referentne visine z_e [m]	vršni tlak izazvan brzinom vjetra $q_p(z_e)$ [N/m ²]	$c_s c_d$	c_f	referentna površina konstrukcije ili k. elementa $A_{ref} = a \cdot h \text{ [m}^2\text{]}$	sila vjetra F_w [N]
1	5	1531,2	1,0	1,8	$0,68 \cdot 3,75 = 2,55$	7028,4
2	15	1760,9	1,0	1,8	$0,68 \cdot 3,30 = 2,24$	7100,1
3	26	2220,3	1,0	1,8	$0,68 \cdot 3,30 = 2,24$	8952,2
4	37	2603,1	1,0	1,8	$0,68 \cdot 3,30 = 2,24$	10495,7
5	48	2832,8	1,0	1,8	$0,68 \cdot 3,30 = 2,24$	11421,8

Tablica 10 Moment inercije I_x poprečnog presjeka vertikalnog nosača

dio [m]	F_w [N] za J dio konstrukcije	F_w [N] za Z/I dio konstrukcije	h [cm]	f [cm]	I_x [cm ⁴] za J dio konstrukcije	I_x [cm ⁴] za Z/I dio konstrukcije
1	10847,3	7028,4	375	1,50	709,36	459,62
2	10970,6	7100,1	330	1,36	539,23	348,98
3	13832,5	8952,2	330	1,36	679,90	440,02
4	16217,4	10495,7	330	1,36	797,12	515,89
5	17648,3	11421,8	330	1,36	867,45	561,41

U tablici 10. prikazane su dobivene vrijednosti za moment inercije I_x poprečnog presjeka vertikalnog nosača konstrukcije (prema izrazu 17.).

Prema prikazanim rezultatima za I_x (tablica 10.) odabran je karakteristični presjek vertikalnog nosača. Nosač je aluminijski profil EN AW 6060 T66 serije Schüco USC 65 (slika 12.), koji ima sljedeće podatke: $I_x = 554,35 \text{ cm}^4$ (dva profila zajedno za savijanje, pa je: $I_x = 2 \cdot 554,35 = 1108,70 \text{ cm}^4$), $I_y = 8,35 \text{ cm}^4$ (jedan profil za izvijanje zbog dilatirajućih umetaka), $A = 11,61 \text{ cm}^2$, $m = 3,13526 \text{ kg/m}$, $E = 70 \text{ GPa}$, $R_{p0,2} = 160 \text{ MPa}$ [9,10].



Slika 12 Karakteristični presjek aluminijskog vertikalnog nosača serije Schüco USC 65

Navedeni podaci su potvrđeni i putem Schuco Statik programa.

Isti proračun je napravljen i za glavno djelovanje vjetra na S - sjeverni dio konstrukcije. Dobiveni rezultati potvrđuju dobar izbor vertikalnog nosača.

4.1.2 Proračun stalnog opterećenja - izvijanje I_y

U radu je prikazana kratka kontrola stabilnosti vertikalnog nosača serije Schüco USC 65 poprečnog presjeka prikazanog na slici 12. čiji je $I_y = 8,35 \text{ cm}^4$ na bočno izvijanje (tj. kontrola zadanog I_y). Kako je vertikalni nosač bočno povezan horizontalnim nosačima, nema potrebe za kontrolom stabilnosti na bočno uvojno izvijanje. Kako je $F_q = 0,77 \text{ kN/m}^2$, stvarna sila F kojom je opterećen vertikalni nosač za proračun stalnog opterećenja u svrhu kontrole stabilnosti vertikalnog nosača na bočno izvijanje prema izrazu 24. iznosi:

$$F = \frac{1,35 \cdot 3,3}{2} \cdot 0,77 = 1,715 \text{ [kN]}.$$

Minimalni moment inercije I_{min} je: $I_{min} = I_y = 8,35 \text{ cm}^4$.

Polumjer tromosti i_{min} (prema izrazu 22.) je: $i_{min} = 0,85 \text{ cm}$, dok je za slobodnu duljinu izvijanja $h_o = h = 330 \text{ cm}$ vitkost vertikalnog nosača λ (prema izrazu 21.): $\lambda = 388,24$. Kako je $\lambda = 388,24 > \lambda_p = 73,47$ (prema izrazu 25., ako je $\sigma_p = 128 \text{ MPa}$ prema izrazu 26.), kritično naprezanje σ_{kr} ovog vertikalnog nosača određeno je pomoću Eulerove jednadžbe, dakle prema izrazu 20. σ_{kr} je: $\sigma_{kr} = 4,58 \text{ MPa}$.

Stvarno naprezanje σ u vertikalnom nosaču (prema izrazu 23.) je: $1,48 \text{ MPa}$. Vertikalni nosač je stabilan jer je zadovoljen uvjet da je: $\sigma_{kr} > \sigma$.

Provjera produljenja nosivog aluminijskog vertikalnog nosača uslijed temperaturnih promjena: $\Delta h = \alpha_{AlMgSi} \cdot h \cdot \Delta t = 0,000024 \cdot 3300 \cdot 50 = 3,96 \text{ mm}$. Konstruktivno je izvedena dilatacija od 10 mm između vertikalnih nosača pomoću oslonca (slika 7.).

4.2 Proračun ukupnog koeficijenta prolaska topline U_{cw}

Proračun ukupnog koeficijenta prolaska topline aluminijske ostakljene fasadne konstrukcije U_{cw} za objekat West Gate u Splitu (100% vanjske ovojnice) izvršen je pomoću SchuCal+ (U-Cal) programa dana 19.07.2015., a dobivena vrijednost je $U_{cw} = 1,3 \text{ W/m}^2\text{K}$, što je u skladu s certifikatom EnEV 2009 i to bez upotrebe dodatne zaštite od sunca (unutrašnjih sjenila).

5. Zaključak

U radu je prikazan postupak odabira nosivog vertikalnog nosača metalne konstrukcije temeljem statičkog proračuna. Dobivene geometrijske karakteristike aluminijskog profila potvrđene su i putem Schuco Statik programa. Posebna pažnja data je lokalnom utjecaju djelovanja vjetra na

metalnu konstrukciju. Navedena je potreba za daljnjim istraživanjem, mjerenjem i analizom utjecaja koeficijenta izloženosti vjetru na silu vjetra. Toplinske karakteristike metalne konstrukcije, u ovom radu aluminijske fasadne ostakljene konstrukcije potvrđuju usklađenost iste s novim odredbama, ali isto tako primjenom prezentiranih rješenja zelene tehnologije u metalnoj industriji moguć je i potreban daljnji razvoj i napredak. Sve ima svoju energetska i ekonomsku opravdanost, a prije svega doprinosi se zaštiti i očuvanju okoliša.

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Green Metal Structures

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Abstract. The development of modern metal structures, which are an integral part of modern, ever more demanding building structures, is based on so-called “green technology”. The world trend is to select suitable materials for modern building structures that have a bearing on energy efficiency, while simultaneously contributing to the protection and preservation of the environment. All of the aforementioned is economically justifiable. Modern building structures in certain buildings involve the 100% use of external envelopes. This paper presents the significant impact that metal structures have as

the fundamental support of modern building structures. The procedure of forming metal structures is shown using static calculation, that is, the selection of materials and the most favorable geometric features or profiles. In addition to steel as the basic material of metal structures, this paper pays special attention to the benefits of aluminum. As metal structure profiles must also frequently satisfy the aesthetics and appearance set by the main architects of buildings, aluminum as a material is particularly favorable. This paper also presents the great impact that metal structure profiles have on building structure. Various materials and profiles have different thermal properties. In the final section of the paper, all of the above is shown using a concrete example, from static calculation to the selection of materials and profiles for metal structures. In particular, the impact of different types of materials and profiles on building structure is shown. The results presented demonstrate energy efficiency and economic feasibility. The specialized programs Schuco Statik and SchuCal + were used, as well as the laboratory test results of authorized institutions.

Key words: *metal structures, green technology, aluminum, profiles, static, thermal features*

Primjena simulatora za Arduino platformu u nastavi

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Sažetak. S obzirom na sve veću primjenu mikrokontrolera, mikroračunala i programibilnih elektroničkih sklopova u elektrotehnici, poznavanje programiranja neophodno je za studente elektrotehnike. Kroz kolegij Uporaba računala, koji slušaju studenti prve godine elektrotehnike, predviđeno je da se studenti upoznaju sa osnovama programiranja. Arduino je open-source platforma koju čini skup jednostavnih i fleksibilnih elektroničkih i softverskih komponenti koje se mogu jednostavno povezivati u složenije cjeline i upravo je ona odabrana za primjenu u nastavi. Međutim, uvođenje Arduino platforme u nastavu prate i brojni nedostaci. U prvom redu to je ulaganje u nabavu elektroničkih komponenti, osiguravanje potrebnog prostora za rad te promjena koncepta izvođenja nastave. Naime, sada se javlja potreba za povećanjem satnice kolegija jer studenti pored programiranja sklopova trebaju utrošiti vrijeme i na fizičko povezivanje istih. Da bi se izbjegli navedeni nedostaci, u nastavu je uveden rad sa simulatorom Arduino platforme, i to upravo *Autodesk 123D circuits*. Ovaj program omogućava studentima da prije praktične realizacije sklopa, koristeći računalo, dizajniraju sklop i analiziraju njegov rad. Simulatoru se pristupa putem web preglednika i upravo ovo svojstvo čini ga pogodnim za primjenu u e-učenju. U radu je prikazan rad sa simulatorom i njegove mogućnosti, s osvrtom na mogućnosti timskog rada na projektu.

Ključne riječi: *Arduino, programiranje, simulator*

1. Uvod

Danas su u procesu edukacije računalo i elektroničko učenje (engl. *e-learning*) pojmovi bez kojih je izvođenje nastave nezamislivo. Elektroničko učenje se definira kao korištenje multimedije i Interneta u svrhu poboljšanja kvalitete učenja, omogućavanja pristupa udaljenim izvorima i uslugama te omogućavanje suradnje i komunikacije na daljinu [1]. Upravo je razvoj ICT (engl. *Information and Communications Technology*) i njegovo uvođenje u nastavu utjecalo na razvoj elektroničkog učenja, tako da se danas razlikuje [1]:

- klasična nastava - nastava u učionici (f2f ili *face-to-face*)
- nastava uz pomoć ICT-a - tehnologija u službi poboljšanja klasične nastave (ICT *supported teaching and learning*)

- hibridna - mješovita nastava - kombinacija nastave u učionici i nastave uz pomoć tehnologija (*hybrid, mixed mode* ili *blended learning*)
- online nastava - nastava je uz pomoć ICT-a u potpunosti organizirana na daljinu (*fully online*).

Dostupnost računala i razvoj Interneta doveli su do promjene odnosa između studenta i predavača. Nekada je predavač bio izvor znanja koji je predvodio studente. Danas je predavač voditelj i savjetnik studenta, čija je uloga da procjeni mogućnosti studenta i usmjeri ga u sve prostranijoj riznici znanja čovječanstva [2]. Primjena elektroničkog učenja pruža mogućnost predavaču individualnog pristupa studentu, a prema njegovim sposobnostima i interesima, što je u skladu s nastavim konceptima poznatih pedagoga i psihologa (Jean Piaget, Lav Vygotski, Roger Schank ...) koji zagovaraju individualizaciju nastave, rad u parovima, timski rad i učenje otkrivanjem.

Važan segment u nastavnom procesu na tehničkim studijima su laboratorijske vježbe. Naime, one predstavljaju jedan od najvažnijih segmenata u inženjerskoj edukaciji jer se kroz njih omogućuje da studenti usvojena teoretska znanja primjene u praksi. Prema [3] praktične vještine su ključne u pogledu usvajanja ishoda programa. Zbog činjenice da se kod laboratorijskih vježbi radi s elektroničkim sklopovima, veliki izazov predstavlja njihovo uključivanje u koncept elektroničkog učenja. Stoga se veliki naponi čine da bi se laboratorijske vježbe na tehničkim studijima prilagodile elektroničkom učenju.

2. Laboratorijske vježbe u nastavnom procesu

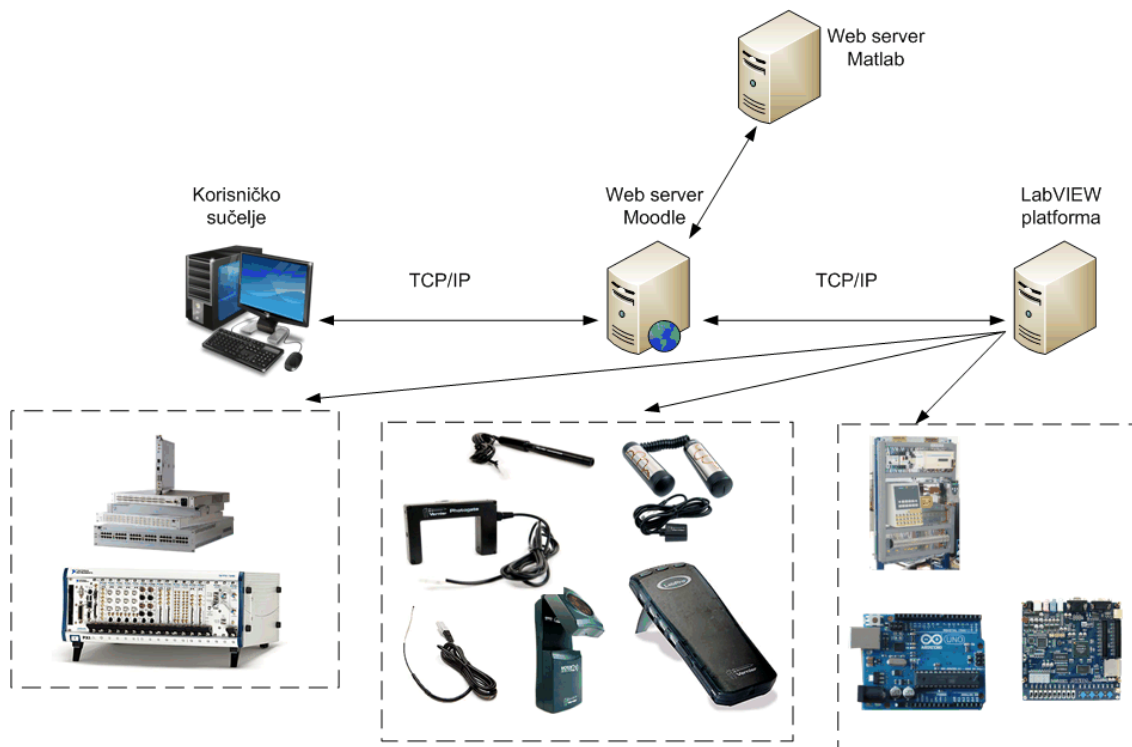
Laboratorijske vježbe uključene u nastavne strategije smatraju se najvažnijim obrazovnim alatima u inženjerskoj edukaciji, posebno za podučavanje složenih ili apstraktnih koncepata [4]. Njihov cilj je povezati teoriju s praksom te posebno pomoći studentima u stjecanju eksperimentalnih vještina te ih izložiti znanstvenom razmišljanju i tako utjecati na njihov razvoj. Vježbe mogu biti stvarne ili virtualne. Prednosti učenja kroz laboratorijske vježbe mogu biti čak i veće ako se vježba dizajnira na način da se omogući timski rad studenata [5,6]. Glavni nedostatak stvarnih laboratorija su visoki troškovi opremanja i potreba za nastavnim osobljem uz relativno slabu iskorištenost, s obzirom na to da studenti laboratorije koriste ograničeno vrijeme. Pored toga, razvoj laboratorija ili razvoj nove vježbe zahtijeva vrijeme za planiranje i testiranje.

Da bi se ovi nedostaci umanjili ulažu se naponi u razvoju udaljenih laboratorija. Udaljeni laboratorij definira se kao laboratorij upravljan računalom kojem se pristupa i upravlja izvana preko nekog komunikacijskog medija. Udaljeni laboratoriji omogućavaju studentima pristup laboratoriju i izvan njegovog radnog vremena. Povećanje vremena dostupnosti laboratorijske opreme i mogućnost pristupa laboratoriju bez obzira na pristupnu lokaciju dovodi do boljeg iskorištenja laboratorijskih resursa te povećanja kvalitete samog učenja. Također, studenti racionalnije koriste postojeće resurse uz niže troškove laboratorija.

Iako je koncept udaljenog laboratorija već odavno poznat, nije došlo do njihove šire praktične realizacije. Razlog tome je velika kompleksnost izrade, ne postojanje standarda i visoka cijena razvoja. Slika 1 prikazuje arhitekturu udaljenog laboratorija realiziranog na Sveučilišnom odjelu za stručne studije Sveučilišta u Splitu [7].

Alternativa udaljenim laboratorijima su virtualni laboratoriji. Kao i kod udaljenih laboratorija pristupa im se i upravlja s njima koristeći neki komunikacijski medij, ali se ne radi sa stvarnim sklopovima već simuliranim. Virtualne vježbe mogu se provoditi bez straha od nezgode ili pogrešaka, a zahtijevaju manje vremena za implementaciju od stvarnog laboratorija. Ne zahtijevaju specijaliziranu ili skupu opremu, a omogućuju studentima da posvete više vremena za razumijevanje pojava koje se istražuju, umjesto proučavanja

postupaka i uputa [8, 9]. Brojne studije su uspoređivale rezultate učenja u stvarnim i virtualnim laboratorijima. Pokazano je da ne postoje veće razlike, ali mala prednost je dana stvarnim laboratorijima [10, 11, 12]. Međutim, uočeno je da su studenti koji su koristili oba laboratorija postigli bolje rezultate od onih studenata koji su koristili samo jednu vrstu laboratorija, bilo stvarni, bilo virtualni [13,14].



Slika 1 Arhitektura udaljenog laboratorija na Sveučilišnom odjelu za stručne studije.

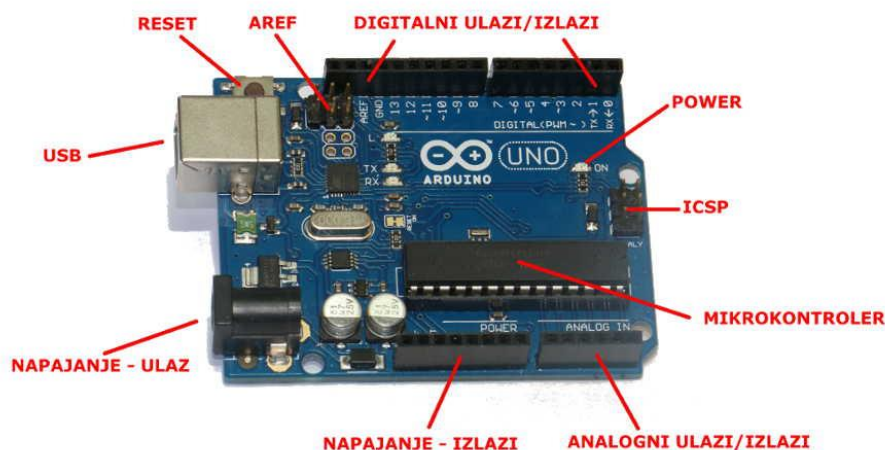
Zbog svega navedenog, u kolegij Uporaba računala na Sveučilišnom odjelu za stručne studije se uveo rad sa simulatorom prije rada sa stvarnim sklopovljem.

3. Arduino (Genuino) simulator

Arduino je platforma otvorenog koda i otvorenog sklopovlja (engl. *open-source*) koju čini skup jednostavnih i fleksibilnih elektroničkih i softverskih komponenti koje se mogu jednostavno povezivati u složenije cjeline [15]. Razvijen je u Italiji za poučavanje programiranja u C/C++ programskim jezicima. Osnova Arduina jesu mikrokontroleri. Mikrokontroler je malo računalo sadržano na jednom integriranom sklopu. Arduino okruženje najčešće koristi 8 bitne mikrokontrolere koje proizvodi tvrtka ATMEL. Najrasprostranjeniji model je ATMEGA328P koji se koristi na osnovnoj Arduino razvojnoj pločici prikazanoj na slici 2.

Glavna namjena mikrokontrolera je komuniciranje s različitim sklopovljem koje se na njega priključi putem ulazno-izlaznih konektora. Arduino razvojna pločica proširuje se s tzv. shieldovima, gotovim tiskanim pločicama (engl. *printed circuit board - PCB*) koji imaju različite funkcije. Tako postoje shieldovi za komunikaciju (*Wi-Fi, XBee, Ethernet, Bluetooth, GSM, Serial, USB ...*), priključak motora, s relejima, NCF/RFID, GPS ...

Upravo su popularnost, jednostavnost i niska cijena čimbenici koji se presudili u odabiru ove platforme za primjenu u nastavi. Pored toga, Arduino platforma ima mogućnost povezivanja s drugim programskim alatima koji se koriste na Sveučilišnom odjelu za stručne studije (*LabView, Matlab*), tako da zapravo predstavlja izvrsno polazište za edukaciju budućih prvostupnika tehničkih studija.



Slika 2 Arduino (Genuino) Uno razvojna pločica.

Glavni nedostatak je osjetljivost platforme. Postoje strujna ograničenja za ulaze i izlaze mikrokontrolera, kao i strujno ograničenje za izlaze napajanja. Pored toga, nepažljivim rukovanjem vrlo lako može doći do uništenja razvojne pločice [16]. Česta izgaranja opreme zbog nepažnje i brzopletosti studenata bili su dodatni motiv za uvođenje simulatora. Studenti trebaju koristeći simulator razviti određeni sklop zadan od strane predavača te ga nakon uspješne realizacije u simulatoru praktično izraditi i testirati (stvarni laboratorij). Projektni zadatak se određuje u dogovoru sa studentom te se na taj način postiže individualni pristup.

Od brojnih simulatora odabran je simulator *123D Circuits* tvrtke Autodesk. Glavna prednost u odnosu na konkurentne simulatore je u tome što *123D Circuits* doslovno simulira stvarni laboratorij i besplatan je za korištenje. Studentu su na raspolaganju brojne komponente koje povezuje koristeći virtualnu eksperimentalnu pločicu (engl. *solderless breadboard protoboard*). Na raspolaganju su pored otpornika i kondenzatora i brojni integrirani krugovi, instrumenti, LED ekran, indikatori itd. Programiranje u simulatoru je identično izvornom Arduino programskom okruženju. Korisniku su na raspolaganju brojne biblioteke te mogućnost pregleda podataka serijske komunikacije (engl. *serial monitor*).

Simulatoru se pristupa putem web sučelja s bilo kojeg računala spojenog na Internet, uz prethodnu registraciju i izradu korisničkog računa. Upravo registracija i izrada računa omogućava praćenje rada studenata te mogućnost formiranja timova koji zajednički rade na zadanom projektu. Uz simuliranje, student može koristeći program izraditi i shemu sklopa te tiskanu pločicu na koju će se zalemiti elementi u slučaju izrade sklopa (umjesto eksperimentalne pločice).

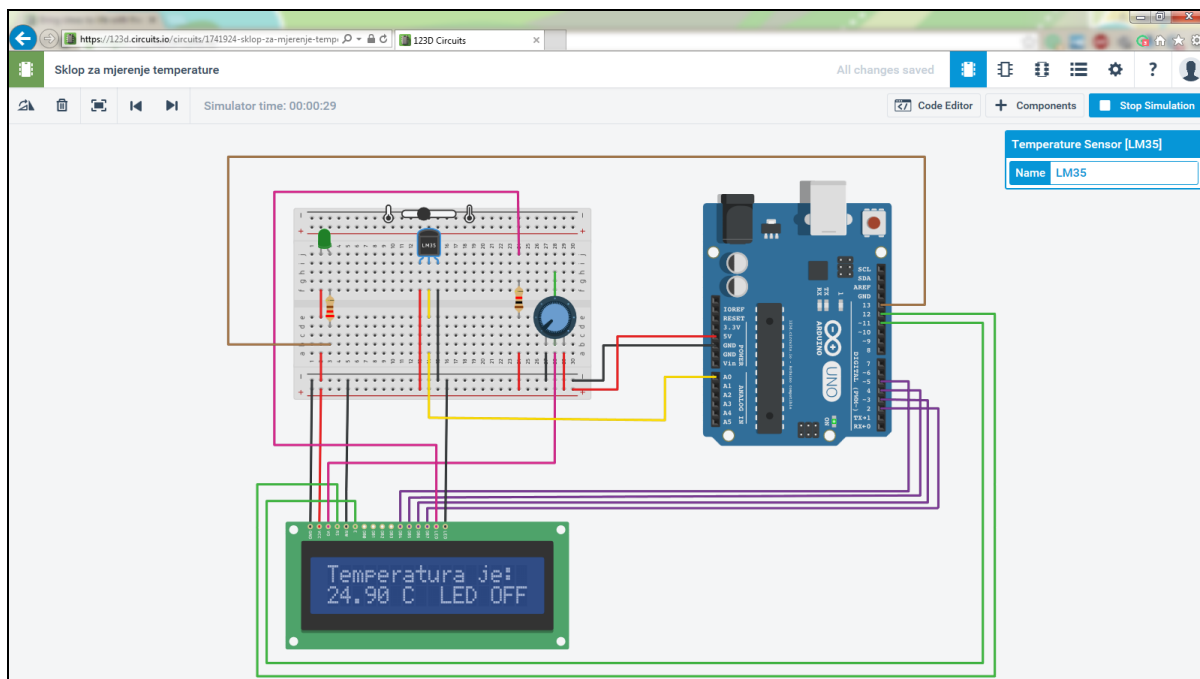
4. Primjer izrade sklopa za mjerenje temperature

Korištenje programa prikazano je kroz realizaciju sklopa za mjerenje temperature. Trenutna temperatura se treba prikazivati na LCD displeju. Sklop ima zadanu graničnu temperaturu pri kojoj se treba uključiti LED dioda. Umjesto LED diode može se priključiti ventilator, motor ili neki drugi uređaj. Sklop je prvo simuliran, a potom je realiziran stvarni sklop te su uspoređeni rezultati. Slika 3 prikazuje simulirani sklop. Sastoji se od Arduina Uno, LCD displeja 16×2 i temperaturnog senzora LM 35.

Sama izrada simulacije je vrlo jednostavna. Klikom na dugme **Components** otvara se izbornik s podržanim komponentama. Nakon umetanja i povezivanja komponenti klikom na **Code Editor** pokaže se prostor za pisanje programa.

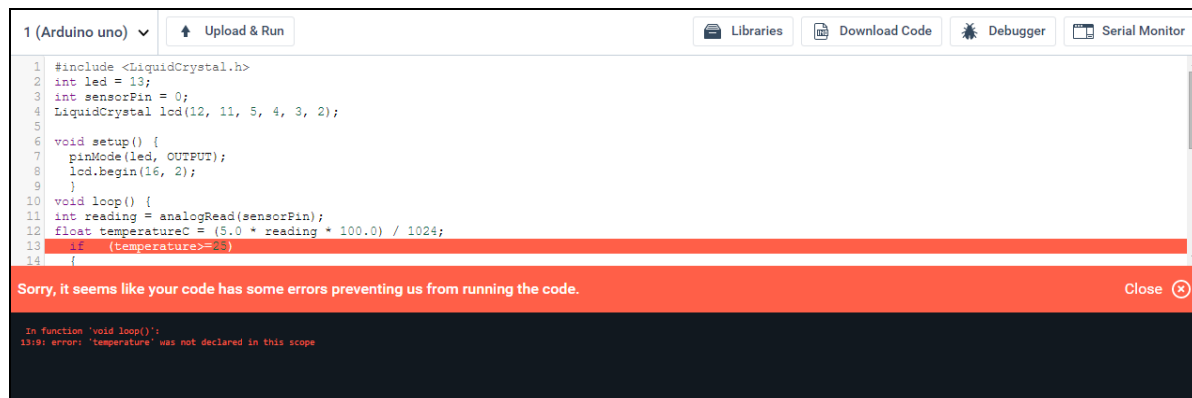
Programi pisani za Arduino mikrokontrolere nazivaju se *sketchevi*. Svaki *sketch* sastoji se od dva dijela – *setup* dio i *loop* dio. *Setup* dio koda izvodi se samo jednom na početku izvođenja

sketcha i u njega se upisuju početne postavke koje su potrebne mikrokontroleru za pojedini *sketch*. *Loop* dio izvodi se nakon *setup* dijela i on se izvodi cijelo vrijeme dok se mikrokontroler ne resetira ili isključi iz napajanja. U *loop* dio upisuju se većina koda mikrokontrolera i tu se definira što mikrokontroler radi.



Slika 3 Simulacija sklopa za mjerenje temperature.

Klikom na dugme **Upload & Run** vrši se provjera programa i pokretanje simulacije. Ako postoji greška u programu, simulator upozorava studenta i pokazuje mjesto s pogreškom u kodu programa, kako je to prikazano na slici 4.



Slika 4 Pogreška u kodu programa.

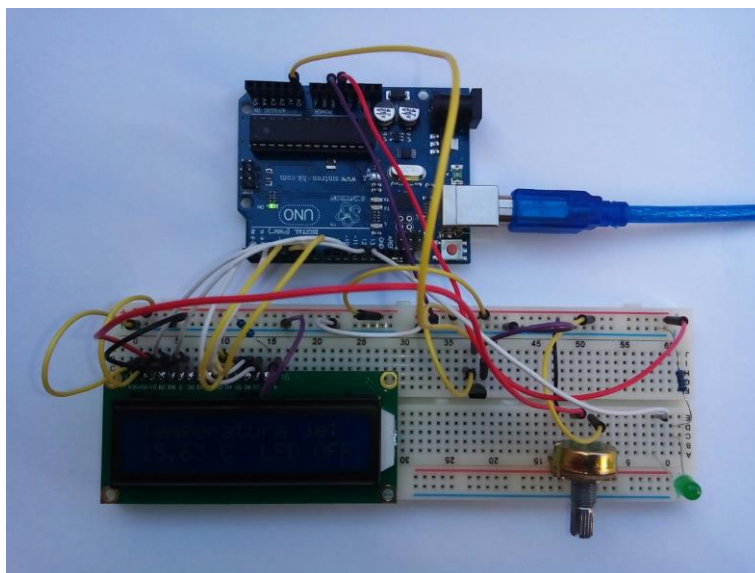
Sama simulacija, ako nema grešaka, može se uvijek pokrenuti klikom na dugme **Start Simulation**. Slika 5 prikazuje ispravan i funkcionalan programski kod koji je realiziran simulatorom.

Nakon realizacije sklopa simulacijom identičan sklop realiziran je u stvarnosti, a prikazan je na slici 6 te je za programiranje korišten programski kod napisan prethodno u simulatoru. Prilikom realizacije praktičnog sklopa pojavio se problem s prikazom temperature na LCD displeju. Promjena temperature bila je brza i učestala što je imalo za posljedicu da je očitavanje temperature na displeju bilo nečitko. Stoga je u programski kod umetnuta naredba *delay* (500) koja pauzira izvođenje programa na 500 ms čime je postignuta čitljivost temperature senzora

na LCD displeju. Ista izmjena učinjena je i u simulatoru, ali nije utjecala na rad simuliranog sklopa.

```
1 (Arduino uno) v Upload & Run
1 #include <LiquidCrystal.h>
2 int led = 13;
3 int sensorPin = 0;
4 LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
5
6 void setup() {
7     pinMode(led, OUTPUT);
8     lcd.begin(16, 2);
9 }
10 void loop() {
11     int reading = analogRead(sensorPin);
12     float temperatureC = (5.0 * reading * 100.0) / 1024;
13     if (temperatureC >= 25)
14     {
15         digitalWrite(led, HIGH);
16         lcd.setCursor(9, 1);
17         lcd.print("LED ON");
18     }
19     if (temperatureC < 25)
20     {
21         digitalWrite(led, LOW);
22         lcd.setCursor(9, 1);
23         lcd.print("LED OFF");
24     }
25     lcd.setCursor(0, 0);
26     lcd.print("Temperatura je:");
27     lcd.setCursor(0, 1);
28     lcd.print(temperatureC);
29     lcd.setCursor(6, 1);
30     lcd.print("C");
31     delay(500);
32 }
```

Slika 5 Programski kod.



Slika 6 Realizirani praktični sklop.

5. Zaključak

U radu je prikazan rad s besplatnim programom *123D Circuits* tvrtke Autodesk, čija je namjena simulacija rada s Arduino platformom. Simulirani sklop je praktično realiziran te je pokazano da ne postoje značajne razlike između simulacije i stvarnog sklopa. Realizacija sklopa u simulatoru je jednostavna i realistična. Umetanje komponenti, njihovo premještanje,

brisanje i povezivanje brzo je i intuitivno. Programiranje je identično programiranju stvarnog sklopa. Nedostatak je nepostojanje *shieldova* te nemogućnost simuliranja LAN, Wi-Fi ili *Xbee* komunikacija. Međutim, s obzirom na to da je upotreba simulatora predviđena kao uvod u svijet mikrokontrolera i njihovog programiranja, navedeni nedostatak nije ograničavajući faktor u njegovoj primjeni.

Naprotiv, primjena simulatora prije rada sa stvarnim sklopovima rezultira većoj trajnosti opreme u laboratorijima jer koristeći simulator studenti mogu eksperimentirati i pogrešno povezivati komponente bez ikakve opasnosti od oštećivanja istih.

Posljedica upotrebe simulatora je manje korištenje stvarnih laboratorija čime se smanjuju troškovi osoblja uz povećanje sigurnosti studenata. S obzirom na to da se za rad sa simulatorom koristi web preglednik, student mu može u bilo koje vrijeme i s bilo kojeg mjesta pristupiti. Na taj način eliminiran je najveći nedostatak stvarnih laboratorija: ograničeno vrijeme koje student može provesti u njemu.

S obzirom na to da u simulatoru nema ograničenja resursa, moguće je svakom studentu pristupiti individualno, i u skladu s njegovim sposobnostima i interesom zadati mu projektni zadatak. Štoviše, mogućnost rada više studenata na istoj simulaciji osigurava mogućnost timskog rada, a upravo sklonost timskom radu je vrlina koju danas traži većina poslodavaca od svojih zaposlenika.

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The use of Arduino simulator in education

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Abstract. Due to the increasing application of microcomputers, microcontrollers and programmable electronic circuits in electrical engineering, the knowledge of programming has become essential for students majoring in Electrical Engineering. In the Computer Usage course, attended by first-year students, they are expected to get introduced to the basics of programming. Since Arduino is an open-source platform that consists of a set of simple and flexible electronic and software components that can be easily interconnected into more complex sections, it has been selected for classroom use. However, teaching with the Arduino platform has numerous disadvantages. First of all, it is the investment in the electronic components, provision of facilities and change in the concept of teaching. In fact, it is

necessary to increase the number of total lessons per semester because in this case students are supposed to spend time not only on programming circuits, but on their physical connection as well. To avoid the above mentioned disadvantages, Arduino simulator Autodesk 123D circuits have been introduced. This program allows students to design and analyse electronic circuits using personal computers before the circuits are realised in practice. The Simulator is accessed through a web browser and this property makes it suitable for use in e-learning. This paper presents how to use the simulator and its capacities, with an emphasis on the possibility of teamwork on the project.

Key words: *Arduino, programming, simulation*

Uporaba programa za upravljanje računalnom učionicom u nastavnom procesu

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Sažetak. Do sada uvriježeni ili tradicionalni načini izvođenja nastave postupno se zamjenjuju suvremenijim informatičkim tehnologijama. Širokopojasni Internet i pad cijene računala rezultirali su trendom izvođenja nastave u računalnim učionicama i kolegija koji se ne bave poučavanjem rada na računalu. Upravo je ova promjena postavila nove zahtjeve u pogledu interakcije između studenta i nastavnika. Kao odgovor na ove zahtjeve pojavili su se programi za upravljanje računalnim učionicama. Danas takav program predstavlja jedan od nezaobilaznih alata u procesu poučavanja u računalnoj učionici. Osnovne značajke ovakvog programa su pored jednostavnije interakcije između nastavnika i studenta i pojednostavljeno dijeljenje datoteka, mogućnosti kratkih provjera znanja, istovremeno praćenje i kontrola rada studenta, postavljanje određenih ograničenja kao i mnoge druge. Mogućnost uvođenja ograničenja kao što su korištenje interneta, zabrana pristupa određenim mrežnim stranicama ili nedozvoljavanje pristupa vanjskim uređajima za pohranu podataka osiguravaju da studenti s punom pažnjom prate nastavni proces. Pored primjene u nastavi, ovakvi programi su važna ispomoć administratorima računalnih učionica jer omogućuju istovremeno rad s više računala. U ovom radu prikazan je program *LanSchool* koji se koristi u računalnim učionicama Sveučilišnog odjela za stručne studije. Prikazane su prednosti njegovog korištenja kod izvođenja nastave, ali i njegova primjena pri administriranju računala.

Ključne riječi: *LanSchool, upravljanje računalnom učionicom, interakcija nastavnik student*

1. Uvod

Nastavni proces u računalnoj učionici uvelike se razlikuje u usporedbi s nastavom u tradicionalnoj učionici. Prvenstveno je problematičan pristup kontroli, tj. upravljanju nastavnim procesom u dijelu koji se odnosi na sudjelovanje studenata. Na prvi pogled tehnologija bi trebala olakšati nastavniku izvođenje nastave u smislu povećanja razine kontrole, no to vrlo često nije slučaj. Naime, u suvremenom tehnološkom okruženju vrlo teško se postiže potpuna posvećenost konkretnoj zadaći uz praktički neprestanu *online*

dostupnost [1]. Tu su podjednako ranjivi, kako učenici u osnovnim i srednjim školama, tako i studenti na fakultetima. Već je sama radna površina zaslona pokrenutog računala remetički čimbenik čiji vizualni karakter odvlači pažnju. Iz navedenog je sasvim jasna potreba učinkovitog upravljanja računalnom učionicom. Rješenje problema su specijalizirani programi namijenjeni ne samo kontroli rada studenata, nego i isporuci nastavnog sadržaja primjerice, *NetOp School*, *Apple Remote Desktop* te u ovom radu detaljnije opisan *LanSchool* [2].

Uobičajeno, takvi programi podrazumijevaju mogućnost dijeljenja sadržaja zaslona nastavnika sa studentima. Osim što se studenti ne moraju naprezati pokušavajući uočiti detalje sadržaja na ploči, odnosno projekcijskom platnu, nema ni mogućnosti skretanja pažnje na druge sadržaje. Osim dijeljenja zaslona, programi za upravljanje računalnom učionicom obično imaju mogućnost zatamnjenja zaslona kad se traži trenutni prekid rada i puna pažnja studenata te mogućnost daljinskog upravljanja računalima što je od velike pomoći pri administriranju računala.

LanSchool se pojavio 1986. godine kao rezultat rada autora D. Doggetta, izvorno pod imenom *PC Chalkboard* [3]. *LanSchool* je vrlo jednostavno, iznimno učinkovito i pouzdano programsko rješenje za upravljanje računalnom učionicom. Program omogućuje nadzor rada studenata na računalima, komunikaciju nastavnika s pojedinim studentom ili pojedinog studenta s ostalim studentima, slanje poruka pojedincima ili grupi studenata, sastavljanje ispita i izvoz rezultata nakon završetka testiranja. Osim toga, vrlo jednostavno se izvodi isporuka i prikupljanje različitih dokumenata te blokiranje pristupa web stranicama na koje studentima nije dopušten pristup. Ne manje važna značajka programa je njegovo vrlo intuitivno, korisniku prilagođeno sučelje, kojim se ovlada u relativno kratkom vremenu.

2. Nastavničko sučelje (*LanSchool Teacher Console*)

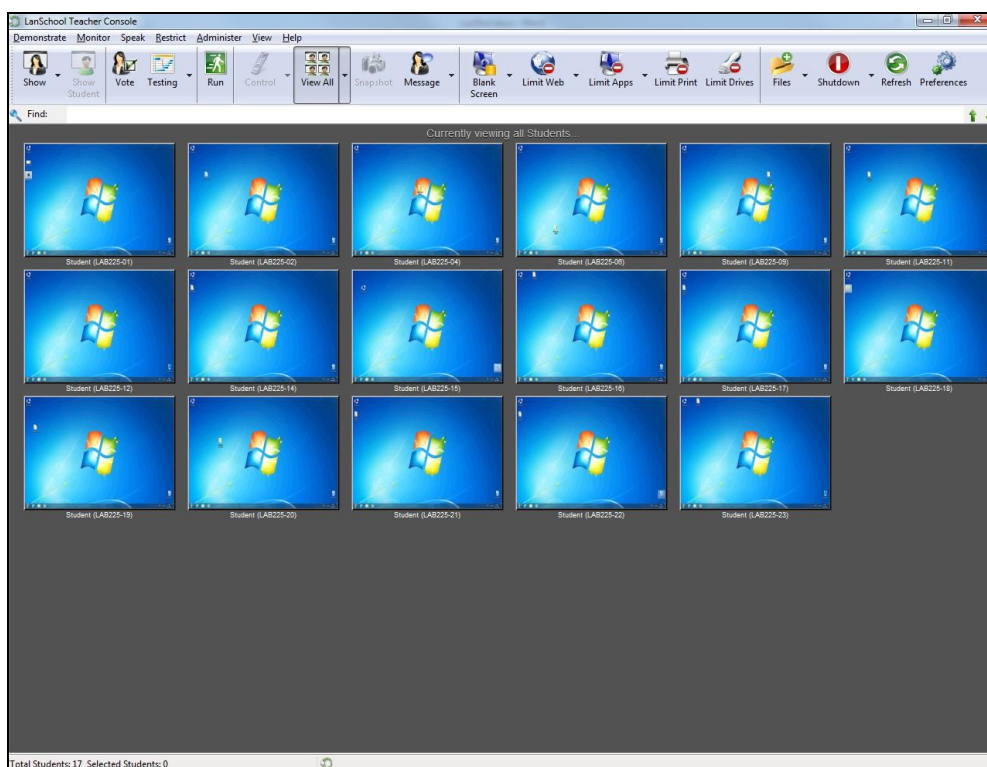
LanSchool [4] pruža nastavniku mogućnost upravljanja svim računalima u računalnoj učionici. Pored toga, funkcionalnost programa omogućava interakciju nastavnika i studenata kroz čak 16000 tzv. kanala, slično isporuci TV programa. Brojni TV kanali emitiraju se na različite TV prijamnike, ali ipak svi prijamnici mogu istovremeno pratiti isti program. To praktički znači da nastavnik može upravljati sa 16000 različitih računalnih učionica s jednog mjesta.



Slika 1: *LanSchool* izbornik.

Pri uporabi nastavničkog sučelja, u sistemskoj traci (paleti sustava ili području obavijesti) nalazi se *LanSchool* ikona u obliku zelenog kruga. Desni klik na nju otvara izbornik s osnovnim funkcijama kao što su dijeljenje zaslona nastavnika s računalima studenata (*Show Teacher's Screen*), blokiranje zaslona studenata (*Blank All Screens*), ograničavanje pristupa web stranicama i aplikacijama (*Limit Web*, *Limit Applications*) te pristup uređivanju opcija (*Options*). Slika 1 prikazuje izbornik sa osnovnim funkcijama.

Ostalim funkcijama upravlja se koristeći konzolu (*LanSchool Console*) koja se pokreće lijevim klikom na ikonu u sistemskoj traci ili klikom na *LanSchol Console* u izborniku koje se dobije klikom desne tipke miša na ikonu programa. Na konzoli, prikazanoj na slici 2, pojedinim funkcijama pristupa se koristeći vrpce s padajućim izbornicima ili koristeći dugmad na alatnoj traci. Radnje se izvode na odabranim (označenim) računalima, najčešće svim u učionici, a moguće je odabrati i samo jedno računalo ili skupinu računala. Više susjednih računala se odabire klikom miša na pojedine minijature (*Thumbnails*) računala studenata uz pritisnutu tipku *Ctrl* na tipkovnici. Sva računala se odabiru kombinacijom tipki *Ctrl*+*A*. U prikazu sa minijaturama označena računala su uokvirena crveno, a u prikazu detalja redci označenih računala su istaknuti plavo.



Slika 2: Prozor programa *LanSchool*.

Tek kad su računala studenata označena moguće je primijeniti funkcije bilo desnim klikom na minijature označenih studenata, bilo putem kartica padajućeg izbornika ili dugmadi alatne trake. Poništavanje odabira vrši se klikom na prazni dio konzole. Ako ni jedan student nije označen, podrazumijeva se kao da su svi označeni pri aktiviranju ključnih opcija kao što su *Blank Screen* i *Show Teacher*.

U slučaju da se računalima u učionici upravlja s više nastavničkih konzola, što je moguće, akciju jednog nastavnika ne može prekinuti nastavnik s druge konzole, nego se ona prekida isključivo sa konzole s koje je i poduzeta. Na primjer, ako jedan nastavnik studentima zatamni zaslone (opcija *Blank Screen*), nastavnik na drugoj konzoli ih ne može deblokirati.

3. Računalo studenta (*LanSchool Student*)

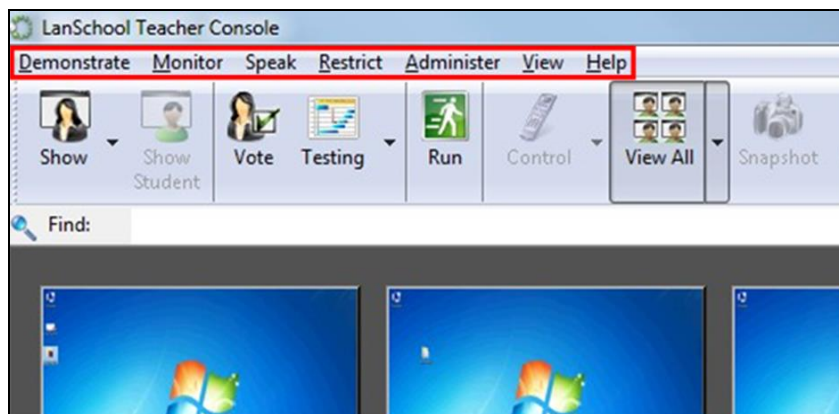
LanSchool instaliran je za rad u pozadini sustava računala studenta. Nastavnik će studente na svom sučelju automatski prepoznati na odgovarajućem kanalu. Studenti na svojim zaslonima, u desnom dijelu programske trake (područje obavijesti), mogu uočiti ikonu *LanSchool*. Postavljanjem pokazivača na ikonu student dobiva informaciju o kanalu na kojem je nastavnik. Klikom na ikonu student može zatražiti od nastavnika pomoć. U skočnom prozoru koji se pojavi student može unijeti pitanje. Nastavnik na svom sučelju vidi oznaku koja ga obavještava da određeni student ima pitanje. Oznaka nestaje kad nastavnik upotrijebi razgovor (*Chat*) ili opciju iz menija *Clear Student Question*. Desnim klikom na ikonu student otvara mapu u koju prima datoteke od nastavnika i u koju sprema datoteke za nastavnika (*Send/Collect* opcija u sučelju nastavnika). Treba napomenuti da se studentu prilikom instaliranja programa *LanSchool Student* može omogućiti biranje kanala. To znači da student, kad mu je to omogućeno, može kroz svoj izbornik napustiti kanal nastavnika u bilo kojem trenutku, što najčešće nije poželjno.

4. Prozor *LanSchool Teacher Console*

LanSchool osmišljen je za jednostavno i lagano rukovanje. Nastavničkoj konzoli (*LanSchool Teacher Console*) pristupa se preko ikone u sistemskoj traci. Prozor konzole sastoji se od naslovne trake, vrpce s padajućim izbornicima, trake s alatima, površine s minijaturama ili popisom računala studenata te statusne trake.

4.1 Vrpca s padajućim izbornicima

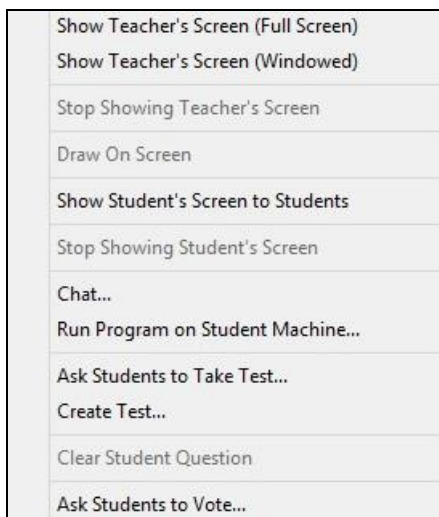
Vrpca s padajućim izbornicima sastoji se od sedam izbornika: *Demonstrate*, *Monitor*, *Speak*, *Restrict*, *Administer*, *View* i *Help*, kako je prikazano na slici 3. Izbornici sadrže naredbe za rad s programom.



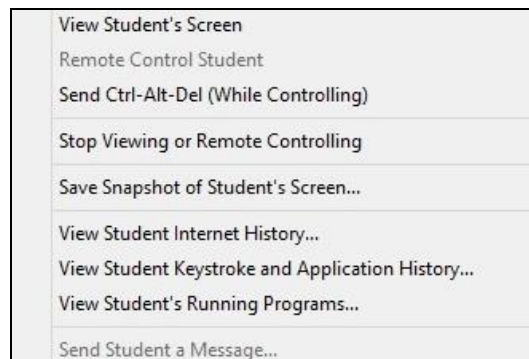
Slika 3: Kartice u vrpci menija

4.1.1 Izbornik *Demonstrate*

Slika 4 prikazuje izbornik *Demonstrate*. Koristi se za upravljanje prikazom minijatura računala studenta, *chat* sa studentom te izradu testova. Opcija *Draw on Screen* (crtanje po zaslonu) omogućena je tek nakon odabira opcije *Show Teacher's Screen*, a *Clear Student Question* nakon što je student postavio pitanje putem svog sučelja.



Slika 4: Izbornik *Demonstrate*.



Slika 5: Kartica *Monitor*

4.1.2 Izbornik *Monitor*

Ovaj izbornik koristi se za praćenje i kontroliranje računala studenata. Slika 5 prikazuje izbornik s prethodno uključenom opcijom *Remote Control Student*. Na računalu studenta moguće je pokrenuti upravitelj zadataka birajući opciju *Send Ctrl-Alt-Del*. Pored toga, nastavnik može vidjeti povijest pretraživanja Interneta i uporabe aplikacija, kao i trenutno pokrenute programe.

4.1.3 Izbornik *Speak*

Izbornik se koristi za audio komunikaciju sa studentima. Dostupne su sljedeće opcije:

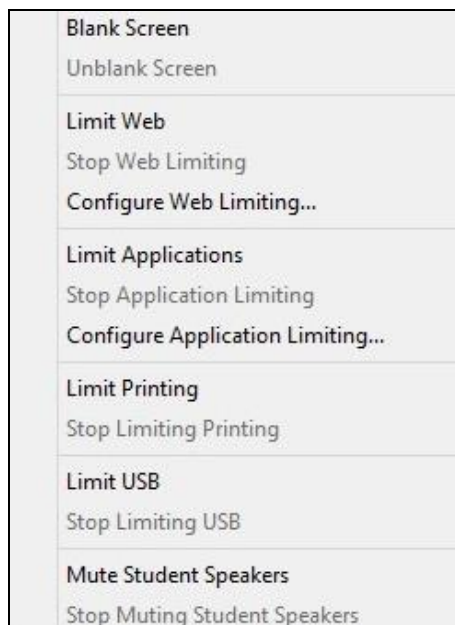
- *Speak to Class* – omogućava nastavniku audio obraćanje studentima koristeći zvučnike, odnosno slušalice.
- *Let Student Speak To Class* – omogućava odabranom studentu audio obraćanje ostalim studentima u učionici.
- *Talk with Student* – uključuje mikrofonski nastavnik i omogućuje razgovor s odabranim studentom.
- *Listen to Student* – uključuje mikrofonski odabranog studenta i omogućuje obraćanje nastavniku.

4.1.4 Izbornik *Restrict*

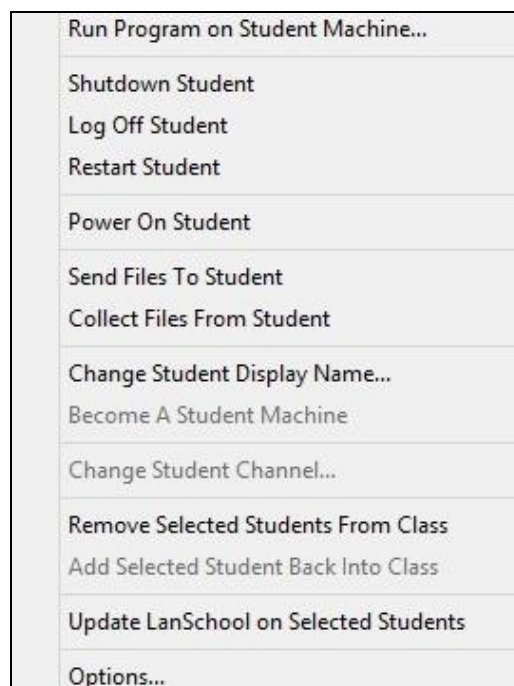
Izbornik upravlja ograničenjima studentskih računala, primjerice ograničenje pristupa Webu i određenim aplikacijama, ograničenje mogućnosti ispisa i uporabe USB spremnika. Na slici 6 prikazan je izbornik *Restrict*.

4.1.5 Izbornik *Administer*

Izbornik nudi mogućnosti administriranja računala studenata, a prikazan je na slici 7. Neke od mogućnosti su: pokretanje određenog programa, isključivanje ili resetiranje računala studenata. Vrlo korisne opcije su slanje datoteka studentima (*Send Files To Student*) i prikupljanje datoteka od studenata (*Collect Files From Student*). Moguće je isključiti označene studente iz razreda te ih naknadno uključiti. Putem ove kartice mogu se konfigurirati sve opcije koje program *LanSchool* pruža. Osim toga, pomoću ovog izbornika nastavnik može privremeno svoje računalo pretvoriti u računalo studenta, tako da odabere opciju *Become A Student Machine*. Računalo će izgledati kao računalo studenta sve dok se korisnik ne odlogira ili dok se računalo ne resetira.



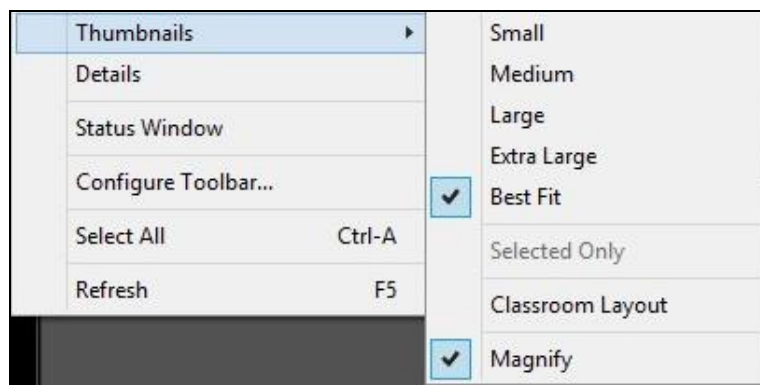
Slika 6: Izbornik *Restrict*.



Slika 7: Izbornik *Administer*.

4.1.6 Izbornik *View*

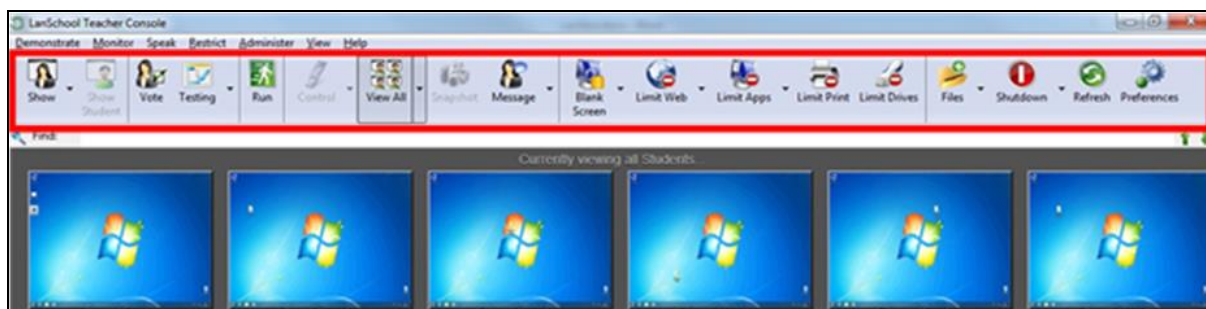
Izbornik *View*, prikazan na slici 8, koristi se za odabir na način prikaza računala studenata i za prilagodbu alatne trake. U pogledu s detaljima (*Details*) zadan je abecedni poredak u stupcu *Login Name*. Klikom na zaglavlje nekog drugog stupca lista će se sortirati prema odabranom stupcu.



Slika 8: Izbornik *View*.

4.2 Alatna traka

Na alatnoj traci, prikazanoj na slici 9, nalazi se dugmad s najčešće korištenim naredbama, a korisnik je može prilagoditi svojim potrebama. Da bi se pokrenula neka funkcija, potrebno je prethodno označiti računalo studenta ili više njih, a zatim pritisnuti željeno dugme na alatnoj traci. Pritisnuto dugme će dobiti obrub i promijeniti osvjetljenje. Prekid funkcije vrši se ponovnim pritiskom na isto dugme. Pojedina dugmad ima strelicu koja omogućuje dodatne opcije za određenu funkciju. Dugmad se može dodavati i pomicati na alatnoj traci koristeći opciju *Configure Toolbar* u izborniku *View*.



Slika 9: Alatna traka.

4.2.1 Dugme *Show*

Dugme prikazuje zaslon nastavnika na svim računalima koja su na istom kanalu. Moguće je odabrati prikaz u obliku prozora ili cijeli zaslon. U načinu s prikazom cijelog zaslona, zaslon nastavnika će na računalu studenta zauzeti cijeli zaslon te mu onemogućiti korištenje miša i tipkovnice. U načinu prikaza u prozoru, student može mijenjati položaj i veličinu prozora sa zaslonom nastavnika te raditi na svom računalu istovremeno prateći nastavnika. Kad nastavnik klikne na dugme *Show* začuje se zvuk na zvučnicima koji studente obavještava o poduzetoj akciji. Nastavnik može promijeniti zvuk u *C:\Program Files\lanschool\start.wav* i *stop.wav*.

4.2.2 Dugme *Show Student*

Ako nastavnik želi prikazati zaslon određenog studenta svim ostalim studentima, jednostavno označi određenog studenta i pritisne dugme *Show Student*. Sve dok je dugme omogućeno student ima kontrolu nad svojim računalom, a svi ostali studenti prate njegov rad na zaslonima vlastitih računala.

4.2.3 Dugme *Vote*

Pomoću ove naredbe nastavnik ima mogućnost dobivanja odgovora na pitanja točno/netočno (*True/False*) ili višestrukog izbora (*Multiple Choice*). U realnom vremenu nastavnik vidi koliko studenata je odgovorilo i kakvi su odgovori.

4.2.4 Dugme *Testing*

Ova opcija omogućava stvaranje testova s količinom do 100 pitanja uz mogućnost umetanja grafičkih elemenata (*.jpg*, *.png*, *.gif*, *.bmp*). Pitanja se mogu nasumično poredati, poslati jednom ili više studenata i pratiti u realnom vremenu. Nastavnici mogu vremenski ograničiti testiranje, pokazati rezultate studentima i izvesti rezultate u obliku *.csv* datoteke. Mogući oblici pitanja su točno/netočno (*True/False*), višestruki izbor (*Multiple Choice*), i kratki odgovor (*Short Answer*).

4.2.5 Dugme *Run*

Pomoću ove funkcije nastavnik pokreće određenu aplikaciju ili web stranicu na računalu odabranog studenta. Ovo može biti vrlo korisno kod studenta koji su početnici u radu s računalom, kao i za administriranje računala.

4.2.6 Dugme *Control*

Ova opcija pruža nastavniku mogućnost preuzimanja kontrole nad mišem i tipkovnicom odabranog studenta ili više njih. Kontroliranje više računala istodobno funkcionira samo ako računala nastavniku izgledaju potpuno isto pa on gledajući u zaslon jednog računala kontrolira i ostala.

4.2.7 Dugme *View All*

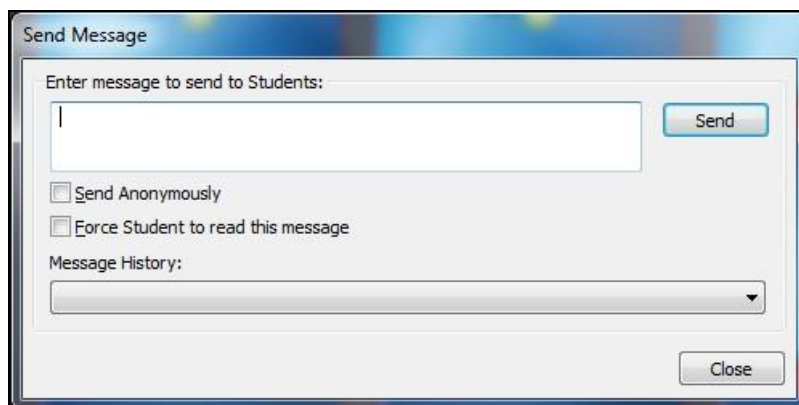
Ova opcija omogućava nastavniku da odabere veličinu prikaza zaslona studenta u obliku malih, srednjih, velikih ili ekstra velikih minijatura. Prelaskom miša preko pojedine minijature, u oblačiću se pojavljuje *login name* studenta i *computer name* računala. Ako student postavi pitanje, ono se također vidi u oblačiću. Malo dužim zadržavanjem miša minijatura se povećava. Desni klik na minijaturu otvara izbornik s opcijama za upravljanje računalom studenta. Osim prelaska na prikaz s detaljima (*Details*), klik na strelicu sa strane dugmeta *View All* nudi još nekoliko mogućnosti. U pogledu s minijaturama moguće je pratiti nekoliko označenih računala odabirom *Selected Only*. Opcija *Classroom Layout* omogućava raspoređivanje minijatura na zaslonu nastavnika u obliku rasporeda računala studenata u učionici. Opcija *Snap to Grid* olakšava poravnavanje minijatura, a *Lock Layout* osigurava očuvanje određenog rasporeda minijatura.

4.2.8 Dugme *Snapshot*

Pritiskom na ovo dugme nastavnik sprema sliku zaslona studenta u standardnom obliku (.jpg ili .bmp). Datum, vrijeme i *login name* studenta također su sačuvani u spremljenoj datoteci.

4.2.9 Dugme *Message*

Na ovaj način nastavnik može poslati svima ili samo odabranim studentima tekstualnu poruku koristeći dijaloški okvir *Send Message*, prikazan na slici 10. Poruka se pojavi u donjem desnom kutu zaslona studenta. Osim poruke, nastavnik sa studentom može pokrenuti razgovor (*Chat*).



Slika 10: Poruka studentima.

4.2.10 Dugme *Blank Screen*

Pritiskom na ovo dugme zaslon studenata se zatamni uz prateću poruku te se onemogućuje miš i tipkovnica. Ova mogućnost korisna je kad nastavnik želi trenutno privući pažnju studenata ili predavati bez ometanja. Poruka koja se pojavljuje na zaslonima može se mijenjati kroz opcije u *Preferences*. Može ih biti i više pa se po potrebi mogu izmjenjivati. Osim toga, poruke se mogu i personalizirati za svakog studenta uključujući u poruku opcije;

- %student name% - ime studenta,
- %login name% - korisničko ime,
- %machine name% - ime računala.

4.2.11 Dugmad *Limit Web* i *Limit Apps*

Da bi se aktiviralo ograničenje bilo Weba bilo pojedinih aplikacija, potrebno je prethodno izvršiti konfiguraciju ograničenja u izborniku kojem se pristupa pritiskom na dugme *Preferences*.

4.2.12 Dugme *Limit Print*

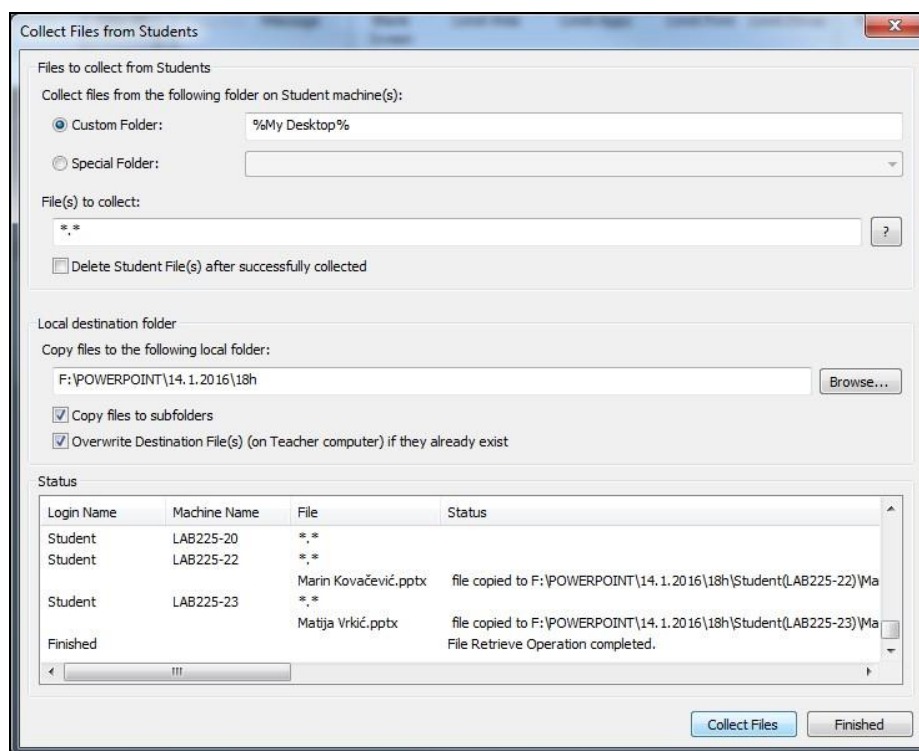
Funkcija ovog dugmeta je privremeno onemogućavanje ispisa za sve ili samo za označene studente.

4.2.13 Dugme *Limit Drives*

Pomoću ove opcije studentima se može ograničiti pristup USB spremnicima i CD-ROM/DVD pogonima.

4.2.14 Dugme *Files*

Pritiskom na ovo dugme otvara se dijaloški okvir za slanje, odnosno prikupljanje datoteka, ovisno koja se opcija odabere koristeći strelicu sa strane (*Send Files* ili *Collect Files*). U dijaloškom okviru za slanje odabire se putanja datoteke, dok dijaloški okvir za prikupljanje datoteka, osim putanje, podržava mogućnost korištenja zamjenskih znakova u imenu datoteke te na taj način uvelike olakšava prikupljanje datoteka. Slika 11 prikazuje dijaloški okvir za prikupljanje datoteka s odabranih računala.



Slika 11: Prikupljanje datoteka.

4.2.15 Dugme *Shutdown*

Pomoću ove opcije označena računala nastavnik može isključiti ili ponovno pokrenuti, a studente odjaviti.

4.2.16 Dugme *Refresh*

Pritiskom na tipku F5 na tipkovnici, koristeći izbornik *View* na vrpci s padajućim izbornicima ili pritiskom na istoimeno dugme na alatnoj traci, osvježava se konzola ponovnim prepoznavanjem računala studenata na određenom kanalu. Lista računala studenata automatski se obnavlja svake 3 minute.

4.2.17 Dugme *Preferences*

Koristeći ovu opciju poziva se dijaloški okvir *LanSchool Teacher Console*, koji se sastoji od sedam kartica kojima korisnik može podesiti program *LanSchool* svojim potrebama.

5. Zaključak

U suvremenom tehnološkom okruženju izvođenje nastave u računalnim učionicama nailazi na izazove učinkovite kontrole nastavnog procesa, kako u smjeru nastavnik - student, tako i obrnuto. Odgovor na ove zahtjeve su specijalizirani programi za upravljanje računalnim učionicama. U ovom radu su prikazane osnovne značajke programa za upravljanje računalnom učionicom *LanSchool* koji se koristi na Sveučilišnom odjelu za stručne studije u Splitu. Nastavnik sadržaje isporučuje izravno na računala studenata u obliku datoteka ili dijeljenjem zaslona svoga računala sa studentima. U bilo kojem trenutku može preuzeti kontrolu nad računalima jednog ili više studenata na nekoliko različitih razina. Interakcijom, koja može biti obostrana, upravlja nastavnik, a može biti tekstualna, zvučna, vizualna. Do povratne informacije u obliku anketa, testova ili prikupljanjem datoteka nastavnik dolazi vrlo jednostavno. Nastavničko računalo ima priključena dva zaslona: jedno se projektorom prikazuje studentima na platnu, dok je na drugom zaslonu prikazan *LanSchool*. Na ovaj način nastavnik tijekom izvođenja nastave prati rad studenata. Program je jednostavan za korištenje, izuzetno dobro je prihvaćen od strane svih nastavnika koji koriste informatičke učionice i postao je nezaobilazni alat u nastavnom procesu.

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The use of classroom management software in education

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Abstract. Modern computer technology is gradually replacing rooted or traditional ways of teaching. Broadband Internet and the decline of computer prices have resulted in the trend of using computer classrooms for courses that are not engaged in teaching computer skills. This

change has set new demands in terms of student-teacher interaction. Programs for the management of computer classrooms have appeared in response to these demands. Nowadays, such a program presents one of the many tools in the process of teaching in a computer classroom. The basic features of this program type are simpler interaction between teachers and students, simplified file sharing, the possibility of quick testing, monitoring and controlling the work of students, the option to specify certain limits, as well as many others. The ability to introduce restrictions such as use of the Internet, access to certain websites or to external devices for data storage, ensures that students are fully involved in the teaching process. In addition, these programs are important tools for administrators of computer classrooms, because they allow one to work on more than one computer at the same time. This paper describes the LanSchool program used in computer classrooms at the University Department of Professional Studies. The benefits of its use in education and its application in administering the computer classroom are shown.

Key words: *LanSchool, computer classroom management, teacher student interaction*

Konstruiranje brodske opreme smanjene mase

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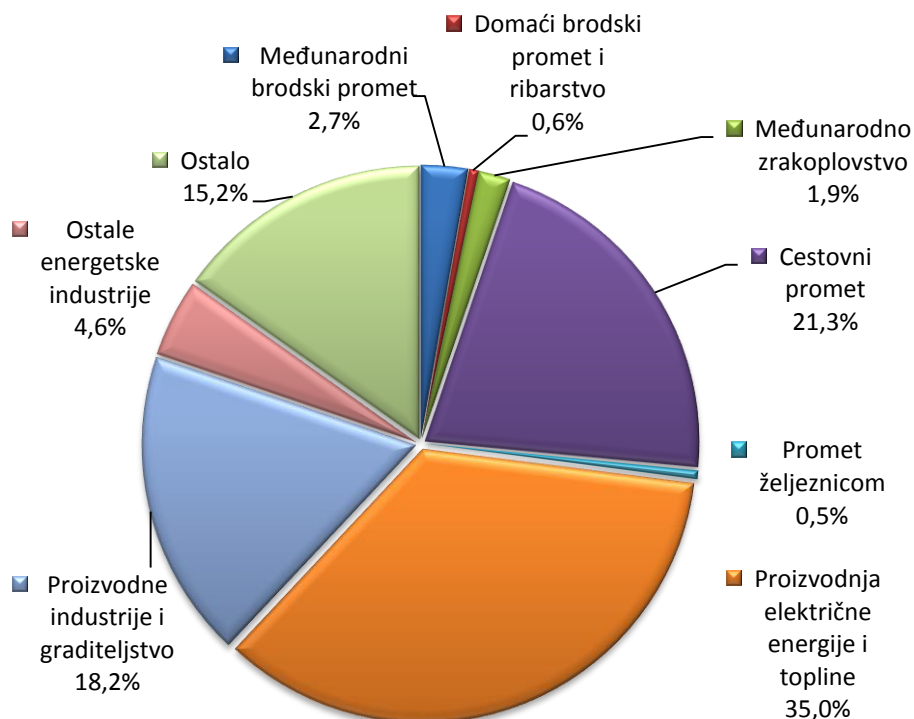
Sažetak: U radu se analiziraju moguće posljedice za proizvođače brodske opreme od *IMO rezolucije MEPC.203(62)* kojom je za većinu novih brodova obvezno ishođenje EEDI svjedodžbe („Certifikata projektnog indeksa energetske učinkovitosti“). Od proizvođača brodske opreme zahtijevat će se energetska učinkovitija oprema manje mase. Uspoređeni su najčešći pogoni brodske opreme po različitim kriterijima, a zbog veće energetske učinkovitosti predviđa se sve veća uporaba reguliranih elektromotornih pogona. Potreba smanjenja mase opreme zahtijevat će složenije tehničke proračune, metode optimizacije, kao i zahtjevnije proizvodne tehnologije. U radu se ukazuje na moguće probleme s kojima će se u budućnosti suočavati proizvođači brodske opreme. Povećani investicijski troškovi „lake opreme“ bit će nadoknadivi nižim eksploatacijskim troškovima.

Ključne riječi: *EEDI, GHG, konstruiranje, oprema broda, mala masa*

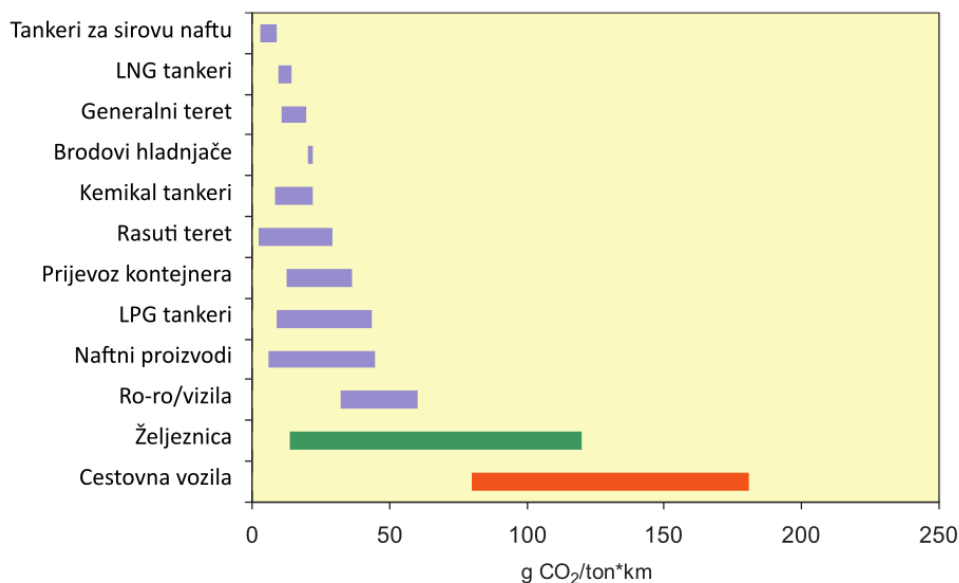
1. Uvod

Neupitno globalno zatopljenje utječe na klimu i vremenske prilike na Zemlji. Najveći utjecaj na globalno zatopljenje imaju emisije stakleničkih plinova koji su uglavnom posljedica korištenja fosilnih goriva. Vlade velikog broja zemalja potpisale su *Protokol iz Kyota* čiji je cilj smanjivanje emisije stakleničkih plinova (GHG). Nastavljanje povećavanja emisije stakleničkih plinova dovelo bi do velikih, a za neke dijelove čovječanstva do katastrofalnih posljedica. Na globalno zagrijavanje najviše utječe količina ugljikovog dioksida (CO₂) u atmosferi. Postoji znanstvena suglasnost o potrebi zadržavanja globalnog zatopljenja Zemlje u granicama do 2⁰C u odnosu na predindustrijsko razdoblje. Udio emisije CO₂ različitih djelatnosti u ukupnoj emisiji CO₂ u godini 2007. prikazan je na slici 1, IMO (2009.).

Udio prometa u ukupnoj emisiji CO₂ veći je od jedne četvrtine, Hayashi, Y., Morichi, S., & Rothengatter, W. (2015.). Najekonomičniji i energetska najučinkovitiji je brodski prijevoz. Iz tog se razloga, prema podacima Međunarodne pomorske organizacije (*International Maritime Organisation, IMO*), oko 90 % roba svjetske trgovine prevozi morima i zbog toga je brodski prijevoz bitan čimbenik svjetske trgovine, razvoja i prosperiteta. Na slici 2 prikazana je emisija CO₂ za različite vrste brodova i transportnih sredstava, IMO (2009.).



Slika 1 Udio emisije CO₂ različitih djelatnosti u ukupnoj emisiji CO₂



Slika 2 Emisija CO₂ za različite vrste brodova i transportnih sredstava

Brodovi u međunarodnoj plovidbi u 2012. godini, prema podacima IMO-a, IMO (2014.), ispuštali su 796 milijuna tona CO₂, što iznosi oko 2.2 % ukupne emisije CO₂ za tu godinu. Zbog globalnog rasta, učinkovitosti i manjeg utjecaja na okoliš izvjestan je daljnji porast brodskog prijevoza. Do 2050. godine predviđa se porast od 50 do 250 %, a sve zavisno o općem ekonomskom rastu, energetskej situaciji i politici.

Iako je brodski promet energetske najučinkovitiji, ulažu se napor da se smanji emisija CO₂. U tom cilju IMO izdvojio je tipove brodova koji su odgovorni za oko 80 % emisije CO₂ pomorskog transporta i propisao obvezu smanjenja emisije CO₂ za nove brodove te usvojio ambiciozni operativni plan postupnog povećanja energetske učinkovitosti, odnosno smanjenja emisije CO₂ u tri koraka od po 5 godina. Za brodove isporučene od 2015. do 2019. smanjenje je 10 %, od 2020. do 2024. iznosi 20 %, a za brodove isporučene poslije 2025. predviđa se

smanjenje emisije CO₂ i do 30 %. Ostvari li se ova dinamika povećanja energetske učinkovitosti brodova smanjit će se emisija CO₂ poslije 2025., za približno 260 Mt godišnje. Potrebna ulaganja u novi dizajn brodova i pratećih tehnologija vratit će se uštedama goriva u iznosu od oko 75 Mt godišnje. Uzme li se da trgovački brodovi imaju životni vijek 25 do 35 godina za očekivati je da će poslije 2050. svi teretni brodovi u međunarodnom prometu podlijevati zahtjevima energetske učinkovitosti.

Kao mjeru energetske učinkovitosti broda IMO utvrdio je „projektni indeks energetske učinkovitosti“ (*Energy Efficiency Design Index* - EEDI) koji je definiran kao:

$$EEDI = \frac{\text{Utjecaj na okoliš}}{\text{Dobitak za zajednicu}} = \frac{\text{Emisija CO}_2}{\text{Transportni učinak}} \left(\frac{\text{g CO}_2}{\text{t} \cdot \text{milja}} \right)$$

i primjenjuje na teretne brodove bruto tonaže (GT) iznad 400, a koji se grade od 01. siječnja 2013., odnosno za brodove koji se predaju poslije srpnja 2015. EEDI svjedodžba je obvezatna i brodovi moraju imati EEDI manji ili jednak zahtijevanom za tu vrstu i veličinu broda.

Primjena EEDI se ne odnosi na brodove bruto tonaže ispod 400 i općenito na brodove koji nisu namijenjeni prijevozu tereta, kao što su:

- putnički brodovi, trajekti, cruiseri
- Ro-ro teretni brodovi
- tegljači
- ribarski brodovi
- radni brodovi
- brodovi s električnim, hibridnom ili turbinskim porivnim sustavom.

Metodologija izračunavanja EEDI-a dana je u MEPC.1/Circ.681, a pojednostavljeno se može sažeti u izraz:

$$EEDI = \frac{C_F \cdot S_{FC} \cdot P}{\text{Kapacitet} \cdot v_{ref}} \quad \text{gdje je:}$$

P – 75 % nominalno instalirane snage broskog vijka, kW

S_{FC} - specifična potrošnja goriva, g/kWh

C_F - faktor konverzije potrošnje goriva u emisiju CO₂, ($C_F \cong 3.15$)

Kapacitet (DWT) – nosivost broda, t

v_{ref} – brzina broda u čvorovima pri: najvećem gazu i velikoj dubini, bez utjecaja vjetrova i valova te pri snazi od 75 % nominalno ugrađene snage broskog vijka, M/h (=čvor)

U tijeku je široka rasprava o poboljšanju definicije EEDI-a, metodologiji izračunavanja, Ančić, I., Šestan, A. (2015.), primjeni novih efikasnijih tehnologija te njegova primjena i na preostale vrste plovila.

Osim EEDI-a obavezna je primjena „brodskog plana upravljanja energetsom učinkovitošću“ (*Ship Energy Efficiency Management Plan, SEEMP*), kojim se zahtijeva da novi i stari brodovi imaju razvijen i primijenjen operativni plan koji maksimira efikasnost broda u službi. Prema *Second IMO GHG Study 2009* sama primjena SEEMP-a omogućava smanjenje emisije CO₂ sveukupne svjetske flote za 10 do 15 %. U Hrvatskoj ovo je uređeno *Pravilima za statutarnu certifikaciju pomorskih brodova, sprječavanje onečišćenja*, NN 97/(2015.).

Suočeni s nastavkom globalnog zatopljenja moguće je očekivati i primjenu tržišnih mehanizama u obliku trošarina na fosilna goriva, obaveznu primjenu energetski učinkovitijih tehničkih rješenja itd.

Povećanje energetske učinkovitosti brodovlja ima potporu vlada, industrijskih i strukovnih udruga, kao i organizacija civilnog društva. Studijom *IMO GHG Study Report 2009* procijenjena su moguća smanjenja emisije CO₂ korištenjem poznatih tehnologija i prakse, tablica 1.

Tablica 1 Procjene potencijalnih redukcija CO₂ u brodarstvu koristeći poznate tehnologije i praksu

	Smanjena emisija CO ₂ g CO ₂ /tona milji	Kombinirano	Kombinirano
PROJEKT (novi brodovi)			
Koncept, brzina, nosivost	2% ÷ 50% ⁺		
Brodsko forma i nadgrađe	2% ÷ 20%		
Snaga i porivni sustav	5% ÷ 15%	10% ÷ 50% ⁺	
Gorivo s niskim sadržajem ugljika	5% ÷ 15%*		
Energija iz obnovljivih izvora	1% ÷ 10%		
Redukcija CO ₂ iz ispušnih plinova	0%		25% ÷ 75% ⁺
SLUŽBA (svi brodovi)			
Upravljanje flotom, logistika i poticaji	5% ÷ 50% ⁺		
Optimizacija plovidbe	1% ÷ 10%	10% ÷ 50% ⁺	
Upravljanje energijom	1% ÷ 10%		

Napomena:

⁺ smanjenje na ovu razinu zahtijeva smanjenje brzine

* ekvivalent CO₂ temeljen na uporabi LNG

Izvor podataka: *IMO GHG Study Report 2009*

Razvidno je kako se najveći potencijal za smanjenje emisije CO₂ nalazi u konceptu broda, brzini i nosivosti broda. Ostale mogućnosti su:

- smanjenje ugrađene snage pogonskih strojeva zahvaljujući poboljšanju forme broda, smanjenju otpora i poboljšanju efikasnosti brodskog vijka
- smanjenje specifične potrošnje goriva zahvaljujući poboljšanju stupnja korisnog učinka motora
- povećavanje brzine broda bez povećanja snage poriva
- uporaba goriva – izvora energije s manjim sadržajem ugljika, npr. ukapljeni prirodni plin (LNG)
- koristiti obnovljive izvore energije
- povećavanje nosivosti broda (DWT) smanjujući masu broda i brodske opreme.

Optimizirajući uporabu trgovačke flote i brodovlja (SEEMP) moguće je već sada smanjenje emisije CO₂ i bez ulaganja u nove energetske efikasnije brodove. Optimizacija treba obuhvatiti: ukrcaj i iskrcaj tereta, rute i plan putovanja, brzinu plovidbe, balast, učinkovito održavanje broda, obuku itd.

U cilju postizanja planiranih smanjenja emisije stakleničkih plinova (GHG) i zadovoljenja zahtjeva za energetskom učinkovitošću i od proizvođača brodske opreme zahtijevat će se oprema visoke energetske učinkovitosti, a male mase.

Za brodove specijalne namjene, koji za sada nisu obvezni ispunjavati zahtjeve EEDI-a (teglači, ledolomci, ribarski brodovi, jaružala, spasilački brodovi, istraživački brodovi) također će se zahtijevati brodska oprema visoke energetske učinkovitosti sa što manjim utjecajem na okoliš.

Usvojeni plan smanjenja emisije CO₂ (30 % poslije 2025.) vrlo je ambiciozan. Za ostvarenje plana potrebna je međunarodna suradnja na svim razinama, edukacija odgovarajućih stručnjaka, nova inovativna rješenja i tehnologije, korištenje obnovljivih izvora energije.

2. Energetski učinkovita brodska oprema

Učinkovita je ona brodska oprema čiji su pogoni energetski učinkoviti, tj. imaju visok stupanj korisnog učinka, odgovarajući životni vijek, malu masu. Mala masa opreme omogućava prijevoz veće količine korisnog tereta, povećava ekonomsku efikasnost, smanjuje potrošnju neobnovljivih resursa, poboljšava dinamičko ponašanje opreme.

2.1 Energetski učinkoviti pogoni brodske opreme

Za pogon brodske opreme i prijenos energije primjenjuju se u pravilu hidraulički i elektromotorni pogoni.

Hidraulički pogoni se mogu podijeliti na:

- elektro-hidrauličke pogone
- hidrauličke pogone.

Elektro pogoni su najčešće indukcijski motori izmjenične struje (AC) i to:

- jednobrzinski elektromotori
- višebnzinski - polno preklopivi elektromotori
- AC indukcijski motori napajani preko pretvarača frekvencije – regulirani elektromotorni pogoni.

Elektro-hidraulički pogon (EHP) se sastoji od: jednobrzinskog AC elektromotora, hidrauličke pumpe, spremnika hidrauličkog ulja, hidromotora, upravljačkog elementa za promjenu brzine, sustava kočenja i hladnjaka hidrauličkog ulja, pri čemu jedna pumpa napaja samo jedan hidromotor. Radi veće energetske učinkovitosti pumpa i hidromotor u pravilu rade u zatvorenom hidrauličkom krugu, tzv. hidrostaticki prijenosnici.

Hidraulički pogon (HP) je sličan elektro-hidrauličkom, s tim da jedan hidraulički agregat (elektromotor, hidraulička pumpa, spremnik hidrauličkog ulja, kontrolna oprema, hladnjak) napaja više hidromotora.

Regulirani elektromotorni pogon (REP) tvore: AC indukcijski elektromotor, pretvarač frekvencije, enkoder, kočni otpornici s hladnjakom i prijenosnik čiji je izlazni moment usporediv s momentom hidromotora. Umjesto otpornika za kočenje može se primijeniti frekvencijski pretvarač s regenerativnim modulom koji generiranu električnu energiju vraća u mrežu.

Usporedit će se opisani elektro-hidraulički, hidraulički i regulirani elektromotorni pogon. Kao kriteriji usporedbe će se uzeti:








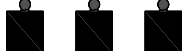


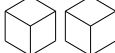

- potrebna tlocrtna površina, obujam i masa
- energetska efikasnost, odnosno stupanj korisnog učinka
- pouzdanost pogona
- potrebno održavanje
- investicijski troškovi

- upravljanje brzinom vrtnje i okretnim momentom
- potreba za grijanjem i hlađenjem
- utjecaj pogona na okoliš
- rad pogona u ekstremnim klimatskim uvjetima.

2.1.1 Usporedba tlocrtne površine, zapremnine i mase različitih pogona

REP nema potrebu za hidrauličkom pumpom, spremnikom ulja, hidrauličkim cijevima i armaturom. Hidraulički cjevovodi, pribor i spojni elementi zamjenjuju se električnim kabelima koji zauzimaju manje prostora i imaju manju masu. Hidraulička pumpa i spremnik zamjenjuju se frekventnim pretvaračem koji ima znatno manji obujam i masu. Nedostatak REP-a je što elektromotor i prijenosnik imaju veći obujam i masu u usporedbi s hidromotorom jednakog momenta. Usporedba različitih pogona prikazana je u tablici 2.

Tablica 2 Usporedba različitih pogona po površini, obujmu i masi

	Potrebna tlocrtna površina i obujam na palubi	Masa na palubi	Ukupni obujam sustava	Ukupna masa sustava
REP				
EHP				
HP				

Napomena:

Ukupni volumen i ukupna masa sustava uključuje i cjevovode, fittinge, hidrauličke agregate, električne kabele, elektroormare.

2.1.2 Usporedba potrošnje energije, odnosno stupanja korisnog učinka

Stupanj korisnog učinka REP-a uključuje stupanj korisnog učinka frekvencijskog pretvarača, elektromotora i mehaničkog prijenosnika, a iznosi između 75 do 85 %, ovisno o veličini elektromotora, vrsti prijenosnika i opterećenju. U slučaju primjene frekvencijskog pretvarača s regenerativnim modulom moguće je u slučajevima kočenja vraćati generiranu električnu energiju u mrežu pa su zato osobito energetski učinkoviti kod vitala dizalica koje češće spuštaju nego podižu teret (regenerativno kočenje) i velikih ribarskih vitala.

Stupanj korisnog učinka EHP-a uključuje stupanj korisnog učinka elektromotora, pumpe i hidromotora. Zbog mehaničkih i volumetričkih gubitaka u pumpi i hidromotoru stupanj korisnog učinka u odnosu na REP je za 20 do 25 % manji, a što ovisi o tipu pumpe i hidromotora, radnom tlaku, brzini vrtnje. Stupanj korisnog učinka EHP-a koji se koriste u brodskoj opremi je od 55 % do 70 %.

HP-a kojih je više na jednom hidrauličkom agregatu imaju manji stupanj korisnog učinka prvenstveno zbog pumpe koja održava najveći tlak koji odgovara samo jednom od pogona. Ovisno o konfiguraciji hidrauličkog sustava i broja hidromotora stupanj korisnog učinka je od 20 do 30 % manji u odnosu na EHP i iznosi od 35 % do 60 %.

2.1.3 Usporedba po kriteriju pouzdanosti rada pogona

Hidraulički pogoni se uspješno koriste desetljećima na različitim tipovima brodova u ekstremnim radnim uvjetima. Primjenom hidroakumulatora moguće je jednostavno izvršavanje sigurnosnih funkcija u kritičnim situacijama (*blackout*). Za REP nema još

dovoljno podataka o učestalosti i vrsti otkaza. Zbog manjeg broja pokretnih dijelova u sustavu REP bi mogli biti u prednosti. S druge strane, nepovoljni radni i klimatski uvjeti (vibracije, velika vlaga, sol u zraku) ne idu na ruku elementima energetske elektronike.

2.1.4 Usporedba po kriteriju zahtjevnosti održavanja pogona

Nadzor i upravljanje REP-ovima na brodu zahtijevaju specijaliziranu stručnu osobu koja može utvrditi i riješiti probleme ovih pogona. Za osiguravanje funkcionalnosti sustava i brzo vraćanje u funkciju u slučaju otkaza potrebna je i vanjska podrška i to vjerojatno najpovoljnije od proizvođača opreme. Dodatni nedostatak REP-a je potreba velikog broja pričuvnih dijelova. Kod hidrauličkih pogona održavanje je jednostavnije, potreban je manji broj pričuvnih dijelova. Prednost REP-a znatno je manje preventivno održavanje, koje se sastoji uglavnom od inspekcijskih pregleda. EHP i HP zahtijevaju veći opseg preventivnog održavanja, koje uključuje provjeru eventualnog propuštanja hidrauličkog ulja, zamjenu hidrauličkog ulja, filtera, fleksibilnih crijeva te ispiranje hidrauličke instalacije. Usporedba pogona sa stajališta zahtjevnosti održavanja dana je u tablici 3.

Tablica 3 Usporedba pogona sa stajališta zahtjevnosti održavanja

	REP	EHP i HP
Rutinsko održavanje	<ul style="list-style-type: none"> • minimalno 	<ul style="list-style-type: none"> • značajno veće
Preventivno održavanje	<ul style="list-style-type: none"> • minimalno 	<ul style="list-style-type: none"> • značajno veće
Utvrđivanje kvarova i popravci	<ul style="list-style-type: none"> • dulje vrijeme otklanjanja kvara • specijalizirana znanja i obuka 	<ul style="list-style-type: none"> • lakše otklanjanje kvara • poznate tehnologije
Pričuvni dijelovi	<ul style="list-style-type: none"> • manje potrošnog materijala • veća količina pričuvnih dijelova • ograničenje na određene dobavljače 	<ul style="list-style-type: none"> • mogući dobavljači širom svijeta • mogu se koristiti pričuvni dijelovi drugih sustava
Potrebna podrška	<ul style="list-style-type: none"> • vanjska (proizvođača) uz dodatne troškove 	<ul style="list-style-type: none"> • unutarnja potpora u organizaciji

2.1.5 Upravljanje brzinom vrtnje i okretnom momentom

REP mogu osigurati upravljanje brzinom vrtnje i okretnim momentom motora u širokom rasponu. Područje brzina vrtnje je od 2 % do 100 % najveće brzine uz puni moment, čak i pri nultoj brzini vrtnje. EHP koji rade u zatvorenom hidrauličkom krugu mogu osigurati slične radne karakteristike kao REP.

2.1.6 Potreba za grijanjem i hlađenjem

Glavni problem REP-a na brodu je hlađenje. Hlađenje zrakom puno je nedostataka osobito pri malim brzinama vrtnje. Temperatura zraka može varirati od -40° do $+45^{\circ}\text{C}$. Za hlađenje pri malim brzinama koriste se neovisno pogonjeni ventilatori. Za motore veće snage preferira se vodeno hlađenje. Za sprječavanje kondenziranja vode u namotima motora potrebni su električni grijači.

Hidraulički prijenosnici mogu imati hidraulički agregat u nadziranim radnim uvjetima u potpalublju. Hidraulička oprema smještena na palubi, pri niskim temperaturama, radi održavanja viskoznosti hidrauličkog ulja u radnom području zahtijeva grijače ili treba imati optok toplim hidrauličkim uljem, a što znatno poskupljuje izvedbu i povećava eksploatacijske troškove.

2.1.7 Utjecaj različitih pogona na okoliš

Moguća propuštanja hidrauličkog ulja predstavljaju ekološku opasnost i sigurnosni problem za posadu. U slučajevima gdje rizici ispuštanja hidrauličkog ulja u okoliš nisu prihvatljivi (npr. ekološki zaštićena područja, *live fish carrieri*, *fish farming*) koriste se biorazgradiva i jestiva ulja. Staro hidrauličko ulje, filteri i sredstva za čišćenje trebaju biti zbrinuti na propisani način. Zbog pulsiranja tlaka u sustavu javljaju se vibracije cjevovoda, odnosno hidraulički prijenosnici su bučniji. REP-ovi su po ovom kriteriju bez sumnje u prednosti. Rezultati usporedbe pogona zbirno su dani u tablici 4.

Tablica 4 Usporedba pogona brodske opreme po različitim kriterijima

Kriterij usporedbe	REP	EHP	HP
Obujam i masa pogona	dobro	loše	zadovoljavajuće
Stupanj korisnog učinka	vrlo dobro	dobro	loše
Pouzdanost rada pogona	vrlo dobro	vrlo dobro	vrlo dobro
Zahtjevnost održavanja	zadovoljavajuće	vrlo dobro	vrlo dobro
Investicijski troškovi	visoki	srednji	niski
Upravljanje brzinom i momentom	vrlo dobro	vrlo dobro	zadovoljavajuće
Potreba za grijanjem i hlađenjem	dobro	dobro	vrlo dobro
Rad u ekstremnim klimatskim uvjetima	vrlo dobar	loš	zadovoljavajući
Utjecaj na okoliš	vrlo mali	srednji	velik

Zbog prednosti REP-ova u odnosu na EHP i HP po značajnim kriterijima kao što su: manji obujam i masa, bolji stupanj korisnog učinka, jednostavno upravljanje brzinom i momentom, mogućnost rada u ekstremnim klimatskim uvjetima, mali utjecaj na okoliš, razumno je pretpostaviti da će se oni u buduću preferirati u pogonima brodske opreme. Osim za brodsku opremu regulirani elektromotorni pogoni mogu se očekivati i u drugim područjima npr. kod pogona za dinamičko pozicioniranje broda. Dodatno povećanje korisnog učinka i dinamike pogona može se postići primjenom motora s permanentnim magnetima.

3. Brodska oprema smanjene mase

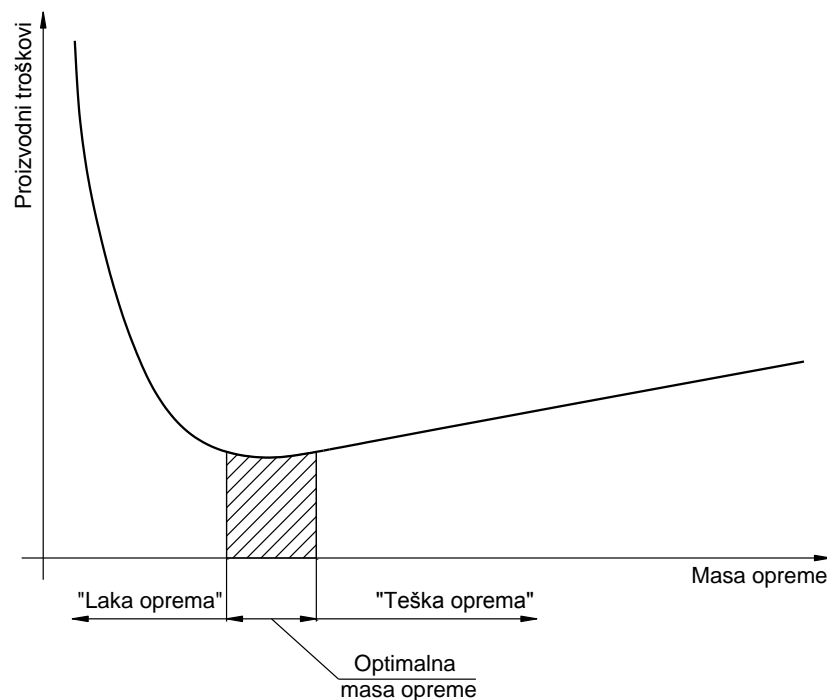
Proizvođači brodske opreme dizajniraju proizvode na način da ispunjavaju funkciju u očekivanom životnom vijeku, zadovolje važeće propise i pravila klasifikacijskih društava, nastojeći pri tome minimizirati proizvodne troškove.

Na proizvodne troškove primarno utječe koncept, geometrija, količina i vrsta materijala te proizvodne tehnologije.

Masa proizvoda koji ispunjava funkciju, uvjete sigurnosti, pouzdanost, životni vijek, a pri tome zadovoljava sve propise i pravila klasifikacijskih društava utječe na proizvodne troškove prema slici 3.

Temeljem proračuna, ispitivanja i iskustva proizvođači brodske opreme masu brodske opreme drže u području koje im omogućava postizanje najmanjih proizvodnih troškova, a s tim i kupcu najmanje investicijske troškove.

Povećavanjem mase opreme iznad troškovno optimalne (područje „teške opreme“ na slici) proizvodni troškovi lagano rastu. Proizvoditi opremu koja po masi spada u ovo područje nema tehničkog ni ekonomskog smisla. Proizvode je proizvođači koji se u nedostatku pouzdanih proračuna osiguravaju „debljinom materijala“ ili se ne odriču starih „teških“ rješenja koji još uvijek prolaze kod kupaca.



Slika 3 Ovisnost proizvodnih troškova o masi opreme

Smanjenjem mase opreme ispod troškovno optimalne (područje „lake opreme“) povećavaju se eksponencijalno razvojni i proizvodni troškovi. Razlozi povećanja troškova su veći udio inženjerskog i visokostručnog rada, složeniji proračuni, zahtjevnije oblikovanje, primjena materijala veće čvrstoće i lakših materijala bitno veće cijene, duži, složeniji i skuplji tehnološki postupci, skuplji alati, složeniji postupci osiguravanja kvalitete i ispitivanja proizvoda. U ovom području nalazi se oprema specijalnih plovila gdje manja masa opreme povećava uporabna svojstva, kao što su ratni brodovi, plovila velike brzine, brodovi za sport i razonodu te općenito oprema kopnenih vozila i zrakoplovna tehnika.

Neizbježni dodatni troškovi za smanjenje mase opreme su općenito manji kada se smanjenje mase postiže boljim konceptom i oblikovanjem, a bitno su veći kada se smanjenje ostvaruje primjenom novih, lakših materijala i tehnologija.

Izrada troškovnog modela proizvodnih troškova o masi opreme složen je zadatak i ovisi o osposobljenosti proizvođača te tehnologija koje su mu na raspolaganju, Wiedemann, J. (2007.). Proizvođači brodske opreme u pravilu ne razmatraju troškove u životnom vijeku opreme, a naročito ne indirektno troškove nastale kao posljedica smanjenja nosivosti broda i veće potrošnje goriva. Težeći najmanjim proizvodnim troškovima opreme, troškovi se prebacuju na kasnije faze životnog ciklusa (pogonski troškovi, troškovi održavanja, troškovi recikliranja). Rijetko se uzima u obzir utjecaj pojedinih konceptijskih rješenja i konstrukcijskih izvedbi opreme na emisiju stakleničkih plinova. Obaveza zadovoljenja EEDI-a navest će i proizvođače brodske opreme da promijene pristup pri razvoju opreme.

Smanjenje mase opreme povećava troškove proizvodnje, ali s druge strane rezultira:

- smanjenjem eksploatacijskih troškova zbog manjeg utroška energije
- većom nosivošću broda
- manjom emisijom stakleničkih plinova.

Smanjenje mase brodske opreme, odnosno dodatna ulaganja u „laku opremu“ moraju imati opravdanje u višoj uporabnoj vrijednosti proizvoda, odnosno moraju biti isplativa u životnom vijeku opreme.

4. Razvoj i proizvodnja lake brodske opreme

Za razvoj i proizvodnju lake brodske opreme ključno je poznavanje opterećenja (djelovanja) po intenzitetu i učestalosti, a koja se mogu očekivati u životnom vijeku opreme. Za veliki broj brodske opreme nema dostupnih podataka. Klasifikacijska društva propisuju opterećenja za opremu koja se smatra sigurnosnom. Iskustva su proizvođača opreme da su ponekad ta opterećenja podcijenjena, npr. sidrena vitla za velike riječno-morske brodove. Za vitla radnih brodova kao jaružala, tegljača, ribarskih i istraživačkih brodova nema pouzdanih podataka. Opterećenja često zavise i o načinu kako se oprema koristi. Primjenom REP-a mogu se, razmjerno jednostavno i uz minimalne dodatne troškove, dobiti spektri opterećenja opreme koja se koristi, a što bi bila dobra osnova za daljnja poboljšanja.

Za razvoj lake konstrukcije bitno je poznavati pomake i raspodjelu naprezanja gotovo u svim točkama konstrukcije pa je nužna primjena suvremenih analitičkih i numeričkih metoda proračuna čvrstoće, krutosti, elastične stabilnosti i zamora. Optimizacija mehaničkih struktura postat će nezaobilazan dio tehničkih proračuna, Schumacher, A. (2013.).

Potrebno je izabrati odgovarajući koncept koji će omogućiti pouzdano funkcioniranje opreme u uvjetima povećanih pomaka nosive konstrukcije, a koji su posljedica većih naprezanja ili primjene materijala manjeg modula elastičnosti.

Lake konstrukcije izvode se od tanjih limova veće čvrstoće pa je oblikovanje konstrukcije bitno zahtjevnije. Povećava se opasnost pojave zaostalih naprezanja te distorzije konstrukcije. Potreba smanjenja mase opreme dovest će do potrebe integracije više dijelova različitih funkcija u jedan složeniji dio.

Izbor materijala veće čvrstoće (čelici povišene čvrstoće) direktno će smanjiti masu opreme. Veća prosječna naprezanja povećat će elastične pomake, a porast će i lokalna naprezanja. Brodska oprema je najčešće dinamički opterećena pa je proračun zamora materijala od najveće važnosti.

Izbor lakših materijala (aluminijske i titanove legure, kompozitni materijali) otvorit će probleme spajanja različitih materijala, elektrokemijske korozije, potrebu galvanskog izoliranja različitih materijala, degradacije materijala, puzanja materijala.

Koristit će se strukturno lakši konstrukcijski elementi (tankostijeni profili, sendvič ploče itd.).

Nove proizvodne tehnologije i tehnike spajanja (lasersko rezanje i zavarivanje, lijepljenje, savijanje) tražit će posebnu pažnju inženjera konstruktora i opsežnije postupke ispitivanja.

S druge strane brodska oprema male mase u eksploataciji će iziskivati češće inspekcije i eventualne popravke. Iz ovih razloga treba oblikovati konstrukciju tako da su vitalni dijelovi dostupni za pregled nerazornim metodama te da su predviđeni i propisani postupci popravaka.

Dugoročni utjecaji konstrukcije na okoliš i okoliša na konstrukciju zahtijevaju obraćanje posebne pažnje površinskoj zaštiti, otpornosti protiv korozije, jednostavnosti recikliranja, utjecajima na okoliš pri otkazu ili pri katastrofalnim otkazima npr. pri potonuću opreme. Dok je oko 70 % aluminija u uporabi prethodno reciklirano, problem učinkovitog recikliranja kompozitnih materijala veliki je izazov.

5. Troškovni model lake konstrukcije

Cilj je, uz zahtjeve koji se postavljaju na opremu, razviti i proizvesti konstrukciju smanjene mase uz zadržavanje životnog vijeka, sigurnosti i pouzdanosti opreme. Snižavanje težine opreme ne može biti cilj sam po sebi. Od najveće je važnosti izgraditi odgovarajuće modele „troškovi – masa konstrukcije“ za različite vrste brodske opreme, Bronner, A. (2008.). Optimalno rješenje može se postići samo sveobuhvatnim pristupom koji obuhvaća:

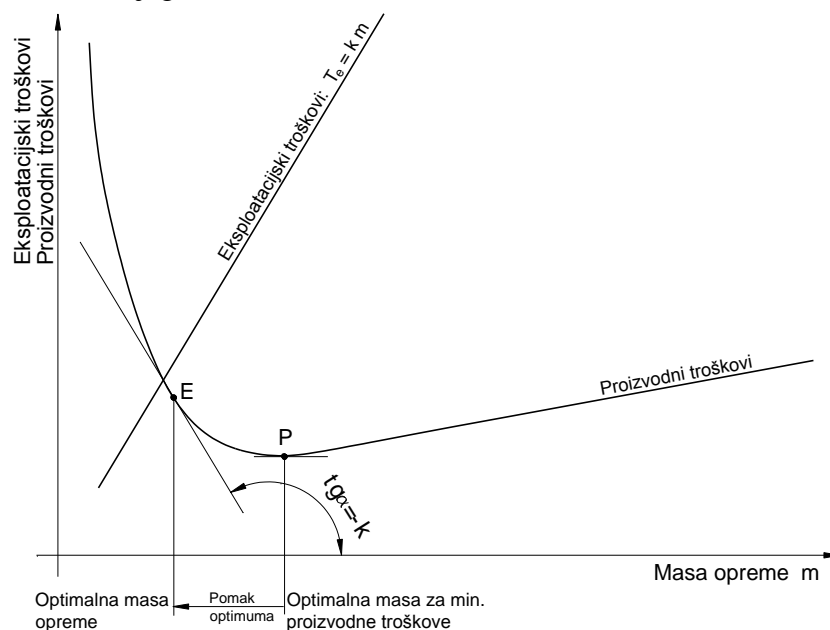
- troškove razvoja

- troškove materijala
- troškove proizvodnje
- troškove ispitivanja
- pogonske troškove
- troškove pregleda, održavanja i popravaka
- troškove recikliranja, oporabe ili odlaganja.

Za određivanje optimalne mase opreme, troškovima razvoja i proizvodnje prikazanih na slici 3, potrebno je pribrojiti eksploatacijske troškove. Radi pojednostavljenja modela pretpostavit će se da su troškovi brodske opreme u eksploataciji srazmjerni njenoj masi (veća masa opreme, a manji korisni teret), slika 4.

$$T_e = k \cdot m$$

Koeficijent proporcionalnosti eksploatacijskih troškova o masi opreme k (\$/t) može se dobiti kao omjer prihoda broda i njegove nosivosti (DWT).



Slika 4 Ovisnost optimalne mase i proizvodnih troškova od eksploatacijskih troškova opreme

Ukupni troškovi su sad:

$$T(m) = T_p(m) + km$$

a imat će svoj minimum za masu opreme koja ispunjava uvjet:

$$T'(m) = T'_p(m) + k = 0$$

odnosno

$$T'_p(m) = -k$$

Masa opreme za koju su ukupni troškovi minimalni je apscisa dirališta (E) tangente s koeficijentom smjera $(-k)$ na krivulju proizvodnih troškova, slika 4. Uzimajući u obzir i eksploatacijske troškove, optimalna masa opreme se tako pomiče u područje „lake opreme“. Povećavanjem faktora proporcionalnosti eksploatacijskih troškova s masom opreme, optimalna masa dublje ulazi u područje „lake opreme“.

6. Zaključno

IMO–ov Odbor za zaštitu pomorskog okoliša (MEPC) usvojio je rezoluciju *MEPC.203(62)* kojom je za nove brodove bruto tonaže iznad 400 obvezno ishođenje EEDI svjedodžbe (*Potvrde o projektnom indeksu energetske učinkovitosti*) te za sve brodove (nove i stare) primjena *Brodskog plana upravljanja energetsom učinkovitošću* (SEEMP). Namjera je smanjiti emisiju stakleničkih plinova brodovlja u međunarodnoj plovidbi. Za očekivati je obveznu primjenu EEDI-a i za brodove koji su do sada bili izuzeti. Od proizvođača brodske opreme zahtijevat će se energetski učinkovitija oprema manje mase. Iz razloga energetske učinkovitosti i male mase, u broskoj se opremi predviđa sve veća uporaba reguliranih elektromotornih pogona. Potreba smanjenja mase opreme zahtijevat će složenije tehničke proračune, metode optimizacije, kao i proizvodne tehnologije. Povećani investicijski troškovi „lake opreme“ nadoknadit će se nižim eksploatacijskim troškovima. Novi izazovi koje donosi potreba zaustavljanja globalnog zagrijavanja prilika su za nove tvrtke da se na vrijeme uključe u rješavanje problema koji se naziru. Pri ovom je nužna međunarodna suradnja i potpora društvene zajednice, kako bi se uključili znanstveni potencijali te educiralo odgovarajuće stručnjake.

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Design of marine lightweight equipment

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Abstract. The paper gives analysis of the possible consequences for manufacturers of marine equipment of IMO resolution MEPC.203(62) which is for most new ships mandatory to obtain EEDI certificate ("Energy Efficiency Design Index"). More energy efficient equipment with lower weight will be required of marine equipment manufacturers. According to different criteria the most common

plants of marine equipment were compared, and because of higher energy efficiency a wider use of regulated electric drives is predicted. The need for weight reduction of the equipment will require more complex technical calculations, optimization methods, as well as more demanding manufacturing technologies. The paper points to possible problems that the marine equipment manufacturers will face in the future. Increased investment costs of "light equipment" will be compensated with lower exploitation costs.

Key words: *EEDI, GHG, design, ships equipment, lightweight*

Uporaba SQL Server Management Data Warehouse za otkrivanje uzroka sporosti u radu SQL Servera

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Sažetak: Otkrivanje uzroka smanjenja performansi SQL Servera je uobičajeni, a često frustrirajući zadatak za administratore baze podataka (DBA), između ostalog, što informacije o sporosti u radu ili *time-out* greškama koje korisnici dobivaju često dođu naknadno, ponekad i kada problem već prođe i teško je uvijek otkriti pravog „krivca“. Uobičajen odgovor administratora baze podataka na pritužbe je uspostavljanje nadzora sljedećih nekoliko dana bez garancije da će se problem ponoviti. U SQL Server verziji 2008 Microsoft je predstavio *Management Data Warehouse* (MDW) bazu podataka koja omogućava nadzor SQL Servera. U tu bazu se skupljaju svi standardni mjerači performansi koji se inače koriste kod analiziranja performansi. Prednost korištenja MDW-a je u tome što se stalno snimaju na stotine brojača koji mjere performanse, a uz jako mali utjecaj toga skupljanja na postojeće performanse. Tako nadzor baza podataka prelazi iz reaktivnog u proaktivni nadzor. Ako se zna točno vrijeme pojave određenog problema lako se može dobiti detaljniji uvid u situaciju koja je u tom trenutku bila na serveru.

U ovom radu prikazano je kako se pokreće MDW, koje izvještaje pruža MDW, a koji se koriste za nadzor rada SQL Servera. Dana su četiri primjera kako je uz pomoć MDW-a SQL DBA grupa u Hrvatskom Telekomu otkrila uzroke blokiranja, pojave zastoja (*time-out*) i globalnog usporenja rada aplikativne podrške koja koristi SQL Server bazu podataka. Naposljetku prikazano je kako se može kreirati novi MDW kolektor za skupljanje *SQL Server Analysis Services* (SSAS) 2008 brojača performansi.

Ključne riječi: otklanjanje poteškoća, dijagnostički nadzor, SQL Server

1 Uvod

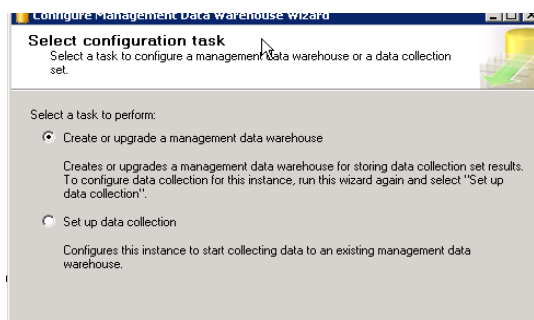
U SQL Server verziji 2008 Microsoft je predstavio *Management Data Warehouse* (MDW) bazu podataka koja omogućava nadzor SQL Servera. MDW sastoji se od skupa komponenti koje omogućavaju skupljanje *PerfMon* brojača kao i unutarnjih SQL Server brojača te spremanje skupljenih podataka u bazu podataka, čime se olakšava administratorima baza podataka otkrivanje problema koji uzrokuju sporost u radu SQL Servera. Pri tome komponente koje rade funkciju snimanja podataka o performansama poznate kao *Performance Data Collector* omogućavaju skupljanje podataka i s više SQL Servera na jedan središnji server i spremanje podataka u dijeljenoj bazi podataka. MDW tako omogućava stalni nadzor performansi na svim postojećim instancama SQL Servera. Također, postoje tri vrste izvještaja koji omogućavaju brzo otkrivanje problema koji mogu uzrokovati smanjenje performansi.

2 Aktiviranje Management Data Warehouse

MDW instalira se zajedno s instalacijom SQL Servera što znači da je besplatan, za razliku od većine dostupnih i kvalitetnih alata za nadzor SQL Servera, ali potrebna je aktivacija za

njegovo korištenje. Prvi korak koji treba napraviti je odabrati SQL Server na kome će se nalaziti MDW baza i na njemu je kreirati. Preporuka je da se koristi poseban SQL Server za nadzor i da se na njega spremaju podaci s više SQL Server instanci.

MDW baza kreira se preko SQL Server Management studija i Management direktorija, izborom čarobnjaka “Configuration Management Data Warehouse”, nakon čega treba odabrati „Create or upgrade a management data warehouse“ (slika 1) i na kraju se unese naziv servera i baze koja će se kreirati na tom serveru (slika 2).



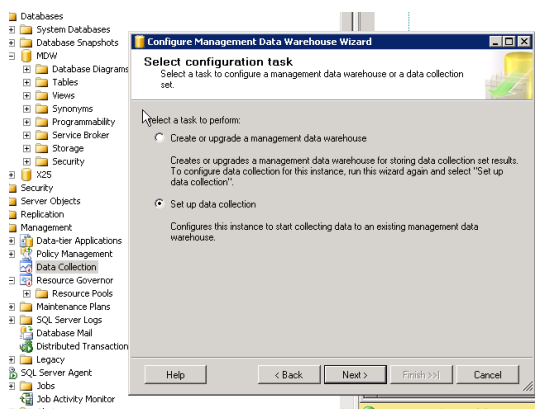
Slika 1. Kreiranje management data warehouse



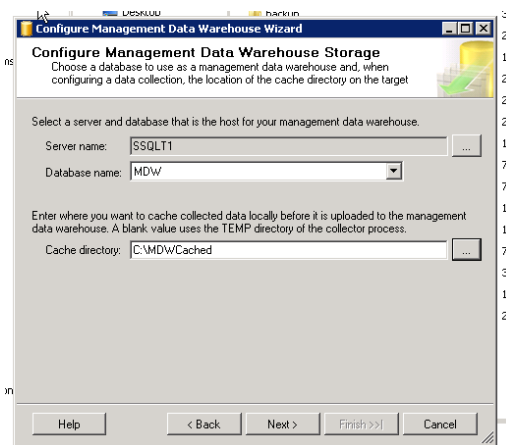
Slika 2. Izbor servera i definiranje naziva baze

3 Startanje Performance Data Collectora

Nakon uspješno završene konfiguracija *Management Data Warehouse* potrebno je startati skupljače podataka preko Management direktorija izborom „DataCollection/Enable Data Collection“, a nakon toga „Set up data Collection“ (slika 3). U posljednjem koraku izabire se SQL Server na kome se nalazi MDW baza i samu bazu te direktorij na disku gdje će se spremati podaci prije prebacivanja u MDW bazu.



Slika 3. Enable Data Collection



Slika 4. Izbor servera, baze i direktorija na disku gdje će se spremati podaci prije prebacivanja u MDW bazu.

Management Data Warehouse Overview: MDW

on SSQLT1 at 25.1.2016 13:48:29

This report provides an overview of the data collector instances that record their data in this management data warehouse. Click on the last snapshot upload time hyperlink to display the report for the associated system collection set.

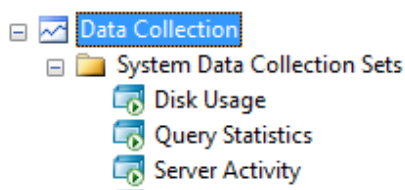
Instance Name	Last Snapshot Upload Times for System Collection Sets		
	Server Activity	Query Statistics	Disk Usage
SSQLT1	25.1.2016 13:45:00	25.1.2016 13:45:00	25.1.2016 13:20:04
SSQLT2	25.1.2016 13:45:00	25.1.2016 13:45:00	25.1.2016 13:23:23
SSQLT3	25.1.2016 13:45:00	25.1.2016 13:45:00	25.1.2016 13:24:28

Slika 5. Primjer kada se u jednoj MDW bazi skupljaju podaci s više SQL servera

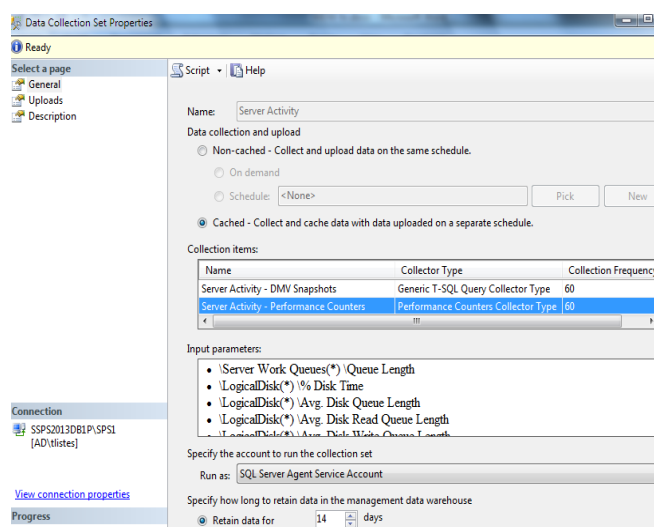
Na ostalim serverima se radi samo korak startanja *Performance Data Collector*a i nakon toga se na zajedničkom serveru počinju skupljati podaci s više servera. Time je omogućen nadzor svih servera s jednog mjesta.

SQL Server 2008 omogućava startanje tri različita skupa kolektora podataka: *Disk Usage*, *Query Statistics*, i *Server Activity*. Nakon startanja skupljanja podataka pojavi se zelena sličica pored svakog kolektora (slika 6).

Ako se pogledaju svojstva pojedinog kolektora, npr. *Server Activity* kolektora može se vidjeti koje sve performanse brojače skuplja ovaj kolektor (*Input Parameter*), kako često, koliko ih dugo čuva te način skupljanja podataka. Kada se odabere *cached* način, kolektor stalno skuplja podatke i sprema ih u direktorij na disku i nakon toga periodički prebacuje u MDW bazu. Npr. *Query Statistics* skuplja podatke svakih 10 sekundi, a *Server Activity* svakih 60 sekundi. U polju „Retain data for“ unosi se broj dana koliko se dugo čuvaju podaci za pojedini kolektor.



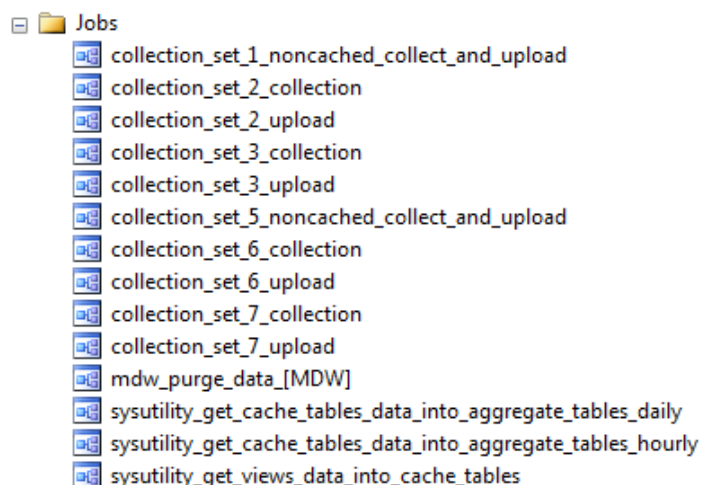
Slika 6. Data collection u SQL Server 2008



Slika 7. Svojstva Server Activity Data collection

Svaki od ovih kolektora ima pridružen niz SSIS (*SQL Server Integration Services*) paketa koji skupljaju podatke, spremaju ih u direktorij na lokalnom disku i zatim prebacuju u MDW bazu kao i skup SQL Agent jobova koji su zaduženi za pozivanje ovih paketa u određenim intervalima.

Nakon startanja *Performance Data Collector*a kreira se više SQL Agent jobova (slika 8) koji su nužni za ispravno funkcioniranje MDW-a.



Slika 8. Job-ovi koji se kreiraju na SQL serveru prilikom startanja skupljanja podataka.

4 Izvještaji dostupni u MDW bazi podataka

MDW baza uključuje tri izvještaja, jedan za svaki vrstu kolektora podataka. Svaki izvještaj ima mogućnost dubljeg ulaska u niže razine zbog analize i detaljnijeg pregleda uzročnika usporenja.

Instance Name	Server Activity	Query Statistics	Disk Usage
SAASDBSQL2\SQL2014	22.2.2016. 17:45:02	22.2.2016. 17:45:02	22.2.2016. 12:00:09

Slika 9. Izvještaji u MDW bazi

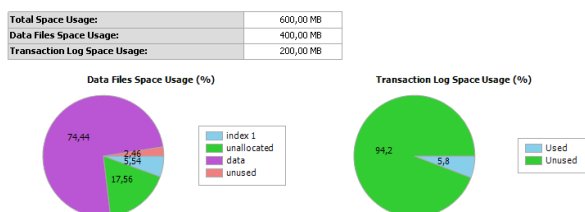
4.1 Zauzeće diska

Prvi izvještaj *Disk Usage* prikazuje koliko koja baza zauzima prostora na disku kao i trend porasta baze. Tako DB administrator može unaprijed reagirati i predvidjeti moguće probleme s prostorom na disku.

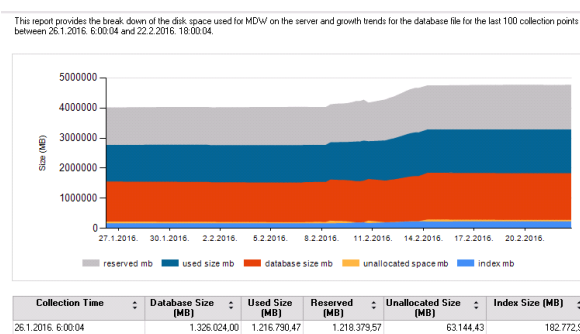
Database Name	Database				Log			
	Start Size (MB)	Trend	Current Size (MB)	Average Growth (MB/Day)	Start Size (MB)	Trend	Current Size (MB)	Average Growth (MB/Day)
T_SQLLDBA	488,31		488,31	0	68,38		68,38	0
master	128,00		128,00	0	50,00		50,00	0
lobilisis_Solution	1.281.524,00		1.507.524,00	8370,37	44.500,00		40.500,00	(148,148)
lobilisis_Solution_Log	562.076,63		572.576,63	388,889	18.700,00		24.000,00	196,296
lobilisis_trace	128,00		128,00	0	50,00		50,00	0

Slika 10. Izvještaj Disk Usage

Ako se odabere pojedina baza, dobije se izvještaj koji pokazuje detaljnije podatke o toj bazi podataka (slika 11), a ako se odabere graf koji pokazuje trend porasta dobiju se detalji za pojedinu bazu.



Slika 11. Disk Usage za pojedinu bazu podataka



Slika 12. Trend porast baze podataka

4.2 Rad SQL Servera

Izvještaj *Server Activity* koristi i performanse brojače i unutrašnje brojače SQL Servera. *Server Activity* omogućava izbor vremenskog intervala unatrag onoliko dana koliko je definirano da se čuvaju podaci u bazi za pojedini kolektor.

MDW - 22.2.2016. 18:30:54 - SZGSERVER3

Specify the start date, start time, and duration of the data that you want to report on.

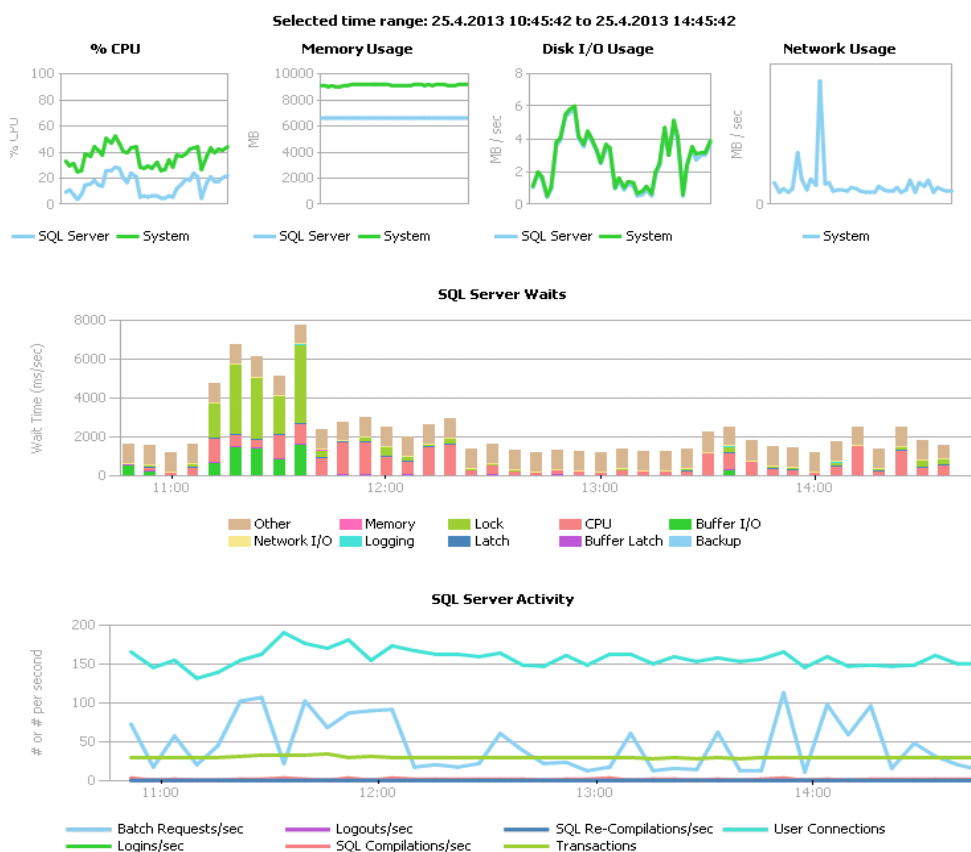
Start date: 22. veljače 2016.

Start time: 14:15:02

Duration: 4 hours

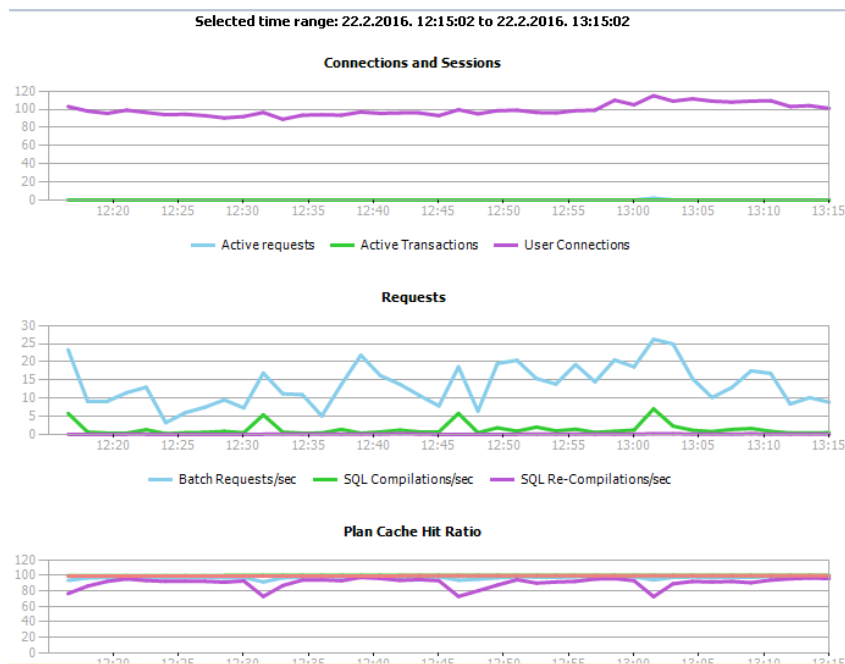
Slika 13. Izbor vremena za koje će biti prikazan izvještaj

Server Activity pruža informacije o korištenju CPU-a, memorije, diska i mreže kako od strane SQL servera tako i od operativnog sustava. Dodatno pokazuje najveće SQL Server waitove kao i ostale aktivnosti na SQL Serveru kao što su broj *Logins/Second*, *Transactions*, *User Connections* itd.



Slika 14. Server activity history

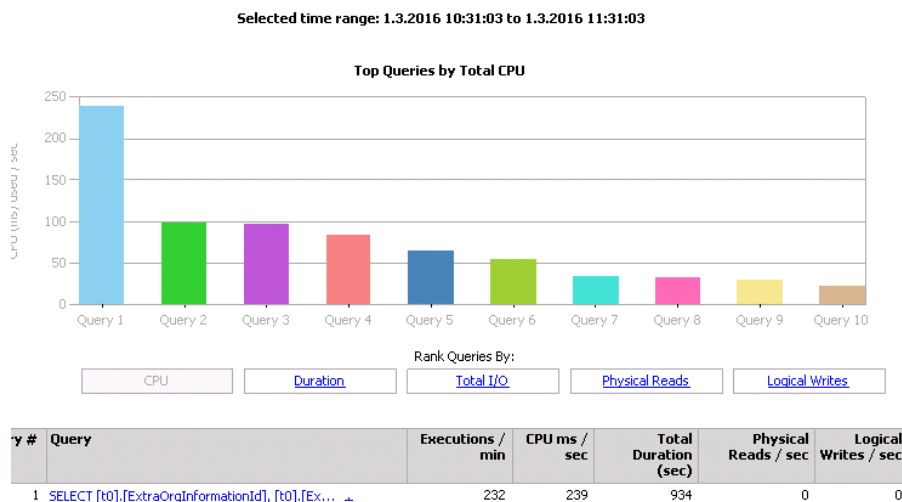
Dalje se može klikom na skoro sve informacije na ekranu ići dublje u podizvještaj za detaljniji prikaz informacija.



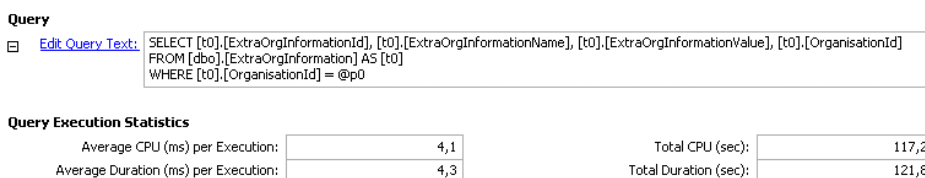
Slika 15. Podizveštaj Server activity history

4.3 Statistika izvršavanja upita

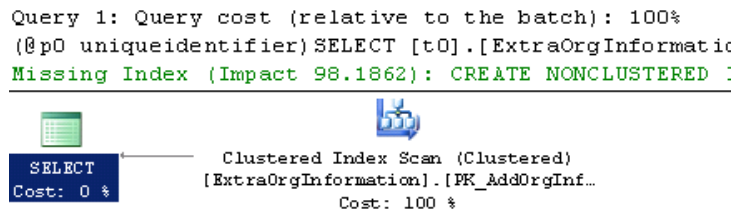
Query Statistics daje izvještaj o izvršavanju upita, pri čemu prikazuje 10 najzahtjevnijih upita po zauzeću CPU resursa. Upite je moguće posložiti po duljini trajanja, ukupnom broju I/O operacija, broju čitanja s diska (*physical reads*) kao i broju čitanja iz memorije (*logical reads*). Nakon identificiranja problematičnih upita, može se detaljnije pogledati i dobiti informacije o upitu uključujući i tekst upita (*query text*) kao i plan izvođenja (*execution plan*) te tako uočiti moguće probleme kao npr. nedostajući indksi (*missing indexes*).



Slika 16. Query Statistics History



Slika 17. Query Details



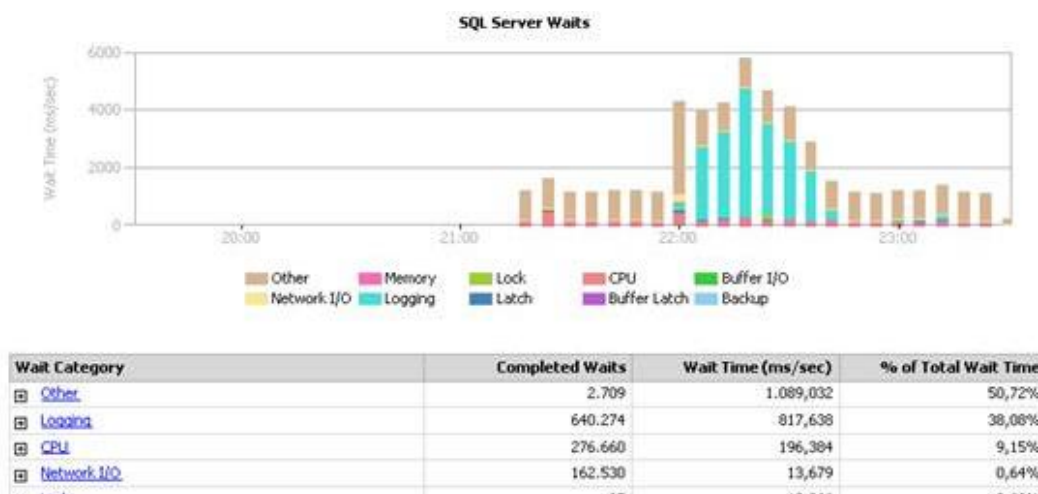
Slika 18. Execution plan of bad query

5 Primjeri korištenja MDW za otkrivanje uzroka sporosti u radu SQL Servera u Hrvatskom Telekomu

Od početka korištenja, MDW se pokazao kao iznimno dobar alat za otkrivanje sporosti u radu SQL Servera kao i uzroka pojave *time-out* poruka korisnicima aplikativne podrške. Osim što je besplatan i dolazi s instalacijom SQL Servera, velika prednost je što se ne mora voditi računa o novim verzijama SQL Servera kao npr. kod komercijalnih alata gdje pojavom nove verzije SQL Servera treba čekati određeno vrijeme da se izda konektor za tu verziju.

5.1 Primjer - sporost diska

Na jednom od sustava korisnici su se žalili na spori rad sustava. Pokretanjem *Server Activity* izvještaja moglo se vidjeti da je *Logging* uzrok najvećim čekanjima na SQL Serveru (*SQL Server Waits*), što ukazuje na problem s diskom na kome se nalaze *transaction log* datoteke jer SQL Server najviše vremena mora čekati da zapiše podatke na disk. Nakon prebacivanja *transaction log* datoteka na drugi brži disk rad aplikacije se znatno ubrzao.

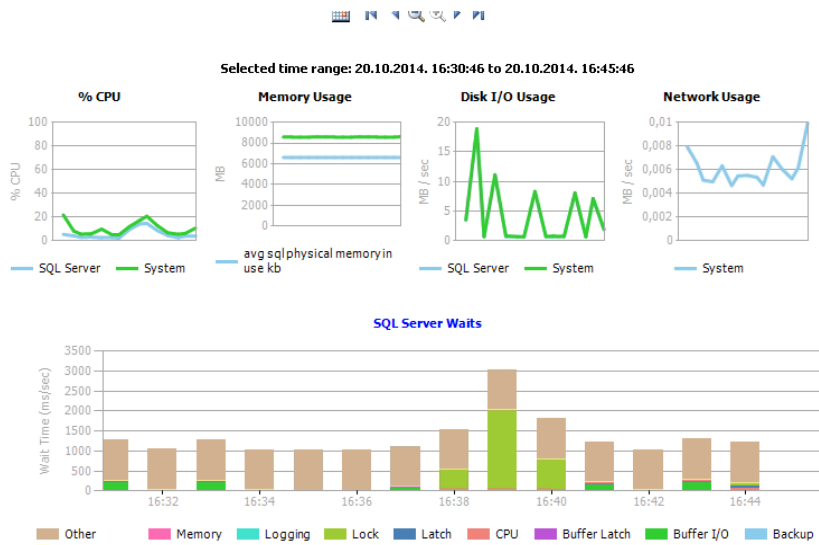


Slika 19. SQL Server Waitovi na serveru sa sporim diskom

5.2 Primjer - problem *time-out* greške

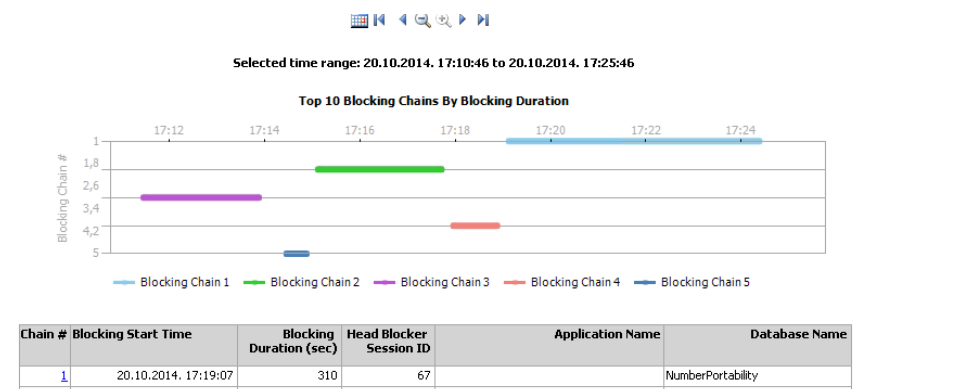
Sljedeći primjer pokazuje kako se pomoću MDW baze podataka mogu otkriti uzroci pojave *time-out* greške na bazi.

Nakon pritužbi korisnika na iznenadnu pojavu *time-out* grešaka iza 16 sati na SQL Server *Activity Reportu* uočeno je postojanje neuobičajeno velikih zaključavanja (*locks*) na bazi u spomenuto vrijeme.



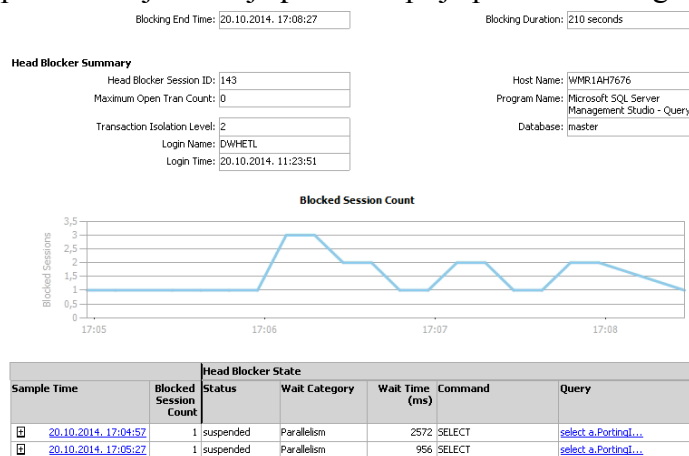
Slika 20. SQL Server Waitovi na serveru s većim zaključavanjima na bazi

Klikom na dio grafa koji pokazuje povećano zaključavanje može se doći do grafa koji prikazuje niz blokiranja s vremenskim rasponima trajanja.



Slika 21. Blocking Chaines

Daljnjim uvidom u izvještaj dobije se konkretan upit koji je izazvao zaključavanje kao i koji korisnik ga je izvršavao te s kojeg računala. Dogovoreno je s korisnikom da pozivanje upita koje je puštao za potrebe izvještavanja pomakne prije početka radnog vremena.



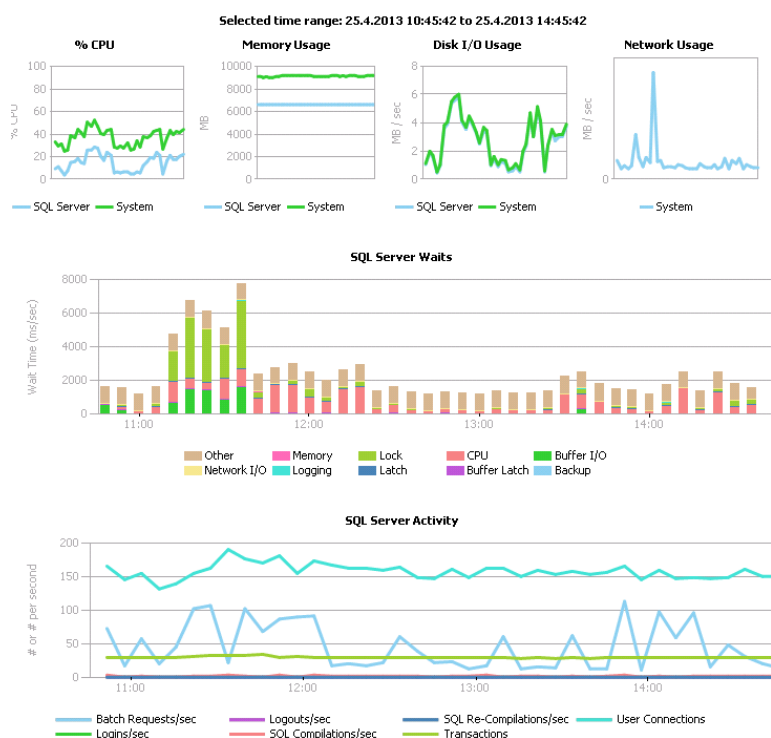
Slika 22. Upit koji je izazvao blokiranje na bazi

U ovom se primjeru može vidjeti kako se zapravo problem prijavljuje često naknadno i DBA grupi je jako teško detektirati uzrok bez posjedovanja ovakvog alata koji omogućava izbor

prošlih vremenskih intervala, i to do razdiobe na 15 min, i tako pregledavati protekle događaje.

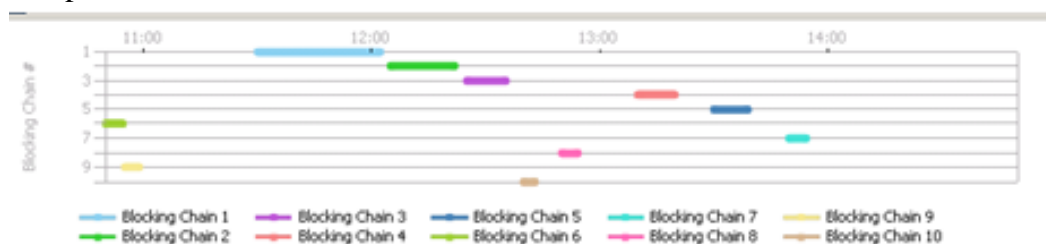
5.3 Primjer – blokiranje upita

Primjer je sličan prethodnom jer se također radi o *time-outima* na bazi za prethodno jutro i traženo je da se otkrije uzrok pojave *time-outa*. Uočena je pojava izrazitih zaključavanja na bazi od 11 - 12 sati upravo kada su se korisnici žalili.



Slika 23. SQL Server Activity report

Klikom na zaključavanja na grafu je vidljiv detaljniji prikaz *Blocking Chain*, kada je započelo blokiranje drugih transakcija i koliko dugo je trajalo, koja aplikacija je izazvala blokiranje i na kojoj bazi podataka.



Chain	Blocking Start Time	Blocking Duration (sec)	Head Blocker Session ID	Application Name	Database Name
1	4.11.2015 11:30:08	1920	721	SQLAgent - TSQL JobStep (Job 0xD63A7BC380A28D4381E)	idom_ePlatforma
2	4.11.2015 12:05:08	990	725	SQLAgent - TSQL JobStep (Job 0xD63A7BC380A28D4381E)	idom_ePlatforma
3	4.11.2015 12:25:18	590	766	SQLAgent - TSQL JobStep (Job 0xD63A7BC380A28D4381E)	idom_ePlatforma
4	4.11.2015 13:10:08	570	372	SQLAgent - TSQL JobStep (Job 0xD63A7BC380A28D4381E)	idom_ePlatforma

Slika 24. Blocking Chain

Otvaranjem detalja blokiranih sesija može se vidjeti da se isti upit koji je izazvao blokiranje pozivao i kroz aplikaciju i preko SQL Server agent joba.

Session	Blocked By	Wait Category (Wait Type)	Wait Time (ms)	Command	Program Name	Host Name
351:0:0	0		0	UPDATE	SQLAgent - TSQL JobStep (Job 0xD63A7BC380A28D4381E)	SAASDB
Query: <code>UPDATE [dbo].[DocumentSubscriptionPropertyProcess] SET [DocumentSubscriptionProp...</code> Status: running Login Name: TCloud\sqlsaas Request Duration: 9059948 ms Request CPU: 677903 ms Request Physical Reads: 108 Request Writes: 10680 Last Request Start: 4.11.2015 10:25:01						
Database Name: idom_ePlatforma Pending IO Count: Session CPU: 0 ms Session Physical Reads: 0 Session Writes: 0 Last Request End: 4.11.2015 10:25:01						
146:0:0	351	Lock (LCK_M_TX)	0	UPDATE	.Net SqlClient Data Provider	EBPPBIZTALK2
Query: <code>Update DocumentSubscriptionPropertyProcess Set CurrentPropertyProcessStateID = @...</code> Status: suspended, waiting for OBJECT: 34:1264163699:9 Login Name: TCloud\Idom_BizHostInst Request Duration: 6512 ms Request CPU: 0 ms Request Physical Reads: 0 Request Writes: 0 Last Request Start: 4.11.2015 10:42:11						
Database Name: idom_ePlatforma Pending IO Count: Session CPU: 0 ms Session Physical Reads: 0 Session Writes: 0 Last Request End: 4.11.2015 10:42:11						
152:0:0	351	Lock (LCK_M_TX)	0	UPDATE	.Net SqlClient Data Provider	EBPPBIZTALK2
Query: <code>Update DocumentSubscriptionPropertyProcess Set CurrentPropertyProcessStateID = @...</code> Status: suspended, waiting for OBJECT: 34:1264163699:8 Login Name: TCloud\Idom_BizHostInst Request Duration: 45379 ms Request CPU: 0 ms						
Database Name: idom_ePlatforma Pending IO Count: Session CPU: 0 ms						

Slika 25. Blocking session

Jednostavno se može dobiti SQL Text upita koji je izazvao blokiranje drugih transakcija.

`UPDATE [dbo].[DocumentSubscriptionPropertyProcess]`

`SET`

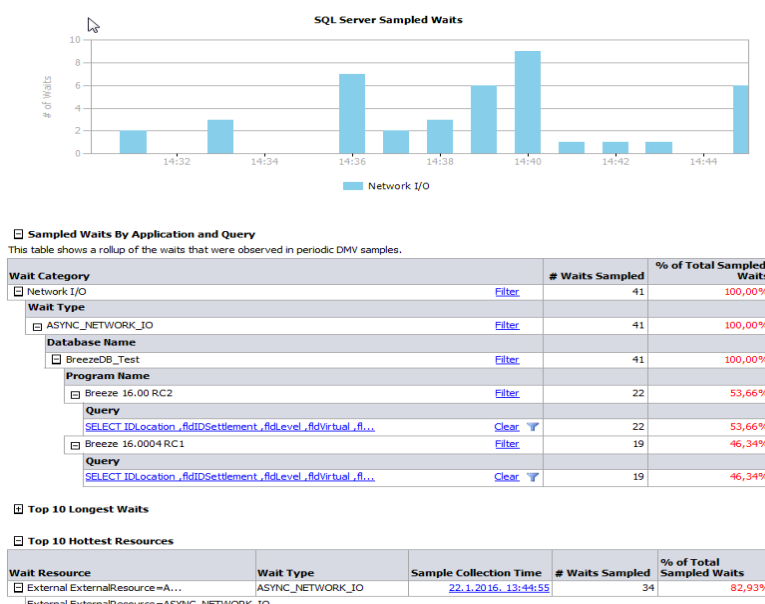
`[DocumentSubscriptionPropertyProcess].[SubscriptionPropertyGuid]`
`[SubscriptionProperty].[Guid].[DocumentSubscriptionPropertyProcess].[SubscriptionPropertyStatusID] = [SubscriptionProperty].[StatusID]`

.....

Da bi se spriječili slični problemi dogovoreno je zaustavljanje izvođenja joba i povremeno pokretanje u vrijeme najmanjih aktivnosti na aplikaciji.

5.4 Primjer - problemi na mreži

Prijavljeni su problemi u radu aplikacije na pojedinim lokacijama. Uvidom u MDW izvještaje uočen je velik broj *Network I/O waitova*. Ovakvi *waitovi* se mogu javiti i u situacijama kada SQL Server šalje veće količine podataka klijentu koji ih ne stiže u kratkom vremenu učitati. Međutim, pokazalo se da su u ovom slučaju problemi u radu uzrokovani slabom propusnošću mreže.



Slika 26. Problemi na lokalnoj mreži

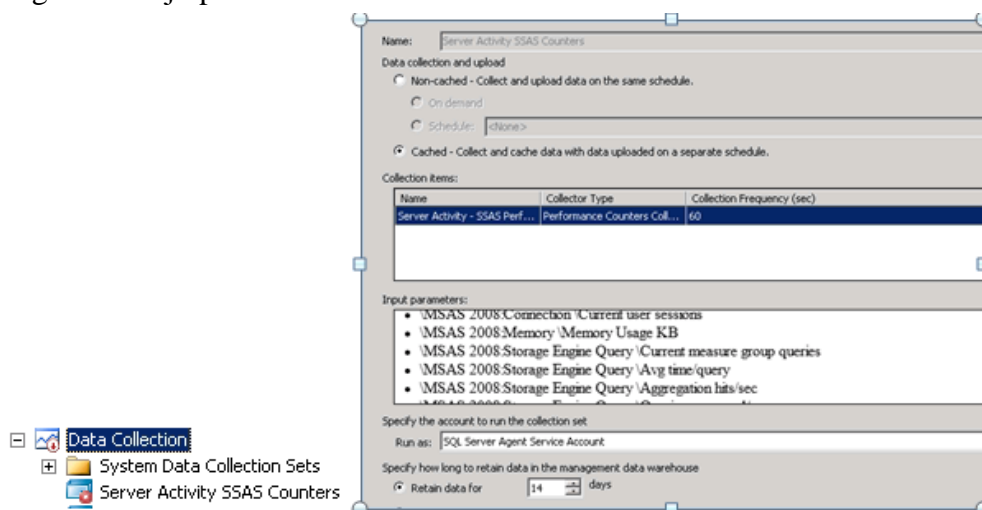
6 Kreiranje vlastitog kolektora za skupljanja Microsoft SQL Server 2008 Analysis Services (SSAS) performanse brojača

Iako MDW inicijalno nema definiran kolektor koji skuplja podatke o *Analysis Services*, a kako postoji potreba za nadzorom SSAS-a, MDW omogućava kreiranje novog kolektora za skupljanje SQL Server 2008 Analysis Services performanse brojača. [2] Prvo je potrebno napraviti skriptu za kreiranje kolektora koju treba izvesti u MDW bazi. Prikazan je dio skripte za kreiranje kolektora *Server Activity SSAS Counters* za skupljanje dijela SSAS performanse brojača:

```
Begin Transaction
Begin Try
Declare @collection_set_id_1 int
Declare @collection_set_uid_2 uniqueidentifier
EXEC [msdb].[dbo].[sp_syscollector_create_collection_set] @name=N'Server Activity SSAS Counters'
, @collection_mode=0
, @description=N'Collects top-level performance indicators for the computer and the Database Engine. Enables analysis of
resource use, resource bottlenecks, and Database Engine activity.'
, @logging_level=0, @days_until_expiration=14
, @schedule_name=N'CollectorSchedule_Every_15min'
, @collection_set_id=@collection_set_id_1 OUTPUT
, @collection_set_uid=@collection_set_uid_2 OUTPUT
Select @collection_set_id_1, @collection_set_uid_2
Declare @collector_type_uid_5 uniqueidentifier
Select @collector_type_uid_5 = collector_type_uid From [msdb].[dbo].[syscollector_collector_types]
Where name = N'Performance Counters Collector Type';
Declare @collection_item_id_6 int
EXEC [msdb].[dbo].[sp_syscollector_create_collection_item] @name=N'Server Activity - SSAS Performance Counters'
, @parameters=N'<ns:PerformanceCountersCollector xmlns:ns="DataCollectorType">
<PerformanceCounters Objects="Processor" Counters="%Processor Time" Instances="_Total" />
<PerformanceCounters Objects="Process" Counters="%Processor Time"
End Catch; [2]
```

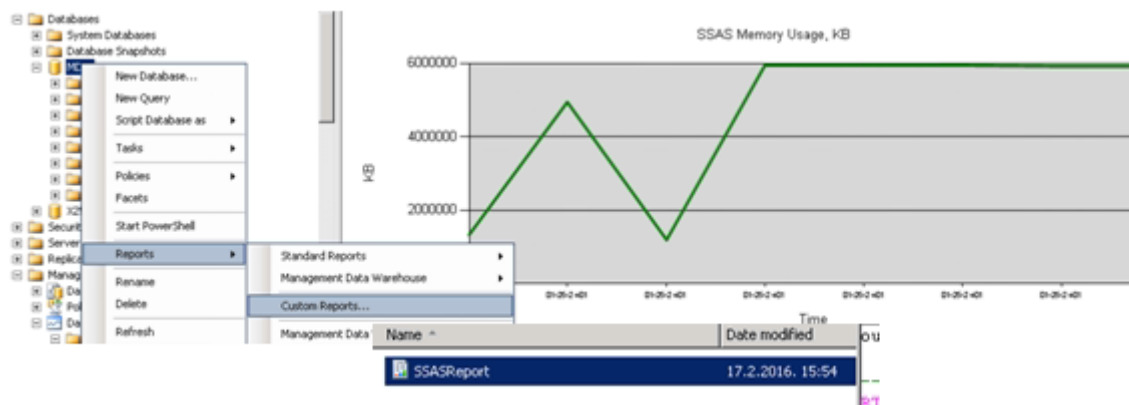
Nakon izvođenja skripte u popisu *Data Collection* pojavi se novi kolektor *Server Activity SSAS Counters* koji je potrebno aktivirati da bi počeo skupljati podatke.

Nakon aktiviranja se mogu pogledati i svojstva tog kolektora. Vidi se koje sve brojače skuplja i koliko dugo se čuvaju podaci u bazi.



Slika 27. Karakteristike Server Activity SSAS Counter

Nakon kreiranja i startanja kolektora potrebno je napraviti izvještaj za prikazivanje tih podataka jer u MDW ne postoji takav izvještaj.



Slika 28. Izvještaj SSAS Memory Usage kreiran u MDW bazi podataka

7 Zaključak

Management Data Warehouse (MDW) nova je komponenta SQL Server Management Studija koja predstavlja skup SQL Server komponenti koje administratorima SQL Server baza podataka omogućava znatno kraći proces otkrivanja uzroka pada performansi i blokiranja u radu. Osnovne komponente MDW-a su kolektori podataka koji skupljaju sve podatke o performansama SQL Servera. MDW je baza podataka u koju se spremaju svi ti podaci i interaktivni izvještaji koji omogućavaju lako pretraživanja podataka. Značajna prednost je što se svi ti podaci mogu skupljati na jednom serveru i s njega nadzirati sve postojeće instalacije SQL Servera verzije 2008 i više. Tako MDW omogućava proaktivno podešavanje, analizu prošlih događaja, statistiku izvođenja upita u određenom vremenskom periodu, predviđanja porasta veličine pojedine baze podataka te planiranje potrebnog diskovnog prostora. U radu je pokazano kako se lako dobije odgovor na pitanje što ili tko je uzrok najvećih čekanja (*waits*) na pojedinoj instanci, koji upit blokira druge i zašto, koji upiti troše najviše resursa, koja baza najbrže raste i slično. Interaktivnost upita omogućava dublji uvid u područje interesa i dobivanje detaljnih podataka o uzroku problema.

Dodatno je pokazano kako se MDW može proširiti s vlastitim skupom kolektora i prikupljati podatke koji se inače ne prikupljaju u osnovnoj instalaciji MDW-a.

Velika prednost ovog alata je u tome što je lako dostupan i besplatan te dolazi sa svakom novom instalacijom SQL Servera. U SQL Serveru 2014 MDW je dodatno proširen s kolektorom *Transaction Performance Collection Sets* pomoću kojeg se u MDW bazi dobije pregled *Transaction Performance Analysis* koji nakon određenog perioda skupljanja podataka preporučuje koje tablice i pohranjene procedure bi bilo dobro prebaciti u memoriju i na taj način značajno povećati performanse korištenjem nove mogućnosti koju donosi SQL Server 2014 In-Memory OLTP (tzv. Hekaton).

Može se postaviti pitanje u kojoj mjeri uspostavljanje skupljanja brojača performansi može dodatno opteretiti SQL Server. Istraživanja su pokazala da je opterećenje zanemarivo prema prednostima i može se odraziti na povećanu iskoristivost CPU-a za oko 4 % i na povećanje zauzeća prostora na disku za 250 - 300 MB dnevno.

Ovim radom pokušalo se potaknuti administratore SQL Server baze podataka na korištenje *Management Data Warehouse* jer im može uvelike olakšati rad, ali u praksi je trenutačno malo zastupljen.

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Using SQL Server Management Data Warehouse for performance troubleshooting

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Abstract: Troubleshooting SQL Server performance problems is a common and often frustrating task for SQL Server DBAs. Performance problem reports arrive after they have occurred. The typical response is to setup limited monitoring for a few days or to attempt to replicate the problem on a copied database.

SQL Server 2008 introduces the Management Data Warehouse (MDW) to SQL Server Management Studio for streamlined performance troubleshooting. MDW is a set of components that enable a database developer or administrator to quickly track down the problems that could be causing performance degradation. The advantage of MDW is that it is possible to store performance data from a number of SQL Servers in one central location, an isolated server and collect in parallel SQL Server and Operating System performance counters. This data is collected by a collection set on each server and stored in a shareable management data warehouse (MDW). After collecting data, the built-in reports can be used for streamlined performance troubleshooting.

The advent of the Management Data Warehouse (MDW) changes the environment by allowing continuous performance monitoring hundreds of performance counters with little effort or performance impact. This is a significant change from reactive to proactive management. The DBA needs to know the time when the problem occurred and MDW allows immediate detail analysis.

This paper shows how to run MDW, after that reports provided by MDW, which is used to monitor operation of SQL Server, and presented. A few examples illustrate how the use of MDW SQL DBA helped a group in the Croatian Telekom to discover the causes of blocking, downtime (time-out) occurrences, and slowing global operation application using SQL Server data base. Finally, it is shown how one can create a new MDW collector for collecting SQL Server Analysis Services (SSAS) 2008 performance counters.

Key words: *troubleshooting, performance and diagnostic monitoring, SQL Server*

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Track 4

Interdisciplinary
Teaching and Learning

Cross-structural quality within a VET provider organization

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Abstract: In this paper we show how certain management tools may be applied to a Vocational Education and Training (VET) provider organization. Firstly, we introduce the tools we view as important and useful in management. We apply three frames for managing an organization: evaluation/self-assessment, risk analysis and strategy. Secondly, in order to get a holistic view of quality at organizational level, we apply our process diagrams and quality manual and use the metrics defined by the Ministry of Education and Culture in Finland. Thirdly, we show what using these tools leads to when talking about human resource management and ICT in education. For human resource management, we have made a personnel program that is based on strategy and is evaluated annually as a part of quality assessment. In the personnel program, the management tools and the professional competence requirements are defined. Also, employee training is included in the personnel program and ICT plays an important part in it. In our strategy, we find points that emphasize the use of ICT. When all this is combined with current trends in education and learning, we get a well-defined plan for the development of ICT in education. Included in the paper is an example of our plan and our experiences and positive results when applying these tools in a holistic way across the organization.

Key words: *Educational quality frame, self assessment, ICT-strategy in VET, HRD and participation*

1. Introduction

In this article, vocational education and training (VET) is discussed with an eye toward the future, and the conventional quality framework classification (EFQM/CAF) partly used in the subchapters. This allows for a comprehensive overview of operations and achievement of results. First, we talk about the future plans of vocational education in Finland. Then we tell about the challenges that especially Point College meets from the management's and educational point of view. In chapter four we introduce three different frameworks: /self-assessment, risk analysis and strategy and then we also discuss some points to be considered when analyzing the assessment results. After that we present our personnel program (chapter 5) and plans for developing the pedagogical use of ICT

(chapter 6). In chapter 7 we introduce our positive results when applying this model and in the last chapter we talk about the future of vocational education in Finland.

2. Future state and issues in vocational education in Finland – the coming reform

2.1 Strategy and decision-making

The status of VET as part of the Finnish education system has undergone radical changes over the past 20-30 years. Curricula were also reformed in 2015. A reform, which will generate EUR 190 million in savings and introduce a new funding model, is being implemented. The flexibility of the education system to meet the needs of its clients and employers are being put to the test with numerous structural and content changes.

It will become impossible to anticipate future trends over the long term due to the rapid rate of change, even if a Finnish education provider, such as Point College, has gotten accustomed to doing strategy work for years. It will be necessary to come up with new funding models and development work carried out using project funding can no longer be done in an isolated, fragmented and redundant manner (or with funding from multiple funding agencies). Instead, national and regional coherence is of the utmost importance in achieving cooperation, trust and real results. Funding is shrinking, which requires the development of creative solutions for Finland's highly functional system and the absolutely necessary streamlining of bureaucracy and administration. This means the radical restructuring of VET.

Finland is adopting entirely new models for authorizations to provide education. These models provide Point College with a certain amount of freedom to target its offerings to working life in its own field. Common regional policy programs for the provision of education are binding together all education providers. The regions will see the formation of synergistic innovation alliances, which promote regional vitality and competitiveness through education and development projects. In Porvoo, this also means close physical proximity between universities of applied sciences and Point College.

From a VET standpoint, the anticipation of real, regional labor and educational needs becomes extremely important, where a specification of needs leads to decisions on what education services will be offered in what field. At the same time, it will be possible to discontinue old services, in which employment is no longer possible. Correspondingly, new professions/products and qualifications must be created quickly. Qualifications are combined creatively and the education provider's ability to create a new combination for a qualification/degree (combined electrician and builder and plumber, for example). VET creates a concrete innovation ecosystem. Indeed, 96% of innovations come from the actual performance of work.

At present, an education provider in Finland must have approximately 30-40 plans, constantly updated, to steer its operations.

Operational steering is being clarified, digitized, rationalized and, above all, accelerated. Operational steering is also being linked to the assessment of educational operations and learning. The Ministry of Education and Culture (MEC) criteria used at Point College is also constantly being developed, and the government sets guidelines for education provider reporting and assessment with consolidated charts of accounts, indicators and data systems, thus facilitating real-time monitoring and openness. Compatibility between different data systems will allow for sensible administration and reporting. Today, funding is set (per capita) based on a biannual accounting day. In the future, the aim is to begin continuous monitoring through real-time reporting.

2.2 Partnerships and resources

Cooperation with employers is increasing exponentially. Workplace instructor training and evaluator training require implementable models in order to succeed, particularly in SMEs. This must be resourced in an entirely new way, in order to ensure that the increasing entry of students into working life will be at all possible. Working life and places of employment must be given "workplace instructor resources", in which a vocational teacher serves in the field as a workplace mentor, helping to create learning support functions for the places in question.

Cooperation with comprehensive schools and, correspondingly, universities of applied sciences must be close, genuine and concrete. Working in close cooperation at different levels of the education system makes it possible to build bridges, paths and channels, which are used to support and promote a faster track to graduation, thus saving society money. To the same extent, cooperation with, for example, universities of applied sciences allows for the differentiation of one's own operations elsewhere, thus making it possible for a teacher in upper secondary vocational education to teach a smaller group and provide excellent support for them. The most important thing is that the network of educational institutions will be considered a unified and professional actor by employers. In this regard, it could be possible to even appoint joint personnel to coordinate regional on-the-job learning across actor, organizational and administrative boundaries. This would save money, but it would also introduce shared operating methods and models, which would be seen by employers as a "one-stop shop".

Where advancements in digitalization are concerned, ICT development is a challenge, in which pedagogical aspects are a question of teacher motivation and are related to different competence challenges than the administrative ICT solutions.

The continued pressure exerted by finances and funding to cut costs further forces vocational education to tailor, productize and set custom pricing for the education it provides. Whether to pay for walls and floors or for high-quality education are questions that are constantly found on the agenda. What constitutes the generation of vitality and competitiveness in each sector and what is well-being? What are the roles and missions of vocational education and how does the government steer regions and actors so as to avoid redundancies? Financial management and its attendant data systems, consolidated charts of accounts and reporting are evolving into real-time functions. Finances and operations are being integrated to form a more clearly-defined entity. In financial systems, greater emphasis is being placed on the possibility for simulation, which allows for quick responses to any fluctuations in cash flow in the new financing model.

3. Point College as a VET provider

3.1 Management and supervision

Changes in vocational education pose a challenge to management and supervision at every level, also at Point College. The modern concepts of learning, human beings and management must go hand in hand, so that engaging in sensible development work with organizations is, as a rule, even possible. People should be committed, motivated and even inspired, with even more time being devoted to this - even here at Point. In dealing with change, management should be on everyone's agenda, where the ability of management to tolerate uncertainty is also measured. The networking of managers on all levels becomes very valuable, as does the co-operation between in-house experts. New job descriptions and the continuous revision of operational guidelines are constantly on the agenda at Point. Communications should play a crucial role, even though it is already well accounted for at Point College.

Occupational well-being and coping on the job require an exceptional effort in management work. Supervisors must be able to cope as well as support their subordinates in coping with their own work. A constantly evolving working life, longer careers and, correspondingly, an increase in the specialized needs of students require a much greater effort than before. The participation of managers in specifying regional educational needs and decision-making together with other actors in the region should be of paramount importance.

3.2 Learning, instruction and core functions

All success in vocational education is based on the continuous development of core functions and pedagogy. It is founded on the idea that learning and instruction meet needs and expectations. The equivalence of qualifications with working life needs must be constantly updated. The mechanism for establishing new qualifications and eliminating old ones must be considerably faster.

The demarcation of vocational upper secondary qualifications, further vocational qualifications and specialist vocational qualifications must be examined in order to create a sort of "puzzle/module" approach, in which suitable pieces are combined to form new qualifications and the boundaries between youth and adult qualifications are blurred.

The development of pedagogy in the adoption of new learning concepts must be done decisively, so that the vocational education will not be a case of "the shoemaker's children going barefoot". New types of coaching, mentoring and gamification methods are coming to the forefront and motivating students is important. The range of teacher skills in using different methods and tools must be increased. The use of comprehensive projects and contracts is also increasing, achieving collaborative, long-term learning experiences. Co-teaching breaks down conventional barriers and the concept of time is upended in the face of competence-based approaches. Personal paths and the recognition of prior learning are moving instruction in a more guidance-oriented direction. There will be more combined studies, in which learning in a virtual environment and project-type collaborative productions are rotated. This creates entirely new kinds of job descriptions for teachers. There is a need for guidance counselors, tutors, mentors, school coaches, job coaches, job coordinators and other, interesting new positions. These job descriptions must be made carefully, in order to create a meaningful role for all actors in new operating approaches.

4. Three frameworks for managing an organization and a holistic view of quality

4.1 Quality management, risk analysis and strategy

Point College has made an effort to combine three different frameworks, so that administration can be developed. They are evaluation/self-assessment, risk analysis and strategy. All of these must be carried out in accordance with the principles of good governance and, for example, mandatory audits, and they must all create functions and procedures aimed at the future. However, it must be possible to consolidate and define them into a singular future. The two figures below illustrate this model.

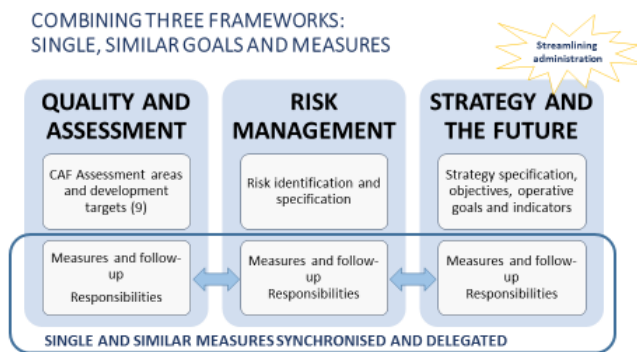


Figure 1 Combining three frameworks

The quality and assessment model has been set for Point College by combining MEC assessment criteria and the CAF. The CAF (Common Assessment Framework, which is a system for the public sector), is like a sub-framework of the EFQM (European Framework of Quality Management). Point College has already used these tools and frameworks, as well as their indicator ideas, four times in conducting its own self-assessment.

In EFQM/CAF models, the indicators involve the following results: customer results, people results, society results and business results. Indicators are always divided into performance indicators and satisfaction indicators. The self-assessment of operations and results has been geared toward common strategic focal points and measures. Personnel, students and employers have been involved in self-assessments. Personnel have been able to make comments on the final assessment with a method called gallerywalk.

Point College operations are described in the Quality Manual of Point College and operational processes. Operations are steered by an organizational model, process hierarchy, management system and operational guidelines, along with their job descriptions. There is also a large number of plans, guidelines and programs, which set the future course for Point College.

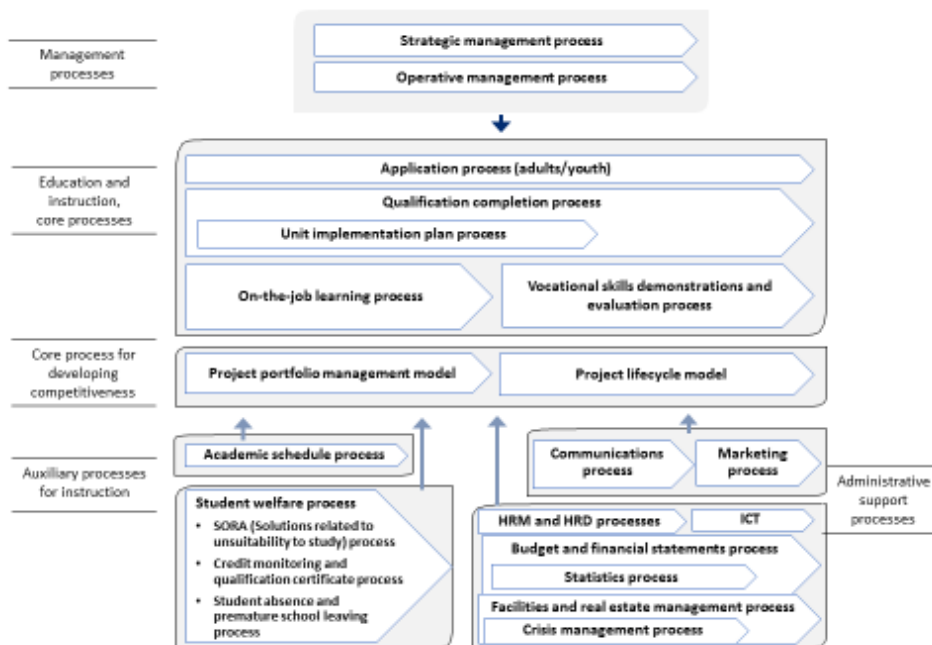


Figure 2 Point College - Process hierarchy

4.2 Some remarks to be considered when analyzing the results

Student results

Students begin their studies at different times and there are several admissions during the academic year. Graduation times vary widely. Students are more independent or, correspondingly, receive more targeted support for specialized needs. Half of each age group apply for vocational studies, with students eagerly earning new qualifications. Student satisfaction has increased, with the variety of study paths ensuring that fewer students will drop out of their study programs than do at present. Because the new models may include various combinations and switching of fields, seeking a study path is like putting a puzzle together. There are now very few marginalized youths - only those following or looking for their own paths. Students are now more international and international mobility is on the rise with the availability of excellent financial assistance.

People results

In the new solutions the number of personnel may be lower for permanent staff, while the network of experts will be more extensive on the working life side of things. The number of qualified teachers is growing because pedagogical challenges are growing. Coping on the job and occupational well-being must be ensured in the changes, so that the number of sick leaves and cases of fatigue will not increase as the aging workforce is renewed. It is possible that personnel satisfaction could be improved, but this would require a renewal of management.

Society results

The profile and brand of vocational education are made permanent through skilled communications and operations that must be carried out in much closer cooperation with working life and students. Messages concerning partnership and participation should also be aimed at several targets using quantitative indicators. This will serve to confirm the establishment of cooperation and partnership. One societal message might include emphasizing agreement and trust in the reform of vocational education as well as how trust capital is built.

Vocational education should be prominently mentioned when discussing the upper secondary level alongside general upper secondary schools. Vocational students should not be underestimated, nor should they be considered as somehow inferior to students in other forms of education. Moreover, it should not be assumed that they were forced to take the vocational education route because they did not make it into a general upper secondary school. Messages coming from the sphere of vocational education should emphasize success, competence and professional skills in core operations, not merely communications from an administrative and production organization standpoint. The skills function should actively taken advantage of in this respect.

Business results

The reform of vocational education has made it possible to get rid of unnecessary cost items. The vocational education generates employment and promotes further studies more effectively and precisely. On the other hand, “exchange training” and building new careers becomes easier and faster due to the new, but more clearly defined qualification structure and, in part, to units common to multiple qualifications. Elective studies have been optimized into a regional course offering that transcends educational structures.

Personnel qualifications and money invested in their development produce increasingly better results, and teachers are more at workplaces to support learning. Facilities and equipment in a school environment have been minimized and schedules have been used throughout the year and each day. The Finnish Government and EU have been able to meet the requirements for reform by

sensibly combining different forms of funding much more effectively and clearly than before. Forms of funding and the number of funding agencies have sharply fallen, so it has been possible to allocate funding appropriately to the reform of vocational education.

5. Human Resource Management (HRM)

5.1 Structure and emphases of the Personnel Program

The management of personnel processes is primarily assigned to upper management and immediate supervisors. Managing personnel processes is an integral part of the daily routine for supervisors and managers, not a discrete part.

The Personnel Program, or strategy, is a very important management tool, in which we have defined the most important principles and processes in management and leadership. The program also defines some rules of conduct.

The basis for the Personnel Program is specified in the organization's strategy (vision, mission, values, business idea and the strategic objectives). The basic elements of the Personnel Program are: descriptions of the whole management system and rules of procedure, structure of the staff, description how cooperation and occupational safety are carried out, our core processes of staff management (a more detailed presentation will follow) and finally, monitoring methods and operational assessment (a more detailed presentation will follow).

5.2 Core processes of staff management

In the following we will introduce the core processes of staff management and the tools we use for monitoring and assessment.

Our image as an employer and ensuring attractiveness

As our image as an employer is particularly affected by active communications, we have invested in our marketing and brand communications. Attractiveness is influenced by personnel and customer feedback, which is actively monitored and used.

Managing employment relationship lifecycles

This process includes everything from recruiting to the end of the employment relationship. Other key points are: Introduction program (to the workplace and one's own tasks), wages and benefits, job descriptions, working hours and individual resource planning, rewarding the staff, absence and attendance management and substituting, work-related travel, occupational health care and insurances.

Managing competence and performance

In the management of everyday performance and the long-term development of competence, we have defined the following areas as vital: assessment of the current status of competence and developmental needs; continuous maintenance and development of competence; motivation and encouragement; meeting and information procedures; development discussions and role of work groups. The needs are evaluated annually and the Employee Training Program is defined.

Required areas of professional competence are defined in the Point Competence Circle, which includes four themes: individual vocational competence, work community and network competence, strategy competence and self-management skills.

Managing occupational well-being and work ability

Occupational well-being, coping and maintaining work ability comprise a key area, which must be addressed in management. We use an existing and proven occupational framework:

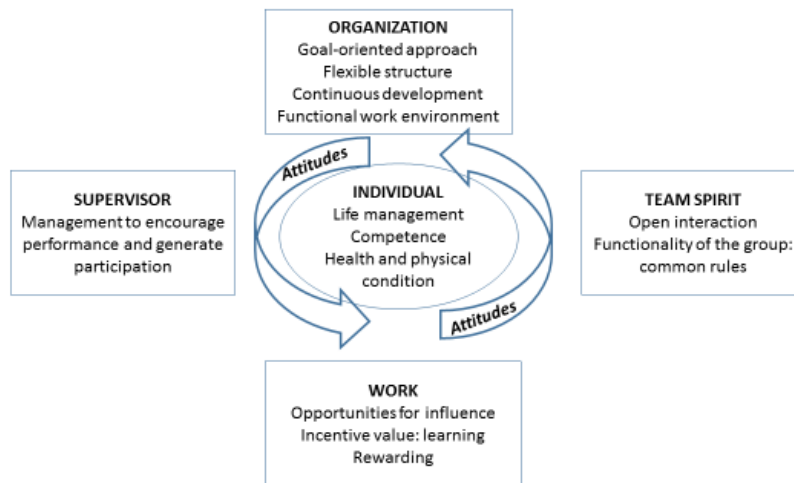


Figure 3 Framework for Occupational Well-being (Manka 1999, 2008)

The management of occupational well-being also includes the following five areas: Early intervention model – guidelines for dealing with inappropriate behavior; Work community communications and skills; Independent self-management and ensuring one's own well-being; Self-management; Recreation and shared events.

Confirming the personnel plan and ensuring organization resources

In operative management, the focus is on managing sub-entities and supervisory work in daily routines, which are used to ensure the planning, execution and monitoring of operational resources. *Anticipation – Planning – Implementation – Reporting – Assessment* is an on-going management process where supervisors must take into account the whole scale from strategic objectives to daily tasks of each member of the staff.

Follow-up and assessment

Tools used in the monitoring and assessment of personnel management are annual personnel surveys and an assessment of operational and performance quality. The indicators used in monitoring comply with EFQM/CAF indicators, whose dimensions are internal performance and personnel satisfaction. The conclusions drawn from assessment are included in the following year's operational plan, which also involves a revision of the personnel plan, if necessary.

5.3 From Professional Competence Requirements to Employee Training Program

Part of the Personnel Part is Employee Training Program. Each year, we define the key points on how to develop the competencies of the whole staff. The Employee Training Program is drafted and updated each year at the cooperation negotiations. The employer is under no obligation to provide training, but employees may demand that the employer provide an explanation as to why an individual or group has not received any training. We have specified that all personnel undergo minimum three days of training each year.

The training plan is based on the employer's operational needs and the long-term employment opportunities while in the service of the employer. When drafting the plan, attention should be given to anticipated changes occurring the enterprise's operations, which may have an impact on the number, structure or vocational competence of personnel.

As mentioned above, our organization will be undergoing several changes in the coming years. Due to the nature of the changes, ICT competence in particular assumes a special significance, even strategically, and an investment is made in it.

We have three focal points 2015-2016: 1) Support for implementation of the new curriculum, 2) ICT: pedagogical and tool-related workshops and 3) Specialist Qualification in Business Management & special needs teacher, guidance counselor and pedagogical studies.

6. ICT as a supportive function for education

First, we will present some points in our strategy that define the role of the ICT function. Then, we will introduce the most important new principles that should be implemented in education. These two things are linked with current trends in ICT and, based on these, we arrive at a plan for the management of pedagogical ICT function as well as a plan for future development goals.

6.1 How to define a pedagogical ICT strategy

In general, a strategy for the whole enterprise can already directly include the role of ICT. If this is not the case, then the ICT strategy is structured in such a way that it will support the main strategy, thus allowing it to be applied in the function of the enterprise.

In our strategy, there are several points that emphasize the use of ICT and require that the college provides digital learning tools to support its education and training function. Our strategy states that "We improve our ability to provide...high quality trilingual and international teaching." The current thinking is that we need information technology for high quality teaching because it significantly increases the possibilities for using different learning methods. It is therefore logical that we have expressed this idea--explicitly-- in our strategy: "We offer flexible models and modern technology to support different learning styles, individuality and development of expertise."

In addition to this, our strategy also includes a statement which obligates the institution to provide teachers with the support they need in their work. Our strategy states that "We support our personnel in times of change". The learning environment is currently undergoing change, moving from a traditional chalkboard-classroom to a modern, partly virtual learning environment which is facilitated by digital tools. As a result, in order to fulfill our strategy's obligation to support personnel, we have provided them with both technical and pedagogical ICT support. Pedagogical ICT support means that we have an ICT specialist, who teachers can contact when they want to try new methods or tools that they are not sure about. The teachers can also request instruction when they want to learn how to use new programs or educational services that are available online.

6.2 Some current trends in vocational education and learning in Finland

Next, we will discuss some current vocational education trends in Finland. The national core curriculum for vocational education was reformed in 2015, with a strong shift to using competence as a measurement instead of time. This means that, in all evaluation, it is important to recognize the competencies a student has achieved. Using a certain amount of time for training is not obligatory if it seems unnecessary.

Another key principle is that subjects are not taught separately, but rather should be integrated with each other in the same way they are linked in work processes. This allows students to naturally discover what the motivation is for studying, e.g. using the student's mother tongue in practical nurse education.

In general, pedagogy has long placed an emphasis on student learning, not teaching. Participation, a student-centeredness and cooperative learning are good examples of the recommended approaches that teachers are encouraged to apply in their work.

In addition, leaving the classroom for the "real world" is highly recommended in all education, particularly vocational education. In vocational education, this usually means that since we prepare the students for work, also much of the learning is supposed to take place in working life.

6.3 Current trends in ICT

Information technology is an area that is in a constant state of upheaval. Below, we will present some trends, which might not be the latest, but currently have something to offer in the field of education.

Visualization

The use of different kinds of visual materials (photographs and videos) is seeing a sharp increase. Visual materials are used both for demonstrating things to be learned and documenting learning that has taken place. Especially in vocational education, where the students are learning skills, it is very practical to demonstrate tasks using a video. In the same way, when the students want to document what they have done, photos and videos are an ideal way to prove that they have achieved the competencies.

Mobile devices

The use of personal mobile devices, such as mobile phones and tablets, is proliferating rapidly. This means that all our services must be scalable for different devices and accessible everywhere. When it comes to data processing that requires the full functionality of a personal computer, we prefer the use of laptop computers over desktop computers, thus allowing us to stay mobile.

Cloud computing

When using mobile devices, you must have your data stored so that you can access it anywhere on any device. This is especially important when the same person uses different devices, depending on the time and place. In addition to storing data, cloud computing also means that the applications you use are available in the cloud.

Gamification

In learning environments, one of the newest and the most inspiring trends is gamification. Games are used for motivating the students, thus making it more fun to do repetitive exercises. It is also very useful to have the students involved in the game design process, which engages them while teaching a great deal.

Social media

Even though social media is needed for communication, it can also be used in education for guiding and counseling students, such as when they are in working life. Closed user groups and the chat function can be used to reach students more quickly than dedicated school systems.

6.4 A well-defined plan for the development of ICT in education

When all of the above are combined, we get a rational, well-defined base for developing the pedagogical ICT-function at Point College. Below are the main points of our plan.

We set the following goals for this academic year:

New students must provide their own laptop computers. This means that we are required to provide an efficient wireless network on our premises and enough power outlets for charging devices.

We enhance use of the digital Learning Management System (LMS). Our goal is to make use of the LMS interactive, so that it is not only used for delivering material from teachers to students.

In certain courses, we stream lectures online and save them so that they can be watched later by students.

Teachers are encouraged to use video conferencing tools for counseling students during on-the-job-learning periods, instead of constantly visiting the students at their places of employment.

Video and photos are a widely accepted way to prove the skills the students have acquired. Students can also collect their learning documents in an electronic portfolio, which can later be shown to a future employer.

Of course, the skills of our own personnel are constantly evolving as we increase the use of information technology in education. However, the degree of use and variety of devices are also increasing, so we can assume that the need for support services will be the same.

Our school maintains operations at three different locations, so there is often a need for telecommuting. This means that we have to provide the necessary tools for it. The electronic calendar is recommended as a tool for the whole organization. Furthermore, various support services must be accessed online, not by a physical visit. Naturally, the answer to such requirements is cloud computing, but this means that we must invest a great deal in data security.

Risks

We have identified the following factors that may cause risks for the success of our plans above: The capacity of our WLAN, data security, teachers' skills and the economical problems the students may have when providing the laptop computers. We will especially follow different indicators of these risks in order to react early enough if some problems arise.

6.5 New development projects

We are involved in several development projects based on, among others, the following themes:

Mobile classroom

A mobile classroom makes it possible to hold classes outside the school. This is needed in such places of employment whose work tools do not support learning documentation.

Integration of work processes and learning documentation

Conversely, in some professions a great deal of the work is done with computers. What kind of documents are needed by students to present and prove their learning?

Models for producing web material

Online courses support individual and remote learning, and our goal is to ensure high pedagogical quality. In order to do so, we collect useful information and guidelines for the course planners as well as different types of structures that can be applied in production phase.

Chat function for counseling students online

For on-the-job-learning periods, we have plans to develop photo and video instructions, which combine the vocational skills requirements of the curriculum with work processes. These are compiled and stored on a platform, which allows students to mark their tasks "Done", much like in a game.

We believe that, although a great deal of work has been done in digitalizing education, there is still much left to do. And, as with all changes in culture, real change takes place slowly and there are always people who will resist it. In our own experience, providing lectures for teachers is not the most efficient way to increase their knowledge in ICT. Instead, we try to organize such activities that require new ICT skills. Not only students but also teachers learn best by doing!

7. Our experiences and positive results with the holistic use of these tools throughout the organization

The best result of the quality work was increasing the overall shared knowledge at Point College: where our strengths are and where improvements are needed. Self-assessments are always visualized and simplified into easy-to-read display boards, which are often presented at meetings. Point College also has an extensive Quality Handbook, which describes operating methods (operational descriptions) and processes, indicators, the entire operational steering system, preliminary data system architecture and archiving system.

In addition, the Ministry of Education and Culture rewards us for our performance, which provides us with financial benefits. In the performance category of Ministry of Education and Culture indicators, Point College has been the top of the class for three years running under "other multidisciplinary education providers" (2013-2015). There are 7 MEC indicators, with the most important being related to student graduation, employment, further study placement, employee qualifications and investment in development. This brings bonus money to the school; in 2016 the bonus we received amounted to 369,000 €. The performance percentage is 4% of the total funding. In the future this may rise to as much as 10%. Also seen from the opposite perspective, our early school-leaving rate is approx. 5%, which is equivalent to the rate in general upper secondary schools, but not typical of vocational education.

8. Discussion

The year 2016 is the real year of changes both locally, regionally and nationally. For VET it means that we have to be really clever to maintain the good profile and best parts of education and training which meets the needs of the working life. We need to sustain the equality and quality between vocational and general education. In Finland vocational education is chosen by about 50 % of the age group. This is exceptional in the European countries.

The regenerative capacity, competence and occupational well-being of personnel will be put to the test in the years to come. New structures, merged organizations, management systems and new content and qualifications in core operations will challenge personnel in a never-ending cycle of change. Stamina will be the key. Where change is concerned, personnel should be instilled with a positive drive for development. The desire and courage to support employees in the development of their own work requires the planning and promotion internal and development projects. In the upheaval brought about by change, a systematic approach will provide at least a slight sense of security and the vision to take small steps.

Especially the role of ICT is essential and crucial in the coming changes. Digitalization is emphasized in the Finnish Government Program and largely utilized in the Finnish workplace. We as an educational provider must prepare our students for the future needs and as well develop our own operations. Participating in the development projects is one way of carrying out this progress.

Audiovizualni nastavni materijali – jezik i kultura u poučavanju stranoga jezika

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Sažetak. Na početku članka naglašava se važnost ispreplitanja lingvistički i kulturološki relevantnih podataka u poučavanju i učenju stranoga jezika. Nastavna literatura kulturološku komponentu nerijetko stavlja u drugi plan; nepotpune činjenice ne uspijevaju razjasniti brojne kulturološke kontekste naroda čiji jezik se uči, a bez čijeg je poznavanja uspješna komunikacija s izvornim govornicima teško ostvariva. Mišljenja smo kako je u nastavni proces potrebno uvoditi autentične materijale koji uspijevaju udovoljiti suvremenim glotodidaktičkim stremljenjima. Skupinu audiovizualnih nastavnih materijala čini lepeza televizijskog i internetskog programa unutar koje posebno mjesto pripada televizijskome reklamnom spotu i televizijskoj seriji. Središnji dio članka razmatra didaktičku ulogu televizijske reklame u nastavi talijanskog jezika te televizijske serije u nastavi engleskog jezika. Jako je bitno naglasiti mogućnost identične i/ili slične primjene i drugih nastavnih materijala iz ove skupine te njihovu uporabivost i u nastavi drugih jezika. Nakon predstavljanja pojma televizijske reklame i Carosella nižu se brojne aktivnosti kojima se naglašava uloga reklamnog spota u učvršćivanju leksičke, morfosintaktičke i kulturološke kompetencije učenika. U nastavku se iznosi primjer didaktičke obrade britanske serije “Fawlty Towers” u nastavi engleskog jezika. Nakon uvodnog pojašnjavanja značenja termina “Fawlty Towers” predstavlja se jedna od epizoda sugestivna naziva “Communication problems”. Humoristično obojeni dijalozi prava su jezična i kulturološka riznica. Okosnicu radnje tvore nesporazumi između nagluhe gospođe Richards i osoblja hotela. Glavno oruđe komike upravo je jezik; briljantne igre riječi i korištenje idioma odražavaju bogatstvo jezika, a načini rješavanja problema predstavljaju tipično engleske kulturološke obrasce ponašanja. Na kraju članka iznose se razlozi koji audiovizualne materijale čine valjanim i dobrodošlim nastavnim sredstvima.

Ključne riječi: jezik, kultura, materijal, kriteriji, obrada.

1. Uvod

Jezik je dio kulture jednog naroda i teško je zamisliti nastavu stranog jezika odvojenu od nastave kulture naroda kojemu je taj jezik materinski. Znanje jezika, naime, uključuje pravilno oblikovanje fraza i rečenica, ali i njihovu primjenu u skladu s kulturnim normama izvornih govornika (Navarro, 2010.). Kultura u užem smislu riječi predstavlja kolektivni identitet jednog naroda koji se odražava u oblicima ponašanja, običajima, stilu i načinu života toga naroda. Kultura u širem smislu predstavlja ukupnost materijalnih i duhovnih vrijednosti i dostignuća koje je narod tijekom svoga razvoja stvorio i postigao, dajući time svoj doprinos općem razvoju i napretku čovječanstva. U kontekstu poučavanja stranoga jezika pojam kulture izuzetno je složen; značenje mu je, naime, uvjetovano kontekstom situacije u okviru

koje se odvija komunikacija (Kramsch, 1993.). Različitosti u kontekstima komunikacije odraz su različitosti među ljudima. Pripadnost određenoj dobnoj/spolnoj/rasnoj skupini, društveni položaj, stupanj obrazovanja, obiteljsko podrijetlo i sl. neki su od čimbenika formiranja supkultura unutar društva. Uzimajući u obzir brojnost ovih čimbenika te složenost međuljudskih odnosa, razumljivo je da se pojam kulture ne može svesti na izdvojenu jezičnu vještinu. Rad na kulturološkoj komponenti jezika trebao bi uključivati osnovno znanje o kulturi, poznavanje kulturalnih vrijednosti, poznavanje karakterističnog načina ponašanja te razvoj kulturalnih vještina (Tomalin, 1995.). Literatura namijenjena učenju stranoga jezika uglavnom se temelji na gramatičkoj i/ili leksičkoj komponenti jezika dok onu kulturološku nerijetko stavlja u drugi plan: činjenice koje se iznose često su nepotpune, studentima nerazumljive i/ili nedovoljno aktualne da bi uspijevale razjasniti višeslojne kulturološke kontekste naroda čiji jezik se uči, a bez čijeg je poznavanja uspješna komunikacija s izvornim govornicima teško ostvariva. Jako je bitno, dakle, od samih početaka učenja stranoga jezika lingvističku komponentu jezika prožimati onom kulturološkom. Mišljenja smo kako je u nastavni proces potrebno uvoditi pažljivo birane, autentične nastavne materijale koji razvijaju pozitivan stav prema jezičnoj i kulturološkoj različitosti s ciljem postizanja opće jezične kompetencije.

U nastavi stranih jezika već se desetljećima rabe raznovrsna auditivna, vizualna i audiovizualna nastavna sredstva (Petrović, 1988.). Skupinu audiovizualnih nastavnih sredstava čini šarolika lepeza televizijskog i internetskog programa: stapanjem slike, zvuka, a nerijetko i pisma stvara se dojam potpuno prirodne situacije prepune verbalnih i neverbalnih reakcija sugovornika. Uspješnom sintezom lingvistički i kulturološki relevantnih podataka te izrazitom sugestivnošću i dopadljivošću u toj skupini važno mjesto pripada televizijskome reklamnom spotu te televizijskoj seriji. Članak razmatra didaktičku ulogu televizijske reklame u nastavi talijanskoga jezika te televizijske serije u nastavi engleskoga jezika, no jako je bitno naglasiti mogućnost slične i/ili identične nastavne primjene i drugih nastavnih materijala iz ove bogate skupine te njihovu uporabivost i u nastavi drugih jezika: film, serija, kviz, dokumentarna/zabavna/sportska emisija te brojni video isječci različite tematike i duljine trajanja.

2. Televizijski reklamni spot

Poruka usmjerena jasno definiranom odredištu (birano tržište, potencijalni potrošači) koja sistematično argumentira tezu o izvrsnosti određenoga proizvoda i/ili usluge te tako oblikuje potrošačeve stavove i odluke pri odabiru s krajnjim ciljem uvjeravanja u istinitost navedene teze neizostavni je dio plaćene tzv. reklamne komunikacije.

Televizijsku reklamu u klasičnome obliku predstavlja kratki film, spot ili grupa spotova (tzv. reklamni blok) s prosječnim trajanjem od 30 sekundi po spotu. Oglašivačka industrija uvelike vodi računa o položaju pojedinog spota unutar reklamnog bloka; uočeno je da se, kako neposrednim tako i odgođenim ispitivanjem pamćenja, najbolje pamte i dosjećaju sadržaji posljedni u nizu (još su uvijek u kratkoročnom pamćenju tzv. efekt novosti) te oni s početka niza (kodiranjem su prvi došli u dugoročno pamćenje i tu se zadržali tzv. efekt prvenstva). Učinkovita reklama izravna je posljedica predanoga rada stručnjaka iz raznovrsnih područja ljudske djelatnosti poput ekonomije, psihologije, antropologije, sociologije, modnog dizajna, likovne i glazbene umjetnosti itd.

Pojava reklama u današnjem smislu riječi usko je vezana uz pojavu novina. Prve reklame u Italiji, smještene na posljednjoj strani dnevnog tiska, datiraju od druge polovine 19. stoljeća. Krasila ih je jednostavnost i neposrednost izraza s učestalom uporabom imperativa (...prendete.../...bevete.../...al vostro farmacista chiedete...).

Prvi televizijski spot reklamiran je u Americi davne 1941. godine, dok su Talijani to iskustvo imali prilike doživjeti 3. veljače 1957. godine. Tog je dana, naime, svjetlo dana ugledala specifična televizijska forma zvučna imena Carosello. U terminu između 20:50 i 21:00 sati, ukupnog trajanja od 155 sekundi, svakodnevno i gotovo neprekinuto punih 20 godina uveseljavao je i zadržavao uz ekrane nacionalne televizije (današnji RAI UNO) gledatelje svih uzrasta. Njegovim utemeljiteljem smatra se priznati redatelj Luciano Emmer, no Luca Magni, Sergio Leone i mnogi drugi sudjelovali su u ostvarenju ovoga ambicioznog televizijskog projekta. Sastojao se od komičnih i/ili animiranih skečeva s obilježjima kazališne predstave u trajanju od 120 sekundi, dok je preostalih 35 sekundi pripadalo reklamnoj poruci.

Talijansko društvo 60-ih i 70-ih godina, zatvoreno i nepovjerljivo prema stranome tržištu, doživljava obiteljsku zajednicu isključivim središtem interesa i vrijednosti što je vidljivo i u reklamnome kodu toga vremena. Familijarni kontekst, humoristično obojani dijalozi, ponavljani slogani (...Ava, come lava .../...Omo lava più bianco ...) te jedinstveni likovi poput pilića Calimera i čelavog profesora Rocka Carosellu su dali pečat osobnosti i prepoznatljivosti. Promjene u talijanskome društvu koje postaje modernije, dinamičnije i zahtjevnije doprinijele su gašenju ove, prema stranome tržištu, zatvorene forme. No, zasluge Carosella velike su: obilježio je početak postojanja talijanske animacije i televizijske reklame, a fraze poput „E dopo Carosello tutti a nanna“ i „A letto dopo Carosello“ i danas odjekuju talijanskim govornim jezikom.

Važno je istaknuti ulogu neverbalne komponente jezika u spotu: izrazi lica, geste, položaj tijela, pogled, intonacija glasa, nazočnost pozadinske glazbe i drugih prirodnih i neprirodnih zvukova od neprocjenjive su važnosti za efektivnost i privlačnost reklamnoga televizijskog spota. Tu valja istaknuti glazbu koja je glavni kreativni sastojak u trećini od 500 novijih televizijskih reklama. Glazba, naime, reklamu čini perceptivno istaknutom u odnosu na drugi televizijski sadržaj što za posljedicu ima bolje pamćenje. Uvjerljivost iskaza postiže se polisemijom te neizostavnom uporabom stilskih izražajnih sredstava poput poredbe, personifikacije, metafore, metonimije, sinagoge i eufemizma. Katkada bivaju angažirane slavne osobe koje autoritetom i kompetencijom reklamu čine vjerodostojnijom (pr. igrač Juventusa u reklami za „Yogurt Danone“). Dodatnu slikovitost jamče sugestija, aluzija, analogija, humor, ironija te neposredan i jednostavan jezik sa zamjetnom uporabom idioma i lokacija. Uspješnost televizijskih reklama ovisi i o karakternim osobinama promatrača, njegovoj spremnosti za prihvaćanjem sugestija i uvjeravanja.

Osamdesete i devedesete godine 20. stoljeća svjedoče nevjerojatnom uspjehu komercijalne televizije te predstavljaju razdoblje svojevrsnog procvata reklamnog svijeta.

2.1 Kriteriji pri pravilnome odabiru televizijskog reklamnog spota u nastavi stranih jezika

Audiovizualni nastavni materijal u nastavi stranih jezika didaktički je opravdan samo ukoliko sadržajno potpuno odgovara jezičnoj kompetenciji, dobi i interesima onih kojima je namijenjen te ukoliko se njegovom primjenom ostvaruju planirani nastavni ciljevi. Tako će, primjerice, studentima elementarnoga jezičnog znanja biti primjerene reklame jednostavnih gramatičkih i leksičkih struktura dok će za bolje poznavatelje jezičnih zakonitosti nastavnik brižno potražiti nešto složenije narativne, opisne i/ili argumentativne reklamne sadržaje (sigurnost u prometu, prevencija bolesti i sl.). Učenicima tinejdžerske dobi znatiželju će pobuđivati najnoviji tipovi mobitela ili laptopa dok će najmlađe veseliti prizori omiljene im igračke ili slatkiša. Studentima Turizma poseban izazov predstavljat će reklamni spotovi za pojedina turistička odredišta, sadržaje ili agencije, a ljubitelji gastronomije dopadljivima će držati reklamne sadržaje s kulinarskim proizvodima.

Nastavnik koji odluči beskrajne didaktičke mogućnosti reklamnoga spota primijeniti u nastavi, mora imati jasno definirane ciljeve. Željene gramatičke elemente moguće je uvesti/učvrstiti onim

reklamnim spotovima koji njima obiluju („Hotel Cristallo“ - imperativ, „Amarena Fabbri“ – imperfekt ...). Reklamni dijalozi često su podatan materijal za uvježbavanje raznovrsnih, studentima vrlo bitnih, komunikacijskih funkcija jezika („San Pellegrino“ – fizički i karakterni opis, „Prosciutto di Parma“ – izražavanje emocija ...). Valja naglasiti kako se primjenom odgovarajućeg, znalački biranog reklamnog sadržaja jednako uspješno mogu uvježbavati i receptivne i produktivne jezične vještine. Iz svega navedenoga jasno je kako je pravilan odabir reklamnoga sadržaja u nastavne svrhe od neprocjenjiva značaja. Naime, nepravilan izbor bilo kojeg nastavnog sredstva u odnosu prema konkretnom zadatku nastave te njegova neusklađenost s jezičnim znanjem studenata može kod onih kojima je namijenjen izazvati nelagodu i odbojnost što u konačnici dovodi do usporavanja i/ili pogrešnog usmjeravanja procesa učenja.

Internetske stranice nude prilično bogat reklamni spektar, a sadržaj je znalački grupiran tematski i/ili po godini proizvodnje što uvelike olakšava postupak traženja i odabiranja željenoga materijala. Kako i same ponekad zavirimo u svijet šarenih televizijskih reklama u nastavku ćemo navesti neke od uistinu brojnih mogućnosti rada na reklamnome spotu.

2.2 Rad na odabranome reklamnom spotu

2.2.1 Rad na odabranome reklamnom spotu u uvodnome dijelu sata

Na samom početku nastavnog sata poželjno je studentima približiti željeni sadržaj jednoznačnim, sugestivnim, usmeno postavljenim pitanjima koja ih izravno uključuju u priču u koju se upravo upuštaju te u njima bude intelektualnu znatiželju. („Servizio Civile“ - *Imate li slobodnog vremena? Kako ga provodite? Sudjelujete li u volonterskom radu? Gdje?...*)

Zatim je uputno studente snabdjeti bitnim podacima o odabranome sadržaju; što spot reklamira, tko su protagonisti, gdje su smješteni i sl. (Lombardo, 2006.). Cilj ovoga uvodnog dijela sata jest studente zagrijati (*riscaldamento*) za nastavnu aktivnost koja slijedi te u njima umanjiti nelagodu stvorenu mišlju da će autentičnome sadržaju biti izloženi bez pismenoga predloška.

Reklamni spot, zahvaljujući kratkoći trajanja, moguće je prikazati onoliko puta koliko to nastavne aktivnosti zahtijevaju. Nakon kratkoga, smisleno koncipiranog uvodnog dijela u kojem se studenti globalno upoznaju s osnovnom tematikom reklamnoga sadržaja može ih se pozvati na prvo gledanje odabranoga spota. Prvo prikazivanje može biti parcijalno (prikaže se prvih ili posljednjih 10, 15 sekundi), a od njih se traži da usmeno iznesu svoje pretpostavke o tome što je upravo viđenoj radnji prethodilo odnosno što bi joj moglo slijediti. Ovdje se od studenata očekuje da se jezikom služe u nešto dužem monologu te je preporučljivo greške, inače česte u govornoj produkciji, bilježiti i naknadno objašnjavati. Naime, pažnja je u prvome redu usmjerena komunikacijskim ciljevima govornoga čina, a svako prekidanje remetilo bi koncentraciju studenata i tako utjecalo na tečnost i fluentnost njihova iskaza.

2.2.2 Rad na gramatičkim elementima jezika

Tekstovi preuzeti iz odabranih audiovizualnih nastavnih materijala pokazali su se didaktički opravdanim i za uvođenje i/ili uvježbavanje unaprijed planiranih gramatičkih elemenata jezika. U dijalogu spota AVIS (*Associazione Volontari Italiani Sangue*) uočljiva je česta uporaba neodređenih zamjenica *qualche, nessuno, ognuno ...* dok je tekst spota „Hotel Cristallo“ podatan za uvježbavanje imperativa *divertiti, riposatevi, abbronziamoci ...*

Gramatičke strukture uzete iz teksta, no ponešto prilagođene ciljevima vježbe, mogu postati predloškom pri izradi raznovrsnih vježbi zasnovanih na transformaciji, supstituciji, sintezi, nadopuni teksta, višestrukom izboru i sl. Na ovaj se način dobro poznati tipovi vježbi predstavljaju u drugačijem svjetlu i tako, unoseći dašak novoga i drugačijega, postaju plodnim tлом za učvršćivanje gramatičke kompetencije studenata. Učenje stranoga jezika, naime, nezamislivo je bez sistematskog učenja gramatike i niza dobro osmišljenih gramatičkih vježbi (Prebeg-Vilke, 1977.).

2.2.3 Rad na fonetsko-fonološkim elementima jezika

Prirodnost reklamnoga jezika najbolje dolazi do izražaja ukoliko se studentima predstavi samo zvučna komponenta spota. Namjernim izostavljanjem slike, u središte pozornosti stavlja se glas. Naime, osposobljenost za govornu komunikaciju na stranome jeziku podrazumijeva aktivno vladanje fonološkom komponentom jezika; njegovim izgovorom, ritmom i intonacijom (Desnica-Žerjavić, 1996.). Upravo radi toga preporučljivo je provoditi vježbe imitacije kojima se usvaja i učvršćuje fonetsko-fonološka sfera jezika. Radi se o djelotvornim, često zanemarivanim vježbama u kojima studenti nakon slušanja odabranog dijela teksta, a bez pisanoga predloška, strpljivo ponavljaju ritmičke grupe pojedinih rečenica koje jasno izgovara nastavnik. Poželjno je da tekst bude u obliku dijaloga, a jezik jasan, bez buke u akustičnome kanalu kako bi se izbjegle nepotrebne poteškoće s auditornom percepcijom. Čitanjem na glas studenti uočavaju vezu između pisanoga teksta i govora što za posljedicu ima učvršćivanje prozodijskih obilježja jezika i uvježbavanje pravila izgovora (Desnica-Žerjavić, 1996.). Jako je bitno kod studenata razviti sposobnost dedukcije značenja nepoznatih elemenata preko već poznatog kontekstualnog leksika.

2.2.4 Rad na leksičkim elementima jezika

Vođen osnovnom tematikom spota nastavnik može biti autorom dobro osmišljenih vježbi koje za cilj imaju leksičku i morfo-sintaktičku nadogradnju jezika. Tako, primjerice, radeći sa spotom „Mele Melinda“ nastavnik studente može upoznati s terminima raznovrsnih stabala i plodova voća ili im ukazati na pravilnu uporabu imenica *frutto / frutti / frutta*. Talijanski jezik bogat je izrazima s imenicama koje označavaju voće. Nastavnik od učenika može tražiti da pažljivo biranim izrazima (*Essere una mela marcia / farsi una pera / avere una pelle di pesca...*) pronađu ponuđene ekvivalente (*essere un elemento corrotto in un gruppo, drogarsi con una siringa, avere la pelle liscia...*) ili da iznesu svoje mišljenje o poslovice *Una mela al giorno leve il medico di turno*. Ovakvim i sličnim vježbama nenametljivo se uvode novi leksički elementi, a istodobno se intelektualna radoznalost drži stalno budnom što je nužan preduvjet za izgradnju pozitivnoga stava prema sadržaju učenja. Jako je važno ispreplitati individualni, tandemski (u paru) i skupni oblik rada, ne samo radi poticanja pasivnih studenata koji riječ rado prepuštaju glasnijima i ambicioznijima od sebe, već i radi postizanja što dinamičnije i lepršavije razredne atmosfere koja svakako pospješuje proces učenja.

Nadalje, u spotu „Salumi Beretta“ televizijska kamera smještena je u unutrašnjost hladnjaka; u kadru je protagonist zbunjena lica koji beznažno traži željeni proizvod. Ovom scenom studente je moguće pozvati na nizanje svih onih pridjeva kojima bi se opisala vanjština i/ili karakterne osobine glavnoga glumca. Raznolikost u uporabi pridjeva moguće je proširiti i na druge osobe, primjerice prijatelja, člana obitelji i sl. Fleksibilnost leksičkog sistema te veliki broj denotativnih i konotativnih značenja leksičkih jedinica posebno su naglašeni u onim reklamama s metaforičkim sloganima („Scotch Brite“ - *dare un colpo di spugna*, „Nicotinel“ - *fare un braccio di ferro* ...). U velikom broju spotova dominantna je verbalna metafora. Riječi su te koje argumentiraju izvrsnost proizvoda („Nescaffè“ - *momenti da assaporare*, „Yogurt Danone“ - *yogurt Danone per sentirti danone*, „Interruttori Serie Living Ticino“ - *spengono un'era e ne accendono un'altra* ...). Vrlo dopadljive su i vizualne metafore u kojima se pred očima promatrača jedna stvarnost pretvara u drugu („Pasta Divella“ - *la pasta Divella è una danza*; plesači se pretvaraju u tjesteninu, „Novo Esso Extra“ - *metti un tigre nel motore*; automobil se pretvara u tigra, „Pelati Cirio“ - *come natura crea, Cirio conserva*; rajčica postaje konzervom...). Poneke reklame mogu se podičiti maštovitom interakcijom obaju metaforičkih kodova („Abbracci Mulino Bianco Barilla Biscotti“ - *mama i kći se pretvaraju u leteće zagrljaje*, „Coccolino“ - *medvjedić miluje ručnike*). Učenici, služeći se jednojezičnim rječnikom, mogu pristupiti traženju drugih izraza i/ili kolokacija koje sadržavaju zadanu riječ (npr. *colpo* ili *ferro*). Ploveći stranicama rječnika učenici uče kako tražiti odgovarajući pojam,

ali i kako od svih značenja odabrati ono koje odgovara zadanome jezičnom kontekstu. Naime, nužno je naglašavati kako je upravo kontekst osnova za tumačenje značenja riječi, za njihovo potpuno razumijevanje i pasivno usvajanje (Skljarov, 1993.).

Osposobljavanje učenika za govornu kompetenciju danas se smatra prioritarnim zadatkom nastave stranih jezika (Skljarov, 1993.). Vizualna komponenta reklamnoga spota čini ga nastavnim materijalom prikladnim za provođenje raznovrsnih govornih aktivnosti. Namjernim izostavljanjem zvučne komponente učenike se može staviti pred kreativan izazov osmišljavanja prikladnoga teksta na temelju viđene slike. Ovu aktivnost preporučljivo je raditi u paru, uz nastavnikovu pomoć, koji postavljajući pitanja potiče na što veću raznolikost u pružanju odgovora. Nadalje, studente je moguće pozvati na dovršavanje započete, reklamnim spotom inspirirane misli (*per me, guidare la macchina significa.... per me essere belli significa...*) i/ili im svratiti pozornost na pojedinosti koje se žele komentirati (dob, odjeća protagonista, obilježja interijera/eksterijera ...).

Studente je moguće potaknuti na iznošenje misli bilo da se radi o kratkom komentaru, dugoj raspravi ili kritičkom osvrtu. („Città di Urbino“ - reklama prikladna za provirivanje u svijet talijanske umjetnosti, povijesti, regionalne stvarnosti i sl.). Sa studentima koji prilično dobro vladaju jezičnim zakonitostima moguće je upustiti se u raspravu o obilježjima samog spota; uloži glazbe, specijalnim efektima, učinkovitosti slogana i sl. te zanimljivo postavljenim pitanjima u njima izazvati želju za usmenim izražavanjem (*Čini li vam se reklama uspješnom? Kome je namijenjena? Može li se usporediti s nekom iz naše zemlje?...*). Ovom govornom aktivnošću učenici znanje usmjeravaju prema određenom komunikacijskome cilju te uvježbavaju jako bitnu vještinu slobodnog iznošenja stava.

Imajući na umu razlike između govorne i pisane komunikacije, jako je bitno od samih početaka učenja stranoga jezika studente izlagati raznovrsnim, pažljivo pripremljenim pismenim vježbama. Studenti, individualno ili u paru, mogu pristupiti pismenom osmišljavanju potencijalnog dijaloga/razgovora među protagonistima iz spota. Kontekstualni leksik i/ili osnovne misli vezane uz reklamni spot mogu biti okosnicom manje ili više vođenoga pismenog sastava. Ovisno o jezičnoj kompetenciji studenata od njih se može tražiti pružanje jednostavnih odgovora na postavljena pitanja do prilično zahtjevnog iznošenja vlastitih teza i mišljenja. Pisanje slobodnih sastava na danu temu provodi se isključivo s onima čije izražajne mogućnosti jamče uspješnost u njihovoj provedbi.

S ciljem proširivanja postojećeg vokabulara poželjno je studente upoznati sa značenjima pojedinih sufiksa i prefiksa. Korisna vježba je pretvaranje jedne vrste riječi u drugu upravo pomoću sufiksa i/ili prefiksa. Vježbanje asocijacija riječi po srodnosti moguće je odabiranjem srodnih riječi po značenju ili uporabi iz veće grupe nepoznatih riječi, odabiranjem riječi iz višestrukog izbora u skladu s danim kontekstom, određivanjem riječi na temelju njihova opisa ili definicije i sl.

Sve ove vježbe, bilo da se provode usmeno ili pismeno, imaju jasno definiran cilj: ubrzati leksičku progresiju studenata te doprinijeti sistematskom proširivanju vokabulara.

2.2.5 Rad na kulturološkim elementima jezika

Jezično kompetentan govornik stranoga jezika pored lingvističkoga znanja mora ovladati i onim paralingvističkim, ekstralingvističkim te onim sociolingvističkim koje podrazumijeva promjene u ponašanju ovisno o kontekstu u kojemu se odvija govorni čin na takav način da ono bude u potpunosti prihvatljivo izvornim govornicima (Navarro, 2010.). Ljudska komunikacija satkana je od verbalnih i neverbalnih komunikacijskih znakova. Verbalnu komunikaciju pojedinac ostvaruje govorom, dok je neverbalna komunikacija ona koju čine neverbalni znakovi. Radi se o svim onim znakovima koji sudjeluju u govornome činu, a sami nisu govor (Navarro, 2010.). Neverbalni jezični znakovi dijele se na dvije skupine: prvoj

pripadaju paralingvistički znakovi (svi elementi vokalizacije koji nisu uključeni u fonološki opis govora; boja i ton glasa, brzina govora te ekspresivni načini izražavanja) dok onu drugu čine ekstralingvistički znakovi (proksemički i kinezički). Proksemički znakovi zasnivaju na prostornim odnosima sudionika u komunikaciji, njihovom međusobnom rasporedu te teritorijalnom ponašanju, dok kinezički znakovi uključuju pokrete lica (facijalna ekspresija i usmjeravanje pogleda), pokrete pojedinih dijelova tijela, držanje tijela u cjelini te geste kao sustave većeg broja raznih tjelesnih pokreta. Poznavanje neverbalne komponente jezika od iznimne je važnosti za stjecanje opće jezične kompetencije; semantička informacija, naime, čini tek 7 % poruke koju prenosimo/primamo dok je preostalih 93 % predstavljeno skupom komunikacijskih odrednica koje pripadaju upravo neverbalnoj komunikaciji (Navarro, 2010.). Najproučavaniji dio neverbalne komunikacije svakako su geste. Koriste se kao nadopuna izgovorenoj poruci i/ili kao potpuna/djelomična zamjena verbalnog iskaza. Na tlu susjednog nam poluotoka one predstavljaju vrlo bitno komunikacijsko sredstvo i smatraju se sastavnim dijelom njegova lingvističkog i kulturološkog nasljeđa. Talijani, naime, pribjegavajući gestama, izražavaju raznovrsne komunikacijske funkcije: osjećaje i osjećajna stanja, opise, radnje, mišljenja i mnoge druge. Autentični kinezički elementi, često nazočni u televizijskim spotovima, izvrsna su prilika za uranjanje u prostran svijet talijanske gestualnosti. Dakako, naša pažnja trebala bi biti usmjerena prema onim gestualnim oblicima koji su kulturološko snažno obojeni i kao takvi strancima nedovoljno razumljivi i/ili potpuno nepoznati („Parmiggiano Reggiano“ – izražavanje nezainteresiranosti/ravnodušnosti uzastopnim trljanjem prstiju dlana o vrat; *uopće/nimalo ni najmanje mi nije stalo/me nije briga*, „Servizio Civile“ – izražavanje vlastita lukavstva spuštanjem donje vjeđe kažiprstom; *ne vjerujem ti, lukav sam ja, ne možeš me nadmudriti ...*). Uočenu gestu studentima je moguće predstaviti kratkom definicijom, crtežom, ključnom riječju, ekspresivnim registrom i/ili pripadajućim verbalnim iskazom. Mnogo je načina na koji je moguće poigrati se gestualnim jezikom u nastavnim okvirima. Studente se tako može pozvati da, na temelju kontekstualnog leksika, zamijećenu gestu prepoznaju te ju definiraju na neki od gore navedenih načina. Ovakav tip vježbi potiče studente na samostalnost u iznošenju vlastitih pretpostavki čime se stvaraju uvjeti za razvoj jako bitnog kreativnog mišljenja. Nadalje, nastavnik može biti autorom kratkih, dobro osmišljenih dijaloga čiji tekst/dio teksta je moguće zamijeniti/popratiti odgovarajućom gestom. Bitno je da vokabular bude prilagođen općem i jezičnom znanju studenata. Na taj način umanjuje se potreba za dodatnim pojašnjenjima koja bi remetila kontinuitet rada. Jako je bitno da predstavljene geste budu konvencionalne, eksplicitne, aktualne te, barem na razini prepoznavanja, nazočne na cijelom teritoriju susjedne nam zemlje. Jednako tako, potrebno je voditi računa i o polisemiji pojedinih gesta.

Nepoznavanje značenja gesta u odnosu na komunikacijski kontekst u kojem se koristi može rezultirati nerazumijevanjem poruke ili pogrešnim razumijevanjem iste. Jednako tako, neselektivno pribjegavanje elementima vlastita jezika često rezultira slanjem neprimjerene/neshvatljive poruke. Talijan, usprkos dobrom poznavanju engleskoga jezika, korištenjem geste „*mano a borsa*“, postaje neobičan anglosaksonskoj kulturi koja gestu ne poznaje. Radi se o specifičnome pomicanju šake postavljene *u šišku* sa spojenim vrhovima prstiju. Ovom gestom pojačava se intenzitet izgovorenog upitnog iskaza te unose elementi čuđenja, ravnodušnosti i/ili ironije, a moguće ju je parafrazirati riječima *Ali što želiš/radiš/govoriš?*

Norme ponašanja vezane uz neverbalnu komunikaciju mogu se toliko razlikovati u pojedinim kulturama da isti pokreti, ne samo da imaju različito značenje, već bivaju nejednako vrednovani postojećim mjerilima pristojnosti. Naime, kao što je neophodno ukazivati na mogućnost gramatičke i leksičke interferencije materinskoga jezika potrebno je, od samih početaka učenja stranog jezika, brinuti o mogućnosti interferencije vlastite kulture na razumijevanje i savladavanje one strane. Posljedice nepoznavanja strane kulture mogu

uzrokovati neugodnosti i nesporazume. Usporedbe imaju za cilj osvijestiti značajke vlastite kulturološke i jezične stvarnosti i prihvatiti različitost one strane.

Reklame su katkada svjedocima neželjenih stereotipa i klišeja. Tako, primjerice, televizijsku obitelj iz reklame za proizvode „Mulina Bianca“ čine majka, otac i dvoje plavokose djece. Smještene u pastoralnom mjestu, lijepe i nasmijane, budi ih cvrkut ptica. Dobro raspoređeni, prilaze kuhinjskom stolu obasjanom jutarnjim zrakama sunca te započinju dan omiljenim im proizvodima „Mulina Bianca“ (*stelline, abbracci...*).

Nadalje, televizijski lik djevojke/žene/majke gotovo u pravilu je nasmijan, dotjeran i besprijeorna stasa bez obzira radilo se o deterdžentu, gelu za tuširanje ili novom modelu glačala koji reklamira. Naime, radi se o idealiziranju često potrebne iz marketinških razloga. Gore spomenuta televizijska obitelj tako je daleka od tipične obitelji iz, primjerice, sivog predgrađa Milana dok je televizijski lik žene u nesuglasju sa stvarnom, od svakodnevnih briga umornom domaćicom iz Modene. Te je stereotipe potrebno uočiti i na njih studentima skrenuti pozornost kako bi se oslobodili pogrešnih predodžbi. Radeći s televizijskim spotom studentima se pruža mogućnost uočavanja razlika između dviju kultura što za posljedicu ima razvoj osjećaja tolerancije, uvažavanja i otvorenosti prema kulturi susjednog nam naroda. Radi se o pretpostavci koja rezultira jačanjem jako bitne kulturološke svijesti.

3. Televizijska serija

Televizijska serija predstavlja pravo vrelo izvornih kulturoloških podataka. Način i stil života, gastronomska obilježja, unutrašnji i vanjski izgled kuće, radne navike, provođenje slobodnog vremena samo su neke od uistinu brojnih sličica iz svakodnevnog života koje se jasno ocrtavaju u serijama te tako studentima pružaju uvid u mentalne koncepte stanovnika određenog područja. Mentalni koncepti nazočni su i u pripadajućim jezičnim konstrukcijama. Drugim riječima, televizijska serija kao izrazito autentičan materijal daje uvid u kulturološku pozadinu jezičnih tvorevina i na taj način pridonosi podizanju kulturološke osviještenosti kod studenata. Kao što je već navedeno, suvremena metodologija poučavanja stranoga jezika već neko vrijeme ističe nužnost razvijanja, upravo ove, kulturološke dimenzije učenja kao važnom i nazamjenjivom preduvjetu pri ostvarenju uspješne komunikacije.

S ciljem pojašnjavanja metodologije rada na podizanju kulturološke i lingvističke osviještenosti, autorice su se poslužile legendarnom britanskom humorističnom serijom *Fawlty Towers*.

3.1 Fawlty Towers

Fawlty Towers, ta izuzetna humoristična serija, nastala je sedamdesetih godina prošlog stoljeća. Osmislio ju je John Cleese, član cijenjene grupe *Python*, koja je urnebesnim i bizarnim humorom obilježila britansku humorističnu scenu dvadesetog stoljeća. Zanimljivo je da je u svega dvanaest epizoda serija uspjela steći kulturni status, a 2000. godine zauzela je prvo mjesto na ljestvici od stotinu najboljih britanskih televizijskih programa Britanskog filmskog instituta.

Inspiraciju za seriju John Cleese dobio je prilikom boravka u hotelu Gleneagles, u Torquayu, gradu na jugo-zapadu Engleske, gdje se imao prilike susresti s izuzetno drskim vlasnikom hotela. Nekulturni vlasnik poslužio je kao predložak za kreiranje glavnog lika serije, Basila Fawltyja. Samo prezime vlasnika, koje se očituje i u naslovu serije, daje naslutiti komiku s kojom će se susresti gledatelj; prezime je, naime, homonim s pridjevom *faulty*, što znači *loš, neispravan i faličan*. Sam je hotel takav jer bezobrazluk i snobizam vlasnika nikako ne mogu biti temelj za napredak.

Igra riječi, na engleskom *puns*, između ostalog proizašla iz upravo spomenute homonimije – *faulty – fawlty* - predstavlja glavno oruđe britanskog humora; komika, ponekad dovedena do ruba apsurdna, ostvaruje se kroz brojne kontekstne situacije kreirane od strane likova upravo kroz kulturološki specifično poigravanje jezikom.

Kako bi se dočarala kulturološka upečatljivost serije, odabrana je sedma epizoda pod nazivom *Communication Problems (Problemi u komunikaciji)*. Sama epizoda, naime, sadržava najmanje pythonskih bizarnih elemenata koji bi mogli zbuniti studente i odvratiti im pažnju od kulturoloških specifičnosti.

3.2 *Communication problems* (Problemi u komunikaciji)

Znakovitog naziva, ova epizoda pravi je primjer kako nepoznavanje kulture i jezika te pomanjkanje tolerancije mogu rezultirati ne baš malim problemima u komunikaciji.

Prvu prepreku u komunikaciji predstavlja konobar Manuel, simpatičan i bezazlen Španjolac, čije je nedovoljno poznavanje kako engleskog jezika tako i karakterističnih kulturoloških obrazaca, uzrokom neprekidnih nesporedazuma. Nesporedazumi se ogledaju u briljantnim igrama riječi iz kojih proizlazi i komika situacije. Katkada situacije poprimaju i tragikomičnu notu, koja se očituje u Fawltijevom stavu prema Manuelu. Njega, naime, Manuelovo loše vladanje jezikom izluđuje te, kako bi ublažio osjećaj bijesa, podsmjehuje mu se, konstantno ga nazivajući *nitwit*, što na hrvatskomu prijevodu znači *idiot*, *blesan*. I ne samo što ga naziva pogrdnim imenima, nego i njegovu zbunjenost, proizašlu iz gore spomenutog neznanja, drugima „opravdava“ pogrdnim odgovorom *He knows nothing. He's from Barcelona!*

U odnosu Fawltija prema Manuelu, a i prema drugim gostima hotela koji ne potječu iz Engleske, primjećuje se karakterističan obrazac engleskog humora sedamdesetih godina prošlog stoljeća; u podrugljivom stavu prema strancima mogu se nazrijeti umjereni oblici ksenofobije i rasizma.

Drugi izvor frustracije za Basila Fawltija jest lik gospođe Alice Richards, nagluhe i čangrizave usidjelice. Ona jest nagluha, no valja istaknuti da je njena nagluhost selektivna: ona uspijeva čuti ono što ju trenutno intrigira i što, zapravo, želi čuti. Sama njena pojava nipošto ne odgovara Basilu jer ona za njega jednostavno nije dovoljno otmjena, kao i većina gostiju hotela. On tako smatra da može biti drzak i neprofesionalan prema svima koji potječu iz nižih slojeva društva. Njegov beskrupulozni snobizam odražava još jedan obrazac britanskog humora iz sedamdesetih godina prošlog stoljeća, a to je profinjena i sarkastična kritika snobova, čije očajničko nastojanje da se umile osobama iz visokog društva i tako si osiguraju ulazak u njega, redovito završava apsurdnim i tragikomičnim situacijama.

3.3 Odabrani dijalozi

Cijela epizoda obiluje smiješnim te lingvistički i kulturološki intrigantnim situacijama, no kako bismo jasnije predočile igru riječi kao glavnu odliku komike, odlučile smo prikazati dvije situacije. Radi se o televizijskim ulomcima koji se, prema poznavateljima britanskog humora i ljubiteljima humorističnih serija uopće, smatraju legendarnima.

Prva situacija predstavljena je uvodnom scenom koja daje naslutiti komični smjer cijele epizode. Riječ je o dijalogu između gđe Richards i Manuela u kojem ona pokušava doznati u kojoj je sobi smještena te traži razgovor s upraviteljem hotela. Njezino nezadovoljstvo uzrokovano je po njenome mišljenju nedovoljno ljubaznom recepcionerkom. No, sve što je uspjela „doznati“ od Manuela jest da se upravitelj zove C.K. i da nešto s njim nije uredu te da ima četrdeset godina; informacije koje svakako nije tražila:

Mrs Richards: I'd like to talk to the manager.

Manuel: Que? (što na španjolskom)

Mrs Richards: K?

Manuel: Si! (da na španjolskom)

Mrs Richards: K.C. is the manager?!

Manuel: What? No, Fawlty the manager!

Mrs Richards: K.C. What aged forty! What are you talking about, you silly man!

Manuel: No, no ... Mr. Fawlty is the manager! Fawlty!

Mrs. Richards: What's wrong with him?

Druga situacija, ili bolje rečeno, nesporazum, nastao je prilikom prvog susreta gđe Richards s Basilom Fawltyjem.

Basil je već u početku iritiran samom činjenicom da se njena naglušost može riješiti, a ona uporno odbija uključiti slušni aparat jer troši baterije (*the battery runs down*). Svoju iritabilnost ne srami se pokazati pa tako kad gđa Richards podnese pritužbu da je tražila sobu s pogledom, ali je nije dobila, on spremno, jedva čujno, komentira: *Mad, deaf and blind*, i, potom, obrativši se gošći, nadodaje: *Madam, may I remind you that the sea is right there, between the land and the sky!*

Na uporno inzistiranje gđe Richards da pogled, kao takav, ne postoji – *the view is invisible!* – Fawlty, već u deliriju bijesa, uzvraća na karakterističan način: *Well, you are in Torquay, Madam! May I ask what you expect to see from the Torquay bedroom window? Sidney Opera House perhaps? Or, the hanging gardens of Babylon!? Heard of wilderbeast sweeping majestically ... I'm sorry Krakatoa isn't erupting at the moment!* I na koncu ovu briljantnu jezičnu bujicu zaključuje, na sebi svojstven crnohumorni način, sugestijom: *May I suggest moving to a hotel closer to the sea, or preferably in it!*

Njegova reakcija na iritantnu narav Alice Richards refleksija je tipično britanskog obrasca ponašanja, takozvanog *stiff-upper-lip philosophy*. Koliko god ljuti ili pak žalosni bili, njihovo je ponašanje uvijek, mogli bismo reći, stoičko; samokontrola je nazočna uvijek, nema psovki ni suviše vike u slučaju ljutnje, kao ni patetičnoga naricanja u slučaju tuge. Jedini pokazatelj stvarnog stanja emocija sofisticirano su konstruirane rečenice u kojima jedna riječ može biti uporabljena na više načina. Ta metaforička igra riječima je, dakle, jedini pokazatelj nijansi osjećaja koju osoba izvanjski vrlo uspješno skriva.

Izvorna televizijska serija, u svojoj šarolikosti, prikladna je za rad s jezičnim skupinama različitog predznanja. Međutim, važno je naglasiti da će se u radu sa skupinama nešto slabijeg predznanja nastavnik fokusirati na objašnjavanje lingvističke komponente dok će u radu s naprednijim grupama moći biti kreativniji i staviti naglasak na objašnjavanje kulturološke pozadine jezičnih tvorevina. Spektar aktivnosti s naprednijim grupama je širi, a može se sastojati od testa razumijevanja, pisanja eseja na obrađene teme, predstavljanja zadanih dijelova materijala na stranom jeziku od strane studenata i sl.

4. Zaključak

Audiovizualni materijali, odabrani prema gore navedenim kriterijima, ozbiljan su nastavni sadržaj. Autorice ih same, također, rado primjenjuju, a razloga koji ih čine didaktički opravdanim i poželjnim uistinu je mnogo:

- Autentični su materijali koji u pomalo artificijelnu razrednu atmosferu unose svježinu i dinamiku.
- Lako razumljivi scenariji čine ih uporabivim na svim stupnjevima znanja jezika.
- Izuzetno su praktična motivacijska sredstva jer se pripadajuće vježbe mogu unaprijed pripremiti i sačuvati za višekratnu uporabu.

- Ovisno o potrebama nastavnoga trenutka moguće ih je više puta i na različite načine prikazati (potpuno, djelomično, sa i bez zvuka/slike).
 - Kao sredstva priopćavanja neizravno prenose informacije iz različitih područja ljudskih djelatnosti: kulture, povijesti, politike, sporta.
 - Vedrim koloritom, pozadinskom glazbom, atraktivnim sloganima privlače pažnju te bude radoznalost. Znatiželja je, naime, bitna pretpostavka pri usvajanju novih sadržaja.
 - Vizualni i auditivni elementi predstavljaju nadopunu verbalnom izrazu te u kombinaciji s jezičnim znakovima pospješuju pamćenje podataka.
 - Studente izlažu različitim registrima jezika, jeziku po regijama i određenim interesnim područjima. Izloženost samo jednoj varijanti stranoga jezika, samo jednome idiolektu, ne može osposobiti učenika za razumijevanje govornoga jezika u svim njegovim varijantama na fonološkoj razini.
 - Prikladni su za uvježbavanje i rad na svima četirima jezičnim vještinama.
 - Jedinstvena su sredstva integriranja kulturoloških podataka kod studenata (struktura obitelji, uloga žene u društvu, moralne vrijednosti i sl.).
 - Unose potrebnu interakciju između nastavnika i studenata; radi se o stalno nazočnoj interakciji neophodnoj za uspješnu nastavu stranoga jezika.
 - Potiču na kritičko promišljanje i zauzimanje stava prema poruci koju prenose.
 - Senzibiliziraju s međukulturalnom dimenzijom lingvističkoga podučavanja.
- Osobno se uvjerivši u njihovu didaktičku opravdanost, autorice ih rado preporučuju nastavnicima stranih jezika.

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Audiovisual materials in foreign language teaching - cultural and linguistic aspects

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Summary. This paper underlines the importance of a frequent introduction of both cultural and culturally defined linguistic elements in the everyday language classroom. The authors believe that by exposing students to carefully selected authentic materials, such as television commercials and sitcoms, they will help them to understand the similarities and differences between cultures and, thus, pave the way for tolerance and effective communication. This, as well as the two major theories on culture and its influence on language itself, are discussed in the introductory part of the paper.

The main part of the paper revolves around the didactic role of both television commercials in the Italian language classroom and television series in the English language classroom.

After a brief insight into the notion of a television commercial and the so-called Carosello which is perceived as an extremely important segment of the Italian culture, the criteria for the selection of audiovisual materials are analysed. Then, the variety of related activities that may be used to foster the grammar and vocabulary acquisition are presented. Cultural elements are also discussed.

As an example of British cultural elements, the didactic analysis of one episode of the classic sitcom *Fawlty Towers* is provided further in the paper. The episode, *Communication Problems*, revolves around misunderstandings between selectively deaf Mrs. Richards and the hotel staff. These serve as a perfect example of culturally specific behavioural patterns, which are reflected in the fascinating use of language, such as idioms, puns and clever use of synonyms.

Key words: *language, culture, authentic materials, selection criteria, analysis.*

Using context clues – An inexhaustible treasury for vocabulary learning

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Abstract. Second language vocabulary acquisition is important for learners who frequently acquire impoverished lexicons despite years of formal study. This paper deals with the «guessing strategy», one of the most appreciated methods that helps students discover the meaning of an unfamiliar word they come across. The research reviews the values and efficiency of this approach, as well as its advantages in relation to other methods of vocabulary learning. The paper describes the significance of context clues and information they offer about the meaning of an unknown word. Different types of contextual clues have been described and examples are provided for each type. It was decided to include students to find out what type of context practice suits them best. They were provided with exercises containing similar vocabulary, but different context clues to discover which of these they were going to be the most successful at, and whether there the final results would differ. Some indicators confirm that the level of language competence plays an important role in guessing, and that insufficient vocabulary can prevent learners from discovering the meaning of unknown words. The reasons for some theorists' neglect of the positive effects of this method are also introduced. The conclusion states that the strategy of guessing gives positive results whenever it is available. Teachers must avoid unrestrained use of this particular method, because in certain cases, it may easily become the cause of frustration and demotivation, instead of enhancing general comprehension.

Key words: *vocabulary acquisition, guessing strategy, context clues, meaning, exercises*

1. Introduction

The understanding of words is vital to effectively communicate and understand the world around us. From the late 80s, vocabulary has been an area of special interest for the acquisition of the second language. Researchers realized that many of learners' difficulties result from an inadequate vocabulary. Even when they are at higher levels of language competence and performance, they still feel the need of learning vocabulary. Of all the vocabulary strategies commonly recognized today in both the first and second language, the most widely studied and encouraged is the guessing of the meaning of unknown words from context or the „guessing strategy“. It has been the subject of many research studies and the great majority of studies demonstrate its value and indicate that the strategy is effective. Furthermore, most EFL vocabulary learning guides and instructional methodologies advocate a „vocabulary in context“ approach, suggesting that vocabulary should never be taught in isolation as in word lists with their mother-tongue equivalents. Studies of context effects have established that words are recognized better in context than out of it. This strategy offers

many advantages over laborious, time-consuming methodical instruction in vocabulary. Providing students with the meanings of all new words or encouraging extensive use of dictionary may not be adequate enough to stimulate vocabulary acquisition. The reason is that „word lists“ or „word-translation“ pairs prevent students from applying more suitable strategies such as inferencing and guessing meaning of words in their natural contexts. Some even believe that dictionary usage interrupts the flow of reading (Brown 1997). Another fact in support of this strategy is that it involves skills of interpreting surrounding text while reading which enhance reading skills (Coady and Nation, 1988). However, there is also a growing number of studies that bring into question the value of encouraging the guessing strategy for EFL learners. There are positive outcomes from the use of context to help learners to receive target words, recognize the surrounding and contextual meanings, retrieve words, restore them in long-term memory and have an appropriate use of them in the four language skills. Not all contexts are helpful, though. Some contexts give little information about a word's meaning. This strategy has therefore some weaknesses. Although there is a belief that learners benefit from encountering vocabulary in native-like contexts, some authentic texts may be unsuitable for particular learners if there are too many unknown words and the control of unknown words seems to be important for the comprehension of texts.

2. What is context?

Context has been described as the words surrounding a particular word in question, within a sentence or phrase. Context is also taken to include the reader's expectations and purposes for reading; various aspects of the location and situation in which the person is reading; and even the person's culture and times - in short, the reader's entire background of knowledge and experience (e.g. Brown, 1997). These various factors operate simultaneously for proficient readers; they usually operate quite unconsciously; and they can affect the identification of single words as well as the reader's understanding of an entire text.

Among the four skills, reading has particularly received emphasis because of its importance for the learner and his learning of new words through incidental, indirect and subconscious learning. Many research studies have linked vocabulary learning with reading (Huckin, Haynes and Coady 1998). Such learning involves inferring meanings using contextual clues to guess meanings, which should lead learners to activate their knowledge and enhance further vocabulary retention.

Extensive reading is commonly proposed as a way for learners to expand their vocabulary. It involves intensive use of the guessing strategy and has been strongly recommended as the only reasonable means of building a suitable large vocabulary (Krashen, 1989).

3. Justification for the guessing strategy

The fact that the guessing strategy is often encouraged is not surprising considering the enormous amount of words in the English language and the number of words one needs to know to recognize a reasonably high percentage of words in the written text. More and more studies show that a key factor affecting students' ability to make use of context is vocabulary knowledge. Barnett (1988) made some interesting points about it in his discussion on the guessing strategy: All facts suggest a need for selective approach, by the learner and the teacher.

- Usable context varies and is affected by the proportion of unknown words
- Learners with larger active vocabularies use available context better than those with smaller vocabularies.
- Beginning students and advanced students have been shown to use guessing strategies more than middle level learners.

These findings have some important implications. They support the idea that context is created in proportion to preexisting knowledge and show that vocabulary is an important part of that knowledge. In fact it is another indication that the level of linguistic development plays an important part on guessing. On the other hand, insufficient vocabulary can prevent learners from constructing enough context to guess unknown words regardless of how much effort they make.

Beginning students and advanced readers have been shown to use the guessing strategy more than readers in the middle levels (Barnett, 1988). This is probably because beginners don't know much language and have to guess. Advanced readers are likely to guess for the opposite reason; they know enough vocabulary to successfully apply the strategy.

Guessing from context is a complex and often difficult strategy to carry out successfully. To guess successfully from context, learners need to know about 19 out of every 20 words, 95% of a text, which requires knowing the 3000 most common words (Liu & Nation, 1985; Nation, 1990). According to Kelly (1990), even if one knows these words there is little chance of guessing the correct meaning „unless the context is very constrained, which is a rare occurrence“ (p. 203). Although this strategy often may not result in gaining a full understanding of word meaning and form, guessing from context may still contribute to vocabulary learning.

A procedure for guessing from context begins with deciding whether the word is important, whether it is a part of an important idea or is repeated often. Once learners decide that a word is worth guessing, they might follow a five-step procedure as suggested by Nation and Coady (1988):

- determine the part of speech of the unknown word,
- look at the immediate context and simplify it if necessary,
- look at the wider context,
- guess the meaning of the unknown word,
- check that the guess is correct.

Haynes (1984) believes that teachers should encourage guessing if clues are in the immediate context, but they should also teach learners when not to guess. A learner must be aware that many words have several possible meanings. Only by being sensitive to the circumstances in which a word is used can the reader decide upon an appropriate definition to fit the context.

A reader should rely on context clues when an obvious clue to meaning is provided, or when only a general sense of the meaning is needed for the reader's purposes. Context clues should not be relied upon when a precise meaning is required, when clues suggest several possible definitions, when nearby words are unfamiliar, and when the unknown word is a common one that will be needed again; in these cases, a dictionary should be consulted.

4. Using context clues

Contextual analysis is a strategy that can create optimal growth and development of identifying and learning new vocabulary within a text. As pointed out earlier, authentic contexts can be well motivating for vocabulary acquisition. Such learning often involves using context clues to guess meanings, which teachers hope will lead learners to activate their knowledge for further vocabulary retention. Use of context clues is an effective approach to teaching students to use context to figure out the meaning of an unfamiliar word they come across in their reading. Context clues are hints about the meaning of an unknown word. We all know that even when you use the dictionary, it is often necessary to read several definitions of a word before you can find the one that fits the meaning of the sentence. So you will have to be alert to context clues even when you use the dictionary.

Using context clues as a strategy could help students to identify unknown words in sentences or longer texts. Context instruction should require students to have to make hypotheses about

what a word is based on, what they already know, and the context within which the word is found. Teaching students how to use context to derive word meaning is important. Students need guidance to learn new tactics and strategies that will help them increase their vocabulary and reading comprehension. They often guess unknown words without an effective strategy instruction. As educators, it is imperative to help the students learn how to solve a problem when they come to unknown or unfamiliar words within a text. If the learner does not have teacher assistance in this matter, the average learner will ignore the unknown word, skip over it, miss the meaning of the sentence, the meaning of the paragraph, and in many cases, the meaning of the entire text. When there are many new words, students are often discouraged. However, when the vocabulary of the text is more familiar, students are more likely to continue with the reading task.

There are several factors to consider when deciding on the use of context clues. In order for a reader to be successful in figuring out an unknown word, it depends on how many times the word is presented in the context, whether the context is oral or written, the ability of the reader to use context clues, and whether the context is sufficient. One way to implement context clues is by presenting students with single sentences first. It is more manageable and comprehensible for the student using a smaller chunk of a text (Buettner, 2002). Buettner suggested that students are able to focus on working on one sentence at a time. Clues may appear within the same sentence as the word to which it refers, or it may be in a preceding or subsequent sentence.

Most vocabulary is gained through reading and for that reason it is important that learners are able to recognize and take advantage of context clues. A writer may give the meaning of a difficult word in the passage itself. The explanation might follow a comma or a dash after the difficult word. This is especially used for place names, technical terms and other words that even native English speakers may not be familiar with.

For example:

When I was in Germany, I enjoyed *Schweinebraten*, which is a type of roast pork.

5. Types of context clues

There are several kinds of context clues that are quite common.

5.1. Definition

A definition gives the meaning of unfamiliar words. The author may use words, phrases or statements to define something. The writer will use key words or signal words to identify a definition, so we need to look for them.

Signal words:

is/are	means/mean
is/are called	what this means is
is/are known as	consist of
is/are defined as	refer to
is/are described as	may be seen as

e.g. **Inflation** is a rise in the general level of prices for things you buy.

an unfamiliar word = *inflation*

signal word = *is*

the definition = *a rise in the general level of prices for things you buy.*

5.2. Restatement

The author may use other words, phrases, or sentences to provide the meaning of difficult words. We call this example or restatement, the author describes it again or in a different way.

Signal words: or, that is to say, in other words, i.e. or that is

e.g. The surface of Africa consists mainly of **plateaus** or large flat areas.

an unfamiliar word = *plateaus*

signal word = *or*

the restatement = *large flat areas*

5.3. Synonym

The author uses another word or phrase to help the reader understand the meaning of a word. A synonym is a word that means the same or nearly the same as the unfamiliar word.

Signal words: also, as, like, similarly, or

e.g. After seeing the picture of the starving children, we all felt **compassion** or pity for their suffering.

an unfamiliar word = *compassion*

signal word = *or*

the synonym = *pity*

5.4. Cause and effect

The cause for or result of an unknown word enables the meaning of an unknown word to be inferred.

Signal words: because, since, as

e.g. The door was **ajar**, so the dog got out of the house.

an unfamiliar word: *ajar*

signal word: *so*

the cause: *the door was ajar*

the effect: *the dog got out of the house*

5.5. Examples

The author provides several words or ideas that are examples of an unfamiliar word.

Signal words: for example, for instance, such as, like

e.g. In science we are studying marine **mammals** such as whales and dolphins.

an unfamiliar word: *mammals*

signal word: *such as*

example: *whales and dolphins*

5.6. Contrast

You can guess the meaning of new words by using signal words of contrast. They will show the opposite meaning of the new words.

Signal words; but, even though, instead of, in contrast to, in spite of, although

e.g. My last flat was very small, but my new one is quite **spacious**.

an unfamiliar word: *spacious*

signal word; *but*

contrast: *small/spacious*

If students cannot find any signal words, as stated before, they may look around new words or unfamiliar words and try to guess them. Even when students are able to use context clues to infer the meanings of unfamiliar words, the words may not become part of students' speaking, listening or reading vocabularies. In fact, learning new words from context might well be only the first step learners employ and they should carry on to learn new words together with the context where it appears (e.g. remembering the word together with the surrounding context). Students must remember that they should not guess all the time. At some point they should use a dictionary for words that they feel are important enough to have a very clear and precise understanding.

6. Study

The aim of this study was to demonstrate effectiveness of different types of context clues. The questions guiding this research are: do context clue strategies support students when finding the meaning of an unknown word and what types of clues students find more effective or helpful for guessing the meaning of unknown words. This study therefore attempts to examine the comparative effect of types of context clues (synonyms, definitions, examples, contrast) on learners' prediction of the meaning of unknown vocabularies. Thus, the objectives of this study are:

- a) to investigate the effect of contextual clues on predicting meaning of unknown vocabularies which contributed to improve the reading comprehension of different texts,
- b) to examine the effectiveness of certain types of contextual clues which require the learners guess the meaning of unfamiliar vocabularies in the text quickly.
- c) to find the comparative effect of types of contextual clues on learners' prediction of the meaning of unknown vocabularies.

The research was carried out on a sample of 76 first-year students of Business Trade and Accounting and Finance. All of these students are at the intermediate level. The study that was carried out was based on context analysis and effects of context clues.

6.1. Introductory lessons

Types of context clues were presented to students in mini-lessons. Presentations were given on clues that can be found with definitions within text, antonyms or contrasting statements within text, synonyms within text, and examples within a sentence as we decided to focus on these four types of context clue strategies.

During the first mini lesson we introduced our students to context clues, and during the second one we started practicing different types of them.

When a student is trying to reveal the meaning of a new word, it's often useful to help them look at what comes before and after that word. The surrounding words can give helpful context clues about the meaning and structure of the new word, as well as how it is used. We have found it effective to model a self-questioning strategy (activity) to identify the different types of context clues. Students can ask questions that are designed to focus attention on the unknown word and the possible clues to its meaning, such as: What are the surrounding words? How do these offer me clues? What does this word mean in terms of the context? It is also helpful to provide students with frequent reminders and examples of the different types of context clues. We also posted the list of context clues (and some corresponding examples) on Moodle pages. While students are reading chosen texts in pairs, they can try different ways to identify context clues. They can highlight or underline the unknown words and/or the surrounding context. They can mark the clues that they believe will help them uncover a

word's meaning, share their thinking and discuss. It is important that they repeat the process for one or two more words.

During the other type of activity we divided them in groups of four. Students silently read the passages with new and unfamiliar words. After reading, they have to write down definitions for these unknown words, but there's a catch! They're not allowed to use dictionaries, glossaries, dictionary.com or any other reference. Even when we do have a dictionary, we know that a word may have many different meanings depending on the context. They're only allowed to help each other and concentrate on the literary work in which the word appears. They must use context clues. Each team compares definitions. The team with the highest point total at the end wins the game.

The third type of the activity gave them a chance to create a passage with an unknown word for a partner to figure out. Now they are allowed to use dictionaries or online dictionaries to find one word they believe is unknown to their partner and we instructed them to place it within the context of 2-3 sentences. Then students exchanged papers with a partner and tried to use context clues to figure out the meaning of the new word.

The learning outcomes of these and similar activities are that students will be able to figure out the meaning of new and unfamiliar words to enhance reading enjoyment. They will practice looking for new and unfamiliar words in prepared sentences and use context to determine meanings of words. After reading a newspaper or magazine article, they will be able to choose new and unfamiliar words and will use context to determine the meaning of these words. Students can even use dictionaries to check to see if their meanings are correct and to continue development of dictionary skills.

6.2. Pretest and Test

During the next class, students had to do a pretest. As a pretest, they were given the words that were going to be used in tests and had to define them as best as they could.

The test followed and students were given 4 sets of multiple choice exercises, each one containing ten sentences with the same target words, but in each exercise these words were presented in sentences containing a different type of context clue. The test required the learners to read the sentences and choose the correct word for each target word. Four answers were offered for each sentence. The task that was required from the students included the following steps:

- a) read the sentence containing the target word,
- b) identify the context clues,
- c) guess the meaning of the unknown word with the context clues,
- d) choose the best answer from the choices.

6.2.1 The first exercise contained sentences with examples within a sentence as context clues:

Segregation based on race, ethnicity, or sex is discriminatory and should be outlawed.

- a) the best
- b) separation
- c) a coming together
- d) jargon

6.2.2 The second exercise used a context clue strategy including definitions within sentences:

Segregation is the institutional exclusion of an ethnic, racial, religious or other minority

group from the dominant majority.

- a) a coming together
- b) the best
- c) jargon
- d) separation

6.2.3 The third context clue strategy were contrasting statements:

They fought to end the **segregation** of black population and today they are integrated into our society.

- a) jargon
- b) separation
- c) a coming together
- d) the best

6.2.4 In the fourth exercise students had to identify synonyms as context clues:

The high degree of black **segregation**, racial discrimination, is explained largely by the persistence of racial prejudices.

- a) a coming together
- b) jargon
- c) separation
- d) the best

During the tests we noticed that students re-read the given sentences multiple times, used the strategies by locating clues in context, and took the time to think about the meaning. Students used skills and strategies that were practiced in previous classes. The process of acquiring the guessing strategy as well as the activities that were used for this purpose are shown in Table 1

Table 1 Guessing strategy procedure

Explanation	Explain the different types of context clues.
	Demonstrate how to identify context clues with excerpts from an authentic text.
	After you explain and demonstrate using a variety of materials, have students explain the use of context clues in their own words and show how they would apply the strategy in their own way.
Practice	Model a self-questioning strategy, using the list of context clue types, with questions such as these: What are the surrounding words? Do they offer me clues? What does this mean in terms of the context?
	Have students work in pairs to read unfamiliar text on the computer, highlight unknown words, find context clues to hypothesize the meaning, write definitions for unknown words, create a passage with an unknown word for a partner to figure out and then check the meaning using a dictionary
Testing	Pretest: Let students analyze the words that are going to be used in tests. Their task is to define them as best as they can.

	Test: Have students read the sentences and choose the correct word for each target word.

7. Analysis of the findings

The data analysis began by analyzing the results. The mean score of the test result was calculated. The analysis of data revealed that the previous knowledge and use of context clues has a significant impact on guessing the meaning of unknown vocabulary. Moreover, the research examined the comparative effect of types of context clue on learners' guessing of the meaning of unknown vocabulary. The findings revealed that definitions exercise has the most effect, it was followed by synonyms and examples although there wasn't much difference between the results of these three. The strategy of antonyms or contrasting statements proved to be the most difficult one. (Figure 2). The findings of the study reveal that different types of context clues are significantly effective for better comprehension and understanding of unknown vocabularies. Moreover, the learners were able to predict the meaning of unknown vocabularies better if context clues were alternatively synonyms, definitions, examples and antonyms.



Figure 1 The mean score of each exercise

8. Conclusion

This study has explored the effects of word guessing strategy training in the EFL classroom. Looking at the results of the tests, it is evident that the students were able to use the context clues to help them define the meanings of the unknown words. They had a difficult time

describing the words in their pretest because the words they got correct were very minimal. However, when the students were given the words in a sentence, a great number of them were able to use the clues in the sentences to help them. We can conclude that context clue strategies impact the ability of inferring meaning of words. Using context to infer lexical meaning is complex and can be difficult for numerous reasons, such as the learners' lack of vocabulary, their failure to identify or elaborately process unknown vocabulary, a lack of clues or the presence of deceptively transparent clues. Nevertheless, inferring vocabulary meaning from context is an essential strategy for developing reading comprehension and promoting lexical acquisition. Lexical development is a major concern of EFL learners, but unfortunately it is frequently undervalued by course designers and some instructors. To continue reading without interruption, guessing meanings of words from context is a useful skill. The word guessing strategy training as an approach to reading instruction has some beneficial effects on learner's reading ability and can enhance their word guessing ability significantly. The findings suggest that we should use word guessing strategy training in the daily English lessons more actively. We will therefore keep using context clues strategies in the classroom as these are strategies that students will carry with them throughout life because making inferences of meaning of words in context is something that happens naturally in our everyday lives.

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Developing teaching material for a Business English class

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Abstract. Although there is a wealth of published materials available, the business English teaching community stills faces a need to develop its own course materials to suit the particular needs of students. In addition, in a fast-changing environment it is of paramount importance that the material used in the classroom is authentic and up-to-date. It maximizes students' exposure to a rich variety of language use and enables them to develop communicative competence. It is also important that students are engaged affectively and cognitively in the language experience. The material used in a Business English classroom should be driven not only by teaching but also by learning principles. Business English teachers at Higher Education Institutions in Croatia often develop their own materials in addition to using off-the-shelf coursebooks. This paper will show how much Business English is taught at Universities in Croatia and whether - and who for - Business English teachers write their own materials.

Key words: *material development, business English, tertiary level.*

1. Introduction

Teaching materials have a great impact on what and how a teacher teaches and how a learner learns. Effective teaching / learning materials are shaped by taking into consideration various factors such as teacher, learner, and the teaching context. When a new course book, a course book series or any teaching material is being planned, all three elements must be taken into consideration. Course book developers try to target the book at a specific audience, i.e. learners and to tailor the tasks and activities to meet the needs of that particular audience.

The same applies for materials developed for a Business English class. Business English (BE), being part of a broader ESP field, has its own particular demands which shape the teaching material. In addition, the learners taught Business English have their own characteristics which have to be respected and language demands which have to be met. Although on the market there is a myriad of Business English teaching materials (i.e. course books, workbooks, etc.) for students at different levels of the Common European Framework of Reference for Languages (CEFR), it is debatable whether they can meet the specific requirements of students at Higher Education institutions (HEI) as it is a very specific teaching context.

2. What is Business English and who are its learners?

English for Specific Purposes (ESP) is a learner-centered approach to teaching English as a foreign language. It is a term often used to describe language that is inaccessible to people who are not members of a particular language community (Frendo, 2005:6). It meets the needs of learners who need to learn English for use in their specific professional fields such as business. At its core, ESP has been "a practitioners' movement, devoted to establishing . . .the

needs and relevant discourse features for a targeted group of students” (Johns in Paltridge&Starfield, Eds. 2013:6).

2.1 Business English

Business English falls within the scope of ESP (Hutchinson & Waters, 1987) and should be analysed as such. It shares the common features of ESP, such as needs analysis, syllabus and course design, and materials selection. However, it is different from other ESPs as it is a mix of a specific content (related to the particular industry or job area) and general content (related to the ability to communicate in various situations that arise within the business context, such as small talk at a product launch, the ability to negotiate, etc.). In other words, BE draws on general English for some of the content and adds other elements specific to business as is shown on figure 1.

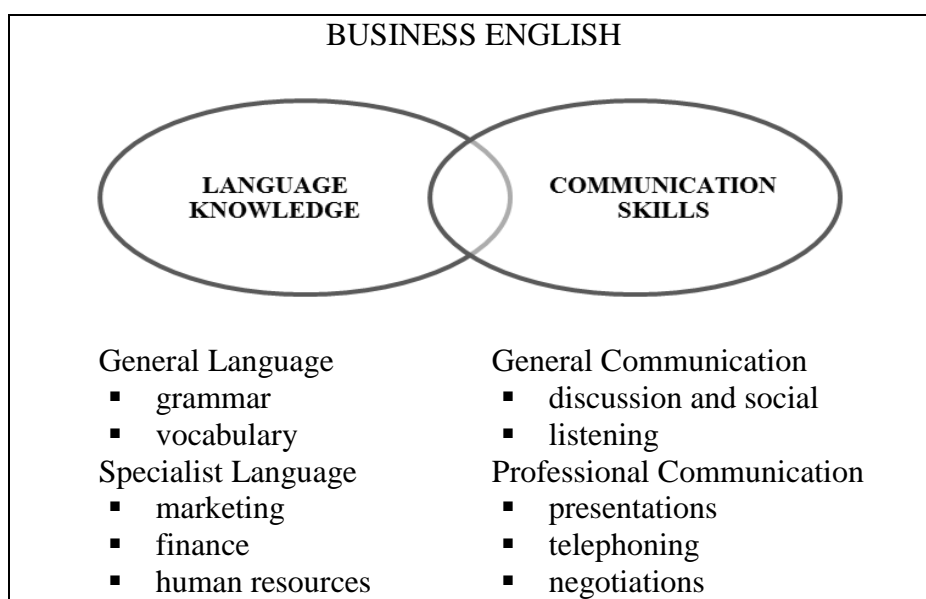


Figure 1 The scope of Business English (from Brieger, 1997:6)

Figure 1 shows that the scope of Business English includes not only language knowledge and communication skills, but also professional content. The teaching of Business English thus brings together three areas: teaching, English and business. Teaching refers to teaching both language, i.e. grammar and vocabulary, and communication skills needed in the professional world, e.g. presentation skills, report and e-mail writing, etc. English refers to the language being taught, and business is the professional content taught, which includes a range of themes related to the professional context such as marketing or finance. To be more precise, the professional context refers to the settings in which relevant language knowledge must be acquired and communication skills developed.

2.2 Business English learners

The content of a BE course and the methodology used always reflect the diverse needs of varied learner groups. Although it might be claimed that a language teacher’s primary role is to teach language and not the content it is not the case with pre-experience learners within the HEI context. Donna (2000:2) states that teaching Business English involves teaching English to adults working in businesses of one kind or another, or preparing to work in the field of business. Frendo (2005:1-2) groups learners according to their experience, level in the organisations’ hierarchy, national culture, needs, and language level. Brieger (1997:3) distinguishes between pre-service students and in-service professionals. A similar distinction is found at Ellis and Johnson (2003:5-6), who say that Business English learners can be

divided into pre-experience learners (or low-experience learners) and job-experienced learners.

Pre-experience learners or pre-service students are learners in educational institutions such as colleges and universities who take Business English courses to prepare for their future career, i.e. because they intend to follow a business career. They usually lack practical knowledge. They are often unaware of their future language needs in terms of communicating within the business context and very often study to pass an examination, be awarded a number of ECTS (European Credit Transfer and Accumulation System) credits, and eventually get a degree. Most students at the University of Split, Faculty of Economics (EFST) are pre-experience learners who, because of their lack of experience, will often need the teacher to “provide a window on the business world”. (Frendo, 2005:1).

On the other hand, job-experienced learners or in-service professionals, are learners who are already employed and have business experience. They need to learn English for a new job or a new situation which they lack the necessary experience for, e.g. establishing joint ventures in another country or being selected for a new project. They do not need their teacher to explain them the world of business but to help them develop the four language skills. Thus, their courses have different objectives and course content, and different methodology might be applied than when teaching pre-experience learners.

3. Business English and its teachers

Business English teacher can work in several contexts: education institute, private language school, in-company or 1-to-1 (Frendo, 2005:2-5). As Higher Education institutions (HEIs) fall within the education institute category, only teachers working in this context are the subject of this section.

Since the field of ESP is extremely varied, Dudley Evans and St. John (1998:14) refer to ESP teachers as ESP practitioners to emphasize the several roles they play. The five key roles of the ESP practitioner are: teacher, course designer and materials provider, collaborator (who works with subject teachers), researcher (who not only gathers materials but also understands those materials), and evaluator (who continuously evaluates the syllabus, materials used and tests learners). For the purpose of this paper, we shall concentrate only on the first two roles, i.e. teacher, and course designer and materials provider. It does not mean that other roles are ignored as all five roles are closely connected and interrelated.

3.1 Business English practitioners as teachers

ESP practitioner's role of a teacher is primarily the role of a language teacher. However, his/her role largely depends on whether the learners are pre-experience or job-experienced ones. Job-experienced learners are the primary knowers of the content and the teacher's role is to create real communication in class on the grounds of learners' knowledge (Sierocka, 2008:35). In-service students, who are a type of job-experienced learners, who are for example taking an in-house course in English have the content knowledge but lack, to a greater or lesser degree, language knowledge. The relationship between learners and teachers in this setting might be more of a partnership where learners contribute to the course with their content knowledge and teachers with their language knowledge. Scrivener (2005:310) says that “you (the teacher) know about English; they (the students) know about the topic”. Harding states that you don't need to be an expert, but you need to have some understanding of the subject area (Harding, 2007:8). Frendo (2005:5) claims that in most other fields of teaching the teacher knows more about the subject than the learner, but in Business English the relationship can be more symbiotic: the teacher knows about language and communication, but the learner often knows more about the job and its content. Although the stated might apply to job-experienced learners, it is not necessarily applicable to pre-service

learners as they also usually lack content knowledge, especially in their undergraduate studies, so the line between the role of a language teacher and content teacher becomes often blurred at HEI. This puts forward a challenge to ESP practitioner as a teacher if he/she needs to be more of an expert in the professional area that their students are studying than it is the case when teaching job-experienced learners. His/her role is not only to teach language but also through that language familiarise students with the professional content. The role of ESP practitioner at a HEI is closely connected to the role of a course designer and materials provider.

3.2 Business English practitioners as course designers and materials providers

Although there is a very wide selection of published textbooks that can be used in a Business English class and the teacher can select materials which match learners' demands and needs, it is uncommon to use only a particular textbook without supplementary material as evidenced by the analysed obligatory literature at the faculties of economics and business in Croatia. It is very difficult for ESP teachers to find on the market one catch-all course book or course book series which would target the very specific professional learners' needs. This is particularly true at HEIs because the needs of the learners' at undergraduate level are very broad and they must cover a wide range of topics since when they take obligatory Business English courses they have not chosen their field of specialization yet. A course book is very important for the teacher as it is often the structure of the course syllabus because it provides a framework for a course, forming in essence a syllabus (Robinson, 1991:57). If such literature is not available, the teacher must provide the material for the course, either by adapting the existing one or developing completely new. The ESP teachers at HEIs are also very often materials providers (Lekaj Lubina et al., 2015) because they must meet very specific and very diverse needs of various ESPs taught at different HEIs. The teaching material must be effective and the ESP practitioner must assess the effectiveness of the materials used, whether it is published or self-produced. Business English teachers embark on the adventure of developing their own materials because appropriate and qualified materials have, on the one hand, a positive effect on the learners' learning styles and learning result and, on the other hand, they have a great influence on what and how the teacher teaches and, to some extent, even the teacher's classroom management is determined by the materials.

4. Teaching materials in foreign language teaching

Business English falls within the scope of ESP (Hutchinson & Waters, 1987) and shares the common features of ESP as was previously explained and the teaching material chosen should meet the specific learners' needs. When selecting the material, it is important to know who the Business English learners are, i.e. whether they are pre-experience or job-experienced learners, so as to cater for their needs appropriately. As there are several types of learners, there should be different types of materials.

Brieger claims (1997:4) that the history of English Language Teaching can be roughly divided into two periods: the pre-communicative era (pre-1975) when most ELT was aimed at learning grammar and vocabulary and the post-communicative era (post-1975) when the main objective became developing fluency and communicative competence as learners needed to learn how to use the language in real-life situations. The way teachers and course book developers look at Business English has changed over the years. In the late 1960s and early 1970s it was believed that specialist vocabulary was what distinguished Business English from General English. This meant that earlier textbooks reflected this approach and all the tasks were aimed at acquiring specific vocabulary and no consideration was given as to how a student would apply the vocabulary in practice, e.g. how they would write a letter or communicate at a meeting. In the mid-1970s and 1980s, more emphasis was being put on

functional areas such as giving opinion, making recommendations, showing agreement (Ellis and Johnson, 2003:3-5). Since then, the emphasis has shifted on understanding the role of lexis and its relationship with grammar as the distinction between the two is becoming more blurred and the approach known as communicative language teaching (CLT) is being developed which aims to develop learners' ability to use language to communicate (Frendo, 2005:12). Business English textbooks have followed the same path.

In recent decades, due to the expansion of international trade and business, there has been a strong growth of published materials in Business English (Dudley-Evans & St John, 1998:2). However, although Business English is a major field in terms of textbooks, many ESP practitioners also must develop their own materials because the very specific learners and teaching contexts demand very specific materials they use in their class in addition or not to a coursebook. Arguments have been presented both for and against using coursebooks (Ur, 2009). The advantages of a course book are obvious: they save teachers a lot of work as they provide a framework to work with. Course content, i.e. all the texts and tasks have been prepared, and the methodology has already been made. It is a convenient and the cheapest way of providing content to learners. The course book also provides a syllabus. The books look good and professional, and are usually a part of the package which includes teacher's book, practice file/workbook, test files, audio and video resources, self-study materials, etc. The disadvantages are that a course book cannot necessarily fully meet the learners' needs and it must be either adapted or supplemented by additional materials. In addition, they can date quickly, the topics may not be of interest to the learners. They are limiting for teachers' creativity and lead to learners' lack of motivation and boredom. Anthony (1997) had a very negative view of teaching from ESP course books believing that teachers were often 'slaves' to the book or worse taught from textbooks which were unsuitable.

5. Business English courses and respective teaching materials at Croatian universities

According to the data of the Ministry of Science, Education and Sports, in Croatia there are 7 universities, 13 public polytechnics, 3 public schools of professional higher education, 3 private polytechnics and 25 private schools of professional higher education. The research presented in this paper focuses on seven universities and undergraduate and graduate programmes of Business and Economics delivered at those institutions.

Business English courses are taught at all state Universities in Croatia, namely at: the Faculty of Economics Rijeka (EFRI), Faculty of Economics and Tourism "Dr.Mijo Mirković" Pula (EFPU), Faculty of Economics Osijek (EFOS), Faculty of Organisation and Informatics (FOI), Faculty of Economics and Business Zagreb (EFZG), Faculty of Economics Split (EFST), University of Dubrovnik (UniDU) and University of Zadar (UniZD). The faculties' websites were analysed to obtain information on what BE courses they offered, when during the course of studies they are offered and how many ECTS were accredited which was a starting point for the analysis on the literature for the courses.

Table 1 Business English (BE) Courses at undergraduate studies at universities in Croatia

Faculty	Undergraduate studies						Graduate	
	1 st	2 nd	3 rd	4 th	5 th	6 th	1 st year	2 nd year
EFRI								
EFPU								
EFOS								
EFZG								
EFST								

FOI							
UNIZD							
UNIDU							

Key: Dark grey stands for obligatory and light grey for elective courses.

Table 1 shows that Business English courses are taught slightly more during the first two years of undergraduate studies, although there are differences in whether they are obligatory or elective courses. EFOS, EFZG and EFST are the only three faculties where BE is offered at the graduate level. Bearing in mind that undergraduate students are pre-experienced learners, their knowledge of the subject matter they are studying to get a degree in, i.e. business or economics, is very limited.

In order to analyse what materials are used, the respective faculties' website were also analysed to find out the literature for the courses. As not only faculties provide all relevant information, the Croatian Scientific Bibliography (CROSBI) was analysed as it provides information on the published coursebooks, workbooks, readers and the like by teachers working at Universities in Croatia. Websites of the University of Zadar, University of Dubrovnik and Faculty of Economics in Rijeka provide no information on the literature, nor was any information available through CROSBI, so these three institutions were excluded from further analysis. At most faculties, a part of the obligatory literature are coursebooks by prominent publishers, e.g. *Market Leader: Accounting and Finance*, *Market Leader* (various levels), *New Insight into Business* all by Longman, *English for Business Studies* and *Business Vocabulary in Use*, *Business Reports in English* all by CUP, *Business Basics*, *A Handbook of Commercial Correspondence* both by OUP and *In Company*, *Case studies* both by Macmillan. However, at all the faculties, ESP practitioners are also material developers which suggests that that they were not able to find a single course material on the market which would target their learners. Table 2 shows what books (coursebooks, readers, workbooks, additional material) were written by ESP practitioners at analysed Croatian faculties and are being currently used in class.

Table 2 Business English books by authors at universities in Croatia

Faculty	Authors	Title	Audience and/or details about the materials
EFPU	Dujmović & Kostić-Bobanović	<i>A Handbook of English Grammar</i>	first and second year undergraduate students
	Kostić-Bobanović & Dujmović	<i>Business English in use</i>	advanced students
EFOS	Sedlan König & Radoš	<i>On the line: a practical training in telephoning skills</i>	a collection of exercises useful in teaching English for telephone purposes
	König	<i>Hold the line, Business telephoning in practice</i>	
	König	<i>The Art of Presenting: a course in delivering presentations in English</i>	covers all major aspects of preparation and delivery of presentations
	Sedlan König, Knežević & Vujčić	<i>College writing skills for busy students</i>	book for everyone who needs to write for academic or business purposes
	Radoš & Meler	<i>English-Croatian Dictionary of Marketing Terms</i>	undergraduate and graduate Marketing students
	Radoš & Kirin	<i>Earn your points – English for</i>	coursebook designed for first-

		<i>First-Year Students of Economics</i>	year students of Economics
FOI	No author(s) were stated	<i>A selection of professional articles with exercises from publications in English</i>	materials used in lectures, consisting of texts and methodologically prepared exercises.
EZFG	Department of Business Foreign Languages	<i>Business English 1, Resource Bank</i>	first year of undergraduate studies
		<i>Business English 2, Resource Bank</i>	second year of undergraduate studies
EFST	Pašalić	<i>Business English 1 for Students of Economics and Business Economics</i>	first-semester undergraduate students of Economics and Business
	Duplančić Rogošić	<i>English for Business and Economics 2</i>	second-semester undergraduate students of Economics and Business
	Radmilo Derado	<i>Business English 3 Reader</i>	third-semester undergraduate students of Economics and Business
	Marinov, Duplančić Rogošić, Pašalić & Radmilo Derado	<i>Return on Investment</i>	a supplementary material for various Business English courses

It can be concluded from information available through CROSBİ and faculties' websites that Business English teachers in Croatia are also materials developers. Most materials are written for students at the institution where the teachers work as can be concluded from the available descriptions of the materials (e.g. third-semester undergraduate students of Economics and Business). However, this does not mean that the materials cannot be used with students at other HEI offering similar programmes (e.g. a supplementary material for various Business English courses).

6. Teaching practice at EFST

Ideally, before any material is developed a needs analysis is conducted. It is almost an essential starting point for ESP teaching and "we can't really address a student's specific needs unless we are absolutely clear about what they are" (Scrivener, 2011:310). Needs analysis enables us to focus on areas that are more relevant to the learner. The aim of a needs analysis is to collect information about the current situation and the target situation and understand the difference between the two, i.e. the training gap (Frendo, 2005:15). The stated gap leads to the design of the course, syllabus, methods, etc. Finding out about and analysing learners' needs is vital in ESP teaching. However, when the teaching practice changes very suddenly or a new course is being introduced practically overnight, there is no time for needs analysis. Teachers then rely on the coursebook that provides the syllabus.

Prior to the academic year 2007/2008, teaching Business English courses at the Faculty of Economics Split was done in a three-lesson block where one lesson was delivered in the form of lectures, which was used to introduce the topic, discuss it and clarify some difficult and/or unknown vocabulary that would be an integral part of exercises in the other two regular foreign language (FL) classes. Each group had around 60 students. The lecture was not a classical ex-cathedra lecture but was rather a combination of introductory tasks and discussion with students during which the teacher would teach using a two-way communication. Since the teaching practice was changed in 2007, students have been put into one to three groups for

ex-cathedra lectures with 250 students on average per group and several smaller groups of around 60 students per group for the regular FL classes. This teaching practice followed all the other courses taught at EFST and the typical type of instruction in the university setting in Croatia where lectures are used to communicate the contents of the subject matter to students. BE teachers had to adapt to the newly emerged situation. Since then, the primary purpose of lecture has been to introduce key concept and relevant vocabulary of the topic all interwoven into a story-telling lecture type. The teachers have also been explaining language structures through various examples. The students have been putting into practice the taught content during FL classes, sometimes even two or three days after the lectures. Thus, the students have been faced a dual challenge; the first one is that they are not familiar with the content and the other is that the content is being taught in a foreign language. The teachers have been challenged by the need to become more of experts in the field that is usually necessary when teaching Business English, or any other ESP.

From the explained teaching practice emerged a need to develop additional materials that would meet the needs of pre-experienced learners not familiar with the content being taught.

7. Materials used at EFST

On the market, there is a wide range of off-the-shelf teaching publications available. At EFST, a commercially available coursebook series (*Market Leader* published by Longman) has been used for classes as the core book as it is a multi-level Business English course for students of Business English. The course enables students to develop the communication skills needed to succeed in business and enlarge their knowledge of the business world (Cotton et al., 2012:4).

	DISCUSSION	TEXTS	LANGUAGE WORK	SKILLS	CASE STUDY
UNIT 1 CAREERS → page 6	Talk about your career plan	Listening: An interview with the Finance Director of a TV company Reading: Facebook profile 'could damage job prospects' – <i>Telegraph</i>	Career moves Modals 1: ability, requests and offers	Telephoning: making contact	YouJuice: Decide on the successful candidate for a job Writing: e-mail
UNIT 2 COMPANIES → page 14	Talk about companies	Reading: India: Tata's search for a new CEO – <i>Financial Times</i> Is John Lewis the best company in Britain to work for? – <i>Guardian</i> Listening: An interview with the CEO of a food company	Describing companies Present simple and present continuous	Presenting your company	Dino Conti Ice Cream: Decide on the best way to invest in a company's future Writing: proposal
UNIT 3 SELLING → page 22	Talk about shopping habits	Listening: An interview with the Director of Marketing of a TV shopping channel Reading: Women on top in new sales industry survey – web article	Making sales Modals 2: <i>must, need to, have to, should</i>	Negotiating: reaching agreement	A partnership agreement: Work on a proposed partnership between a jet charter company and a hotel group Writing: letter
WORKING ACROSS CULTURES: 1 SAYING 'NO' POLITELY					→ page 30

Figure 2 Screenshot of the Content page of the *Market Leader, Pre-intermediate, 3rd edition, Course Book* (Cotton et al, 2012:2)

As illustrated by figure 2, *Market Leader* is a very general Business English course book series which covers a very wide range of business topics. General Business English courses are justified at the undergraduate level at EFST, because Business English courses have to meet students' delayed needs, i.e. students are pre-experience and will be working on the specialism sometime in the future which we, the teachers, do not know what will be. *Market Leader* series has proved as a good basis for different Business English courses, from BE1 to BE6, as it has extensive supplementary material and is regularly updated. It covers a wide

range of general Business English topics and could be used to develop a good syllabus. No needs analysis has ever been conducted because the possible range of jobs future graduate students could have is too wide. Therefore, a general Business English course is ideal for them. In spite of this, the course book has always been supplemented by different authentic materials and activities bearing in mind the specific requirements of the teaching context. The additional materials would change every year so as to fill the gaps students had.

Most materials, whether they be written for a global market, for an institution or even for a class, aim to satisfy the needs and wants of an idealized group of target learners who share similar needs and levels of proficiency No matter how good the materials are, they will not by themselves manage to cater to the different needs, wants, learning styles, attitudes, cultural norms and experiences of individual learners. (Tomlinson, quoted in Mc Donough et al., 2013:64)

Market Leader series had been chosen for the previously explained reasons. However, almost any major off-the-shelf series could be used to teach in a regular Business English class. However, when the teaching practice was changed and one 45-minute ex-cathedra lecture for very large groups of students was introduced at EFST, it became evident that the chosen coursebook, or any other coursebook for that matter, could not meet the newly emerged needs. *Market Leader* course book, practice file and practice exercises on the DVD continued to be used for the FL classes, but it was up to the teacher(s) to devise new additional materials in order to be well prepared to lecture about a business / economics topic for 45 minutes every week. The teachers had to become more of content experts than was previously required so as to be able to deliver lectures in English on a professional topic. They had to write their own materials not only for students but also for themselves.

To compensate for both students' and their own lack of specialist knowledge, teachers had to become researchers, which is also one of the roles of ESP practitioners. Teachers were not provided with any time for needs analysis and very limited time for materials research and materials development. A close cooperation with subject specialist was also required but was not possible because of time constraints during the initial development of the materials. The following year some help and direction was received from subject experts. It was somewhat limited although their experience and knowledge would have lessened the FL teachers' workload. The teachers at EFST thus gathered different, authentic and up-to-date texts from various sources such as business journals, books and relevant websites that they adapted language-wise so the students could understand the language being used to present the unknown content. This is of paramount importance as there appears to be a minimum proficiency level that is required for students to participate in predominately content-related activities (Yogman and Kaylani (1996, quoted in Gatehouse, 2007). Research has shown that students who are struggling to catch up with general language proficiency simply find the content activities to be overwhelming (Gatehouse, 2007). The students should not have to learn both the language and the content at the same time. In addition, although it would be expected that the groups at EFST are fairly homogenous as they must meet the same entry requirements to enrol, i.e. pass lower level at the state Matura exam, that is not the case and groups are heterogeneous with different levels of knowledge.

Having adapted the texts, a wide range of exercises, such as fill in the gaps, matching task, corpus-based tasks, collocation tasks, etc., was written to help students learn and revise the vocabulary necessary for dealing with business topics covered in FL classes. Many tasks also aimed at developing students' communication skills needed in the business context. Some of the materials, e.g. *English for Business and Economics 2*, also provide a key to exercises which makes materials suitable for self-study and revision. Additional materials offered more

opportunity and additional context to students to practice the repertoire acquired in content lectures and language acquired in the FL class.

8. Conclusion and recommendations

The aim of this research was to explore how the teachers at Faculty of Economics Split dealt with changed teaching practice in terms of the materials used. Based on the results of the analysis of faculties' websites and Croatian Scientific Bibliography, it was found that Business English teachers at EFST do not rely only on the course books available on the market but develop their own materials, which is in line with other Business English teachers at Croatian faculties of business and economics. It is also in line with foreign language practices as teachers often develop their own materials as the available off-the-shelf materials cannot meet the specific needs and demand of students at Higher Education Institutions. It should be stressed that the right choice of materials is important as it motivates learners and builds an ideal teaching/learning effect.

Based on the findings of this research, several guidelines for future research can be recommended. First, a questionnaire should be designed to research the teachers' motives for developing the material, what sources they use, what challenges they face, whether they conduct a needs analysis prior to developing the materials and whether they obtain help from content experts. The questionnaire should be administered to all Business English teachers at Croatian Universities. Second, a future research could include all HEIs where Business English courses are taught to see whether there is any difference in material development between institutions offering undergraduate degrees and undergraduate professional degrees. Third, another research could focus on various ESPs taught at different faculties. Although Business English is a big field in English Language Teaching, teachers still develop additional materials. It would be interesting to see how teachers who have no or very limited choice of materials for teaching their ESP cope with this problem.

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Pregovarački postupak bez prethodne objave

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Sažetak. Direktive i uredbe EU o javnoj nabavi, kao skup propisa, primarno uređuju učinkovito i racionalno trošenje proračunskih sredstava država članica EU-a, a Zakon o javnoj nabavi Republike Hrvatske uređen na načelima Ugovora EU-a i načelima javne nabave, sukladan direktivama i uredbama EU o javnoj nabavi, osigurava učinkovito i racionalno trošenje proračunskih sredstava RH. Cjelokupni sustav javne nabave utemeljen je na transparentnosti, zabrani diskriminacije i jednakom tretmanu gospodarskih subjekata što omogućuje slobodu kretanja robe i usluga, a rezultira intenziviranjem tržišnog natjecanja te u konačnici dovodi do gospodarskog rasta i razvoja. Prilikom provedbe pregovaračkog postupka bez prethodne objave naručitelj se obraća gospodarskim subjektima po vlastitom izboru i pregovara o uvjetima ugovora s jednim ili više gospodarskih subjekata te nije obavezan dosljedno primjenjivati načela javne nabave, osobito načela tržišnog natjecanja i transparentnosti. Europski sud pravde je kroz svoju praksu utvrdio dva osnovna pravila za primjenu ovog postupka:

- zakonske pretpostavke moraju se strogo tumačiti, postupak treba provoditi iznimno, kad su zakonske pretpostavke za njegovu provedbu zaista ispunjene
- teret dokaza da okolnosti konkretnog slučaja opravdavaju primjenu ovog postupka je na naručitelju.

Pregovarački postupak bez prethodne objave najmanje je konkurentan i transparentan postupak od svih postupaka javne nabave. Pregovarački postupak bez prethodne objave je drugi primjenjivani postupak kod sklapanja ugovora o javnoj nabavi u Republici Hrvatskoj. Prema statističkom izvješću¹ o javnoj nabavi u Republici Hrvatskoj za 2014. godinu ukupna vrijednost javne nabave bila je 32.875.972.157,00 kuna. Naručitelji su se najčešće koristili otvorenim postupkom i to u 78,54 % slučajeva, a pregovaračkim postupkom bez prethodne objave u 10,78 % slučajeva.

Ključne riječi: *javna nabava, pregovarački postupak bez prethodne objave*

1. Uvod

Javna nabava uređen je postupovan sustav nabave roba, radova i usluga u kojemu se javni i privatni sektor susreću u financijskom smislu. Visina financijskih transakcija u javnoj nabavi, u godišnjoj ukupnosti svih provedenih postupaka, predstavlja važan dio u gospodarstvu svake države članice EU-a. Stoga su jasno određeni glavni zadatci kao što su: osiguranje pravne sigurnosti, učinkovito i racionalno trošenje sredstava iz proračuna, sprječavanje korupcije i kriminala, poticanje gospodarskog razvoja, zapošljavanje i tržišno natjecanje te unaprjeđenje upravljanja javnim financijama.

Republika Hrvatska suočena sa stalnim proračunskim manjkom i kontinuiranim rastom javne potrošnje usmjerila je posebnu pozornost na javnu nabavu. Sustav javne nabave značajnije se

¹ www.javnanabava.hr – 23. veljače 2016. - Službeno izvješće Uprave za sustav javne nabave

počinje primjenjivati procesom pridruživanja europskim integracijama, čime je Hrvatska preuzela obvezu prilagoditi svoje pravne propise zakonodavstvu Europske unije. S obzirom na to da javna nabava ima značajan utjecaj na fiskalni sustav zemlje, unaprjeđenje sustava javne nabave direktno utječe na ekonomičnost, efikasnost, zakonitost i transparentno trošenje novca iz državnog proračuna. Pravna uređenost javne nabave uvjetovala je na kakav način možemo sklopiti ugovor o javnoj nabavi, bilo da se radi o nabavi roba, radova ili usluga. Postupci nabave moraju se temeljiti na transparentnosti, neometanoj tržišnoj konkurenciji i antikorupcijskim mjerama. Temeljem tih načela gradi se čitav sustav javne nabave, a njihovo razumijevanje i pravilna primjena znači pravilno tumačenje direktiva i uredbi EU-a o javnoj nabavi i Zakona o javnoj nabavi.

2. Pregovarački postupak javne nabave bez prethodne objave

Sukladno Zakonu o javnoj nabavi naručitelji mogu provoditi pregovarački postupak javne nabave s prethodnom objavom poziva na nadmetanje i pregovarački postupak javne nabave bez prethodne objave poziva na nadmetanje.

Pregovarački postupak javne nabave bez prethodne objave poziva na nadmetanje Zakon o javnoj nabavi² definira u čl. 2. točki 20. kao postupak u „kojem se naručitelj obraća gospodarskim subjektima po vlastitom izboru i pregovara o uvjetima ugovora s jednim ili više gospodarskih subjekata“. U provedbi ovog postupka naručitelj nije obavezan dosljedno primijeniti načela javne nabave kao što su načelo transparentnosti i načelo tržišnog natjecanja te je iz tog razloga za primjenu ovog postupka javne nabave Europski sud pravde utvrdio dva značajna pravila. Prvo pravilo određuje da se ovaj postupak može provoditi iznimno, kada su za njegovu primjenu ispunjene zakonske pretpostavke, a zakonske pretpostavke moraju se strogo tumačiti. Drugo pravilo određuje da je na naručitelju teret dokazivanja opravdanosti primjene ovog postupka za konkretan slučaj. Naručitelj je obavezan u prethodnoj obavijesti o namjeri sklapanja ugovora navesti obrazloženje posebnih slučajeva i okolnosti koje opravdavaju primjenu ovog postupka. Zakon donosi ista postupovna pravila za javne i za sektorske naručitelje.

Sukladno europskim izvorima prava, i to mišljenja Europskog suda pravde i direktivama EU-a koje uređuju javnu nabavu, u Zakonu o javnoj nabavi RH-a definirani su posebni slučajevi i okolnosti za primjenu pregovaračkog postupka bez prethodne objave i to u: članku 26. st. 2. za javne radove, članku 27. st. 2. za robe, članku 28. st. 2. za javne usluge i čl. 117.

Ugovor o javnim radovima smije se sklapati u pregovaračkom postupku javne nabave bez prethodne objave:

1. Kada nije dostavljena nijedna ponuda ili nijedna prikladna ponuda ili nije dostavljen nijedan zahtjev za sudjelovanje u provedenom otvorenom ili ograničenom postupku javne nabave, pod uvjetom da se početni uvjeti ugovora bitno ne mijenjaju i da je Europskoj komisiji poslan zapisnik iz članka 37. stavka 8. Zakona, ako ga zatraži.³

Neprikladna ponuda je ona ponuda koja u cijelosti ne odgovara potrebama naručitelja određenim u opisu predmeta nabave i tehničkim specifikacijama kojima se nude roba, radovi i usluge koji očito ne zadovoljavaju potrebe naručitelja u odnosu na traženi predmet nabave.

² Zakon o javnoj nabavi (NN 90/11, 83/2013, 143/2013) i Odluka Ustavnog suda Republike Hrvatske broj: U-I-1678/2013 od 19. prosinca 2013. (NN 13/2014)

³ Članak 26. stavak 2. Zakona o javnoj nabavi (NN 90/11, 83/2013, 143/2013) i Odluka Ustavnog suda Republike Hrvatske broj: U-I-1678/2013 od 19. prosinca 2013. (NN 13/2014)

2. Kada zbog tehničkih ili umjetničkih razloga ili razloga povezanih sa zaštitom isključivih prava ugovor može izvršiti samo određeni gospodarski subjekt.
Posebno ili isključivo pravo je pravo koje nadležno tijelo dodjeljuje na temelju zakona, drugih propisa ili upravnog akta, a koje obavljanje određene djelatnosti ograničava na jednog ili više gospodarskih subjekata te ima znatan utjecaj na mogućnost drugih subjekata da obavljaju tu djelatnost.
3. Kada je to nužno potrebno ako se zbog razloga iznimne žurnosti izazvane događajima koje javni naručitelj nije mogao predvidjeti, rokovi u otvorenom, ograničenom ili pregovaračkom postupku javne nabave s prethodnom objavom ne mogu primijeniti.
Okolnosti na koje se poziva za opravdanje iznimne žurnosti ne smiju ni u kojem slučaju biti uzrokovane postupanjem javnog naručitelja. Pod ovim slučajevima podrazumijevamo vanjski događaj koji se nije mogao izbjeći ili otkloniti kao tipičan primjer isključenja protupravnosti radnje te je razlog oslobođenja odgovornosti za štetu. Razlozi nastanka iznimne žurnosti moraju biti dokazivi, moraju potjecati od vanjskih uzroka i ne smiju ni u kojem slučaju biti uzrokovani postupanjem naručitelja. Viša sila (lat. *vis maior*) vanjski je događaj koji se nije mogao izbjeći, predvidjeti ili otkloniti, npr. klizanje tla, elementarne nepogode, ali i ratovi, štrajk.
Primjer: KOMUNIKACIJA EUROPSKE KOMISIJE – iznimna žurnost
Komunikacija u vezi s trenutnom azilantskom krizom, COM (2015)454 final⁴
Cilj komunikacije objasniti je razne mogućnosti zadovoljenja hitnih potreba na temelju primjenjivih propisa Europske unije u području javne nabave, za brzo osiguranje infrastrukture (smještaja), kao i najnužnijih potrepština (npr. šatori, kreveti, odjeća ...) i usluga (npr. usluge čišćenja, sigurnosti ...). Ugovorna tijela morat će za svaki pojedinačni slučaj ocijeniti koji će postupak odabrati za sklapanje ugovora čiji je cilj zadovoljenje najhitnijih potreba tražitelja azila (smještaj, potrepštine ili usluge).
4. Za dodatne radove čija ukupna vrijednost ne smije prijeći 25 % vrijednosti osnovnog ugovora, koji nisu bili uključeni u početni projekt niti u osnovni ugovor, ali su zbog nepredviđenih okolnosti postali nužni za izvođenje radova opisanih u njima, pod uvjetom da se ugovor sklopi s gospodarskim subjektom koji izvršava osnovni ugovor:
 - a) kada takve dodatne radove nije moguće tehnički ili ekonomski odvojiti od osnovnog ugovora bez znatnih poteškoća za javnog naručitelja ili
 - b) kada su takvi radovi, iako odvojivi od izvršenja osnovnog ugovora, nužno potrebni za njegov dovršetak.
5. Za nove radove koji se sastoje u ponavljanju sličnih radova koji se dodjeljuju gospodarskom subjektu s kojim je isti javni naručitelj već sklopio osnovni ugovor, pod uvjetom da:
 - a) su takvi radovi u skladu s osnovnim projektom za koji je bio sklopljen osnovni ugovor
 - b) je osnovni ugovor sklopljen u otvorenom ili ograničenom postupku javne nabave
 - c) je već u prvom pozivu na nadmetanje bila predviđena mogućnost primjene ovoga postupka
 - d) je javni naručitelj pri određivanju procijenjene vrijednosti nabave uzeo u obzir ukupnu procjenu troškova novih radova koji će se ponavljati
 - e) se ovaj postupak odvija unutar tri godine nakon sklapanja osnovnog ugovora.⁵

⁴ <http://www.javnanabava.hr/default.aspx?id=4047> – službena objava Sustava za javnu nabavu

⁵ Zakon o javnoj nabavi (NN 90/11, 83/2013, 143/2013) i Odluka Ustavnog suda Republike Hrvatske broj: U-I-1678/2013 od 19. prosinca 2013. (NN 13/2014)

Ugovor o javnoj nabavi robe smije se sklapati u pregovaračkom postupku javne nabave bez prethodne objave:

- Kada se predmetni proizvodi izrađuju isključivo u svrhu istraživanja, eksperimentiranja, proučavanja ili razvoja. Ova odredba ne obuhvaća proizvodnju kojom bi se ostvarila tržišna isplativost ili pokriće troškova istraživanja i razvoja.
- Za dodatne isporuke od dobavljača iz osnovnog ugovora koje su namijenjene ili kao djelomična zamjena uobičajene robe ili instalacija ili kao proširenje postojeće robe ili instalacija, ako bi promjena dobavljača obvezala javnog naručitelja da nabavi robu koja ima drugačije tehničke značajke što bi rezultiralo nesukladnošću ili nerazmjernim tehničkim poteškoćama u radu i održavanju. Trajanje takvih ugovora, kao i ugovora koji se ponavljaju, ne smije biti duže od tri godine.
- Za robu koja kotira i nabavlja se na burzi robe.
- Za kupnju robe po posebno povoljnim uvjetima od dobavljača koji je trajno obustavio poslovne djelatnosti, ili od stečajnog povjerenika ili likvidatora, ili u okviru nagodbe s vjerovnicima ili drugog sličnog postupka prema nacionalnim propisima zemlje sjedišta gospodarskog subjekta.⁶

Ugovor o javnim uslugama smije se sklapati u pregovaračkom postupku javne nabave bez prethodne objave:

- Kada se predmetni ugovor o javnim uslugama sklapa nakon provedenog natječaja te se, u skladu s odgovarajućim pravilima, mora sklopiti s pobjednikom ili jednim od pobjednika toga natječaja. U potonjem slučaju svi se pobjednici natječaja pozivaju na pregovaranje.
- Za prigodnu kupnju kada je robu moguće nabaviti koristeći posebno povoljnu mogućnost koja je dostupna samo u kratkom razdoblju po cijeni znatno nižoj od cijena uobičajenih na tržištu (samo za sektorske naručitelje).

Pregovarački postupak javne nabave bez prethodne objave započinje danom slanja poziva na pregovaranje. Ovaj poziv naručitelj ne objavljuje u Elektronskom oglasniku javne nabave. Poziv se u pisanom obliku upućuje izravno gospodarskom subjektu, odnosno gospodarskim subjektima s kojima naručitelj namjerava pregovarati. U pravilu se vodi s jednim gospodarskim subjektom, a ako naručitelj pregovaranje vodi s više gospodarskih subjekata, poziv im se upućuje istodobno, ali tako da nemaju uvid u podatke o ostalim gospodarskim subjektima.

Poziv na pregovaranje mora sadržavati:

1. datum do kojeg se mora dostaviti inicijalna ponuda
2. adresu na koju se ponuda dostavlja
3. podatak o jeziku na kojem se ponuda dostavlja
4. ostale podatke koje javni naručitelj smatra potrebnima
5. dokumentaciju za nadmetanje i ostalu moguću dodatnu dokumentaciju.

Sadržaj dokumentacije propisan je u članku 3. Uredbe o načinu izrade i postupanju s dokumentacijom za nadmetanje i ponudama. Dokumentacija za nadmetanje mora biti izrađena na način da sadrži sve potrebne podatke koji su gospodarskom subjektu potrebni za izradu kvalitetne ponude. Dokumentacija se sastoji od više dijelova, a to su: opći podatci, podatci o predmetu nabave, razlozi isključenja, odredbe o sposobnosti, podatci o ponudi i ostali podatci.

⁶ Zakon o javnoj nabavi (NN 90/11, 83/2013, 143/2013) i Odluka Ustavnog suda Republike Hrvatske broj: U-I-1678/2013 od 19. prosinca 2013. (NN 13/2014)

Naručitelj je dužan i u ovom postupku nabave odrediti obvezne razloge isključenja ponuditelja, kao i ostale razloge isključenja ponuditelja. Naručitelj je obavezan sukladno članku 67. i članku 68. Zakona o javnoj nabavi navesti koji razlog ili razloge će koristiti za isključenje natjecatelja ili ponuditelja. Osim razloga za isključenje, u dokumentaciji za nadmetanje, naručitelj je obavezan sukladno članku 69. - 72. Zakona o javnoj nabavi navesti uvjete pravne i poslovne sposobnosti koje ponuditelji moraju ispunjavati, a može financijske, tehničke i stručne sposobnosti.

Gospodarski subjekt pozvan od strane javnog naručitelja dostavlja cjelovitu ponudu u primjerenom roku, koji je naručitelj naveo u pozivu na pregovaranje i u dokumentaciji za nadmetanje. Rok za dostavu inicijalne ponude nije naveden u Zakonu, nego ga određuje naručitelj u svakom konkretnom slučaju ovisno o okolnostima vezanim za složenost predmeta nabave i vrijeme koje je potrebno za izradu i dostavu ponuda te ovisno o žurnosti potrebe za radovima, robama ili uslugama.

Ponuda je pisana obvezujuća izjava volje ponuditelja da izvede radove, obavi uslugu i/ili isporuči robu sukladno uvjetima i zahtjevima naručitelja navedenim u dokumentaciji za nadmetanje, a sadržaj propisan je člankom 10. Uredbe o načinu izrade i postupanju s dokumentacijom za nadmetanje i ponudama. Isti članak Uredbe uređuje i sadržaj ponudbenog lista.

Otvaranje ponuda kod pregovaračkog postupka bez prethodne objave nije javno prema zakonskoj odredbi. Pristigle inicijalne ponude javni naručitelj otvara i prvo provjerava postoje li razlozi isključenja te ocjenjuje sposobnost ponuditelja prema uvjetima navedenim u dokumentaciji za nadmetanje. U slučaju da je kod ponuditelja stečen razlog za isključenje, a on je jedini koji zbog tehničkih ili umjetničkih razloga, povezanih sa zaštitom isključivih prava, može izvršiti ugovor, naručitelj iznimno smije odustati od isključenja.

Kada ne postoje posebni uvjeti, a naručitelj ustanovi da kod ponuditelja ne postoje razlozi za isključenje i da ispunjava uvjete koji se odnose na njegovu sposobnost, tada pristupa pregledu i ocjeni inicijalnih ponuda. Inicijalna ponuda može biti i konačna ako ispunjava sve potrebe i zahtjeve naručitelja. Ako inicijalna ponuda nije i konačna, odnosno ne zadovoljava potrebe i zahtjeve naručitelja u potpunosti, nakon pregleda inicijalnih ponuda naručitelj dostavlja ponuditeljima poziv na izmjenu i/ili nadopunu inicijalne ponude ili na dostavu konačne ponude. Naručitelj prilikom otvaranja inicijalnih i/ili konačnih ponuda sastavlja Zapisnik o pregledu i ocjeni inicijalnih i/ili konačnih ponuda u pregovaračkom postupku bez prethodne objave prema članku 25. Uredbe o načinu i postupanju s dokumentacijom za nadmetanje i ponudama.

Na osnovu rezultata pregleda i ocjene konačnih ponuda naručitelj odabire najpovoljniju ponudu sukladno kriteriju za odabir ponude te donosi odluku o odabiru. Nakon donošenja odluke o odabiru naručitelj je obavezan u Elektroničkom oglasniku javne nabave Narodnih novina objaviti prethodnu obavijest o namjeri sklapanja ugovora ako je ovaj postupak proveden iz sljedećih razloga:

- ako nije dostavljena ni jedna ponuda, ni jedna ponuda nije bila prikladna ili nije dostavljen ni jedan zahtjev za sudjelovanje u otvorenom ili ograničenom postupku javne nabave, ali pod uvjetom da se početni uvjeti ugovora bitno ne mijenjaju
- ako zbog tehničkih, umjetničkih ili razloga povezanih sa zaštitom isključivih prava, ugovor može izvršiti samo određeni gospodarski subjekt
- ako se proizvodi izrađuju isključivo u svrhu istraživanja, eksperimentiranja, proučavanja ili razvoja
- za dodatne isporuke robe od dobavljača iz osnovnog ugovora
- za nove radove ili usluge koji se sastoje od ponavljanja sličnih radova ili usluga koje se dodjeljuju gospodarskom subjektu s kojim je isti javni naručitelj već sklopio osnovni ugovor

- ako se ugovor o javnim uslugama sklapa nakon provedenog natječaja te se, u skladu s odgovarajućim pravilima, mora sklopiti s pobjednikom ili jednim od pobjednika.

U sljedećim slučajevima naručitelj nije obavezan objaviti prethodnu obavijest o namjeri sklapanja ugovora:

- ako je iznimna žurnost razlog provedbe pregovaračkog postupka bez prethodne objave
- ako je predmet ugovora dodatni radovi i/ili dodatne usluge
- ako je predmet ugovora roba koja kotira i nabavlja se na burzi roba
- ako je predmet ugovora kupnja robe po posebno povoljnim uvjetima koji je trajno obustavio poslovne djelatnosti ili od stečajnog povjerenika ili likvidatora ili u okviru nagodbe s vjerovnicima.

U Prethodnoj obavijesti o namjeri sklapanja ugovora naručitelj obvezno mora navesti činjenice i okolnosti temeljem kojih je započeo i proveo pregovarački postupak javne nabave bez prethodne objave. Objava Prethodne obavijesti o sklapanju ugovora u Elektroničkom oglasniku javne nabave Narodnih novina ima učinak dostave odluke o odabiru. U slučajevima kada nije obvezna objava prethodne obavijesti o sklapanju ugovora, naručitelj nakon donošenja odluke o odabiru tu odluku dostavlja ponuditeljima na dokaziv način, a uobičajeno je kao poštanska pošiljka s povratnicom. U oba navedena slučaja odluka nije izvršna, nego je potrebno primijeniti rok mirovanja koji je za nabavu velike vrijednosti petnaest dana, a za nabavu male vrijednosti deset dana, s time da rok mirovanja počinje teći od prvog sljedećeg dana nakon objave Prethodne obavijesti o namjeri sklapanja ugovora, odnosno dostave odluke o odabiru.⁷ Protekom roka mirovanja odluka o odabiru postaje izvršna i nastaje ugovor o javnoj nabavi. Ako je u pregovaračkom postupku bez prethodne objave sudjelovao samo jedan ponuditelj tada odluka o odabiru postaje izvršna danom objave Prethodne obavijesti o namjeri sklapanja ugovora, tj. danom dostave odluke ponuditelju na dokaziv način.⁸ Javni naručitelj obavezan je za svaki sklopljeni ugovor o javnoj nabavi poslati na objavljivanje obavijest o sklopljenom ugovoru najkasnije 48 dana od dana sklapanja ugovora o javnoj nabavi, a sektorski najkasnije dva mjeseca od dana sklapanja ugovora o javnoj nabavi.

U obavijesti o sklopljenom ugovoru naručitelj mora naznačiti relevantne odredbe Zakona o javnoj nabavi na temelju kojih je sklopio ugovor te obrazloženje „posebnih slučajeva i okolnosti“ koji opravdavaju primjenu ovog postupka. Zakon o javnoj nabavi propisuje prekršaj naručitelja i odgovorne osobe naručitelja ako navedenu obavijest ne pošalje na objavljivanje u Elektronički oglasnik javne nabave Narodnih novina.

Primjena ovog postupka u sebi nosi i određene rizike. Postoji mogućnost plaćanja više cijene za nižu kvalitetu. Naime, ponuditelj nije prisiljen snižavati cijenu i jamčiti kvalitetu jer nema konkurencije te se samom provedbom ovog postupka sužava tržište.

Temeljem pregovaračkog postupka bez prethodne objave ne smije se sklopiti okvirni sporazum.

3. Pravna zaštita i nadzor nad provedbom zakona u javnoj nabavi

Pravni okvir sustava javne nabave sastoji se od: Zakona o javnoj nabavi, Zakona o koncesijama, Zakona o javno-privatnom partnerstvu i Zakona o Državnoj komisiji za kontrolu postupaka javne nabave. Osim što uređuju područje primjene, Zakoni imaju za cilj povećati transparentnost i nediskriminiranost cijelog sustava javne nabave.

⁷ Zakon o javnoj nabavi (NN 90/11, 83/2013, 143/2013) i Odluka Ustavnog suda Republike Hrvatske broj: U-I-1678/2013 od 19. prosinca 2013. (NN 13/2014), članak 59.,98.

⁸ Zakon o javnoj nabavi (NN 90/11, 83/2013, 143/2013) i Odluka Ustavnog suda Republike Hrvatske broj: U-I-1678/2013 od 19. prosinca 2013. (NN 13/2014), članak 59.,98.

Nadzor nad primjenom Zakona i podzakonskih propisa u području javne nabave ima za cilj sprječavanje i otklanjanje nepravilnosti koje su nastale ili bi mogle nastati. Kontrolu postupka javne nabave provodi Državna komisija za kontrolu postupka javne nabave koja je samostalno i neovisno državno tijelo nadležno za rješavanje žalbi u vezi s postupcima sklapanja ugovora o javnoj nabavi, okvirnih sporazuma i natječaja na koje se primjenjuje Zakon o javnoj nabavi. Za razliku od kontrole postupka koju provodi Državna komisija, predstavku za nadzor nad primjenom svih zakona koji reguliraju područje javne nabave može podnijeti građanin, pravna ili fizička osoba, anonimna ili službena osoba koja ne mora imati nikakav interes.

Žalbeni postupak, kao najčešći oblik pravne zaštite, temelji se, osim na načelima slobode kretanja roba, slobode poslovnog nastana, slobode pružanja usluga i načelima koja iz toga proizlaze, također i na načelima zakonitosti, učinkovitosti, ekonomičnosti i kontradiktornosti postupka. Pravo na žalbu ima, odnosno žalitelj može biti: fizička osoba, pravna osoba, zajednica fizičkih i pravnih osoba koja ima ili je imala pravni interes za dobivanje određenog ugovora ili okvirnog sporazuma o javnoj nabavi i koja je pretrpjela ili bi mogla pretrpjeti štetu od navodnog kršenja subjektivnih prava, središnje tijelo državne uprave nadležno za sustav javne nabave i nadležno državno odvjetništvo. Ovdje je naglasak stavljen na pravni interes koji fizička, pravna ili zajednica fizičkih i pravnih osoba ima ili je imala za dobivanje ugovora ili okvirnog sporazuma te na štetu koja je pretrpljena ili koju bi mogli pretrpjeti. Ako navedeni uvjeti nisu ispunjeni, Državna komisija odbacit će žalbu zbog nedostatka pravnog interesa.

Zakon o javnoj nabavi, ovisno o vrsti postupka, različito propisuje rokove za izjavljivanje žalbe tako da su obuhvaćene sve situacije i kad je naručitelj proveo postupak javne nabave i kada ga nije proveo. Ako je gospodarski subjekt propustio rok za izjavljivanje žalbe u određenoj fazi postupka, nema pravo na žalbu u kasnijoj fazi postupka za prethodnu fazu. Žalba može biti izjavljena na slučajeve i okolnosti za odabir postupka, dokumentaciju za nadmetanje i moguću dodatnu dokumentaciju, postupak pregleda, ocjene i odabir ponuda, odnosno na razloge poništenja.

Kada govorimo o pravnoj zaštiti u pregovaračkom postupku bez prethodne objave prvenstveno moramo napraviti distinkciju između:

- žalbe protiv prethodne obavijesti i
- žalbe kada prethodna obavijest nije objavljena.

Kod žalbe protiv prethodne obavijesti rok za izjavljivanje žalbe u postupku nabave velike vrijednosti je deset dana, odnosno u postupku nabave male vrijednosti pet dana i to od dana objave prethodne obavijesti o namjeri sklapanja ugovora u odnosu na slučajeve i okolnosti za odabir postupka, dokumentaciju za nadmetanje i moguću dodatnu dokumentaciju, postupak pregleda, ocjena i odabira ponuda. Žalba izjavljena protiv prethodne obavijesti ima suspenzivni učinak te sprječava nastanak ugovora o javnoj nabavi.

U slučaju kada prethodna obavijest nije objavljena žalbu je moguće izjaviti kada naručitelj nije objavio prethodnu obavijest i to u roku od pet odnosno deset dana od dana primitka odluke o odabiru ili odluke o poništenju ugovora u odnosu na slučajeve i okolnosti za odabir postupka, dokumentaciju za nadmetanje i moguću dodatnu dokumentaciju, postupak pregleda, ocjena i odabira ponuda odnosno na razloge poništenja. Žalitelj koji je propustio izjaviti tako navedenu žalbu nema pravo na žalbu nakon objave obavijesti o sklopljenom ugovoru.

Osim prethodno spomenutih situacija ostali slučajevi u kojima je moguće izjaviti žalbu su:

- Ako naručitelj nije objavio prethodnu obavijest o namjeri sklapanja ugovora, žalba se izjavljuje u roku od 30 dana od dana objave obavijesti o sklopljenom ugovoru u odnosu na slučajeve i okolnosti za odabir postupka.
- Kada naručitelj nije objavio prethodnu obavijest te propusti objaviti obavijest o sklopljenom ugovoru, žalba se još može izjaviti sukladno članku 151. Zakona o javnoj

nabavi u roku od 30 dana od dana saznanja za ugovor sklopljen bez prethodno provedenog postupka, odnosno unutar roka od šest mjeseci od dana sklapanja takvog ugovora.

Naručitelj je obvezan odmah, a najkasnije u roku od pet dana od dana primitka žalbe dostaviti Državnoj komisiji za kontrolu postupaka javne nabave žalbu zajedno s podatkom i dokazom o načinu i vremenu zaprimanja, odgovor na žalbu s očitovanjem o žalbenom navodu i žalbenom zahtjevu, dokumentaciju koja se odnosi na postupak javne nabave s popisom priloga, podatak o objavi informacije ili dokaz o obavješćavanju odabranih natjecatelja, druge dokaze na okolnosti postojanja pretpostavki za donošenje zakonite odluke, radnji, postupaka ili propuštanja. Nadalje, naručitelj je obvezan na istim internetskim stranicama na kojima je objavio osnovnu dokumentaciju objaviti i informaciju da je izjavljena žalba i da se postupak javne nabave zaustavlja.

4. Zaključak

Pregovarački postupak javne nabave s prethodnom objavom jedan je od postupaka koje Zakon o javnoj nabavi definira kao postupak uz uvjetovanu primjenu i to isključivo kad nastupe okolnosti i slučajevi koje je Zakon taksativno naveo.

Praksa je pokazala i neminovnost ovog postupka i životnost njegove primjene. Stoga ne čudi da se primjenjuje, u prosjeku zadnje tri godine, oko 10 % u odnosu na sve ostale postupke javne nabave. Praksa je, također, pokazala i dodatne okolnosti koje bi novim zakonom o javnoj nabavi trebalo taksativno navesti i omogućiti širu primjenu ovog postupka. Svjesni njegovog djelovanja na smanjenje primjene načela javne nabave, prvenstveno transparentnosti i jednakog tretmana što uvjetuje ograničavanje tržišnog natjecanja, ipak provođenje dužeg i formalnijeg postupka, u određenim slučajevima dovodi do veće štete od selektivnog ograničenja tržišnog natjecanja. Prvenstveno u slučajevima zaštite zdravlja ljudi i životinja te očuvanja okoliša, kao i za neke usluge iz dodatka II b za koje se predviđa sličan postupak. Cilj izjednačavanja postupka za nabavu usluga iz dodatka II b i pregovaračkog postupka bez prethodne objave pojednostavljenje je složene i zahtjevne procedure javne nabave.

S obzirom na to da je javna nabava područje koje se intenzivno mijenja zbog prilagodbe društvenim i gospodarskim promjenama te razvoja i praćenja elektroničkog poslovanja, neminovne su promjene i pregovaračkog postupka bez prethodne objave i to njegove veće učinkovitosti i ekonomičnosti.

Reference:

Kolar, T., Loboja, A., Vuić Z.: Primjena novoga Zakona o javnoj nabavi i novih podzakonskih propisa Nove uredbe Vlade RH i novi pravilnici za provedbu novog Zakona o javnoj nabavi, Zagreb, Inženjerski biro, 2012.

Zakon o javnoj nabavi (Narodne novine br. 90/2011)

Zakon o izmjenama i dopunama Zakona o javnoj nabavi (Narodne novine br. 83/2013)

Zakon o izmjenama i dopunama Zakona o javnoj nabavi (Narodne novine br. 143/2013)

Odluka Ustavnog suda Republike Hrvatske broj: U-I-1678/2013 od 19. prosinca 2013. (Narodne novine br. 13/2014)

Zakon o Državnoj komisiji za kontrolu postupaka javne nabave (Narodne novine br. 18/2013)

Zakon o izmjenama i dopunama Zakona o Državnoj komisiji za kontrolu postupaka javne nabave (Narodne novine br. 127/2013)

Zakon o izmjenama Zakona o Državnoj komisiji za kontrolu postupaka javne nabave (Narodne novine br. 74/2014)

Uredba o načinu izrade i postupanju s dokumentacijom za nadmetanje i ponudama (NN 10/2012)

Uredba o objavama javne nabave (NN 10/2012)

Uredba o nadzoru nad provedbom Zakona o javnoj nabavi (NN 10/2012)

Portal javne nabave: <http://www.javnabava.hr> - službena internetska stranica Ministarstva gospodarstva, Uprave za sustav javne nabave RH

<http://www.dkom.hr> – službena internetska stranica Državne komisije za kontrolu postupaka javne nabave RH

Negotiated procedure without prior publication

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Abstract. EU directives and regulations of public procurement, as a set of regulations, primarily determine the effective and rational use of budgetary resources of EU member states, and the public procurement law in Republic of Croatia, arranged on the principles of the EU Treaty and the principles of public procurement, provides efficient and rational use of budgetary funds in Croatia. This paper describes the negotiated procedure without prior publication, its normative solutions, the practice of the State Commission for supervision of public procurement procedures and a practical example. Contracting authorities used mostly open procedure in 78.54% of the cases, and negotiated procedure without prior publication in 10.78% of cases in 2014. In the implementation of the negotiated procedure without prior publication, contracting authorities consult the economic operators of their own choice and negotiate the terms of the contract with one or more economic operators. The authorities are not obliged to consistently apply the principles of public procurement (in particular the principles of competition and transparency). Through its practice, the European Court of Justice has established two basic rules for implementing this procedure:

- the legal requirements must be strictly interpreted, the procedure should be carried out in exceptional cases, when the legal preconditions for its implementation are actually filled;
- the burden of proof that the circumstances of this case justify its application is on the contacting authority.

The procedure negotiated without prior publication is the least competitive and transparent procedure of all other public procurement procedures.

Key words: *public procurement, negotiated procedure without prior publication*

Prilog: [Call for initial offer Injector](#)



KLASA:

URBROJ:

Split, _____

Pursuant to Article 27, paragraph 2, point 1 of the Public Procurement Act (Official Gazette 90/11, 83/13, 143/13 and 13/14-decision of the Constitutional Court), we
deliver

INVITATION
for the negotiated procedure without prior publication
for the procurement of injectors
CPV 38340000-0

the economic operator

SCIENCE PRODUCTS GMBH
Hofheimer Str. 63
65719 Hofheim
GERMANY

The initial offer shall be submitted: _____

Address submitting initial bids: Sveučilište u Splitu
Split, Livanjska 5/I

Language of the initial written offer: Croatian

The authorized representatives of the client
Smiljana Bezić, certified representative
Prof. dr. sc. Ante Bilušić
Ivan Golub

TENDER DOCUMENTS

in public procurement

the negotiated procedure without prior publication

for the procurement of injectors

CPV 38340000-0

I. GENERAL INFORMATION

1.1. CLIENT

Name: **SVEUČILIŠTE U SPLITU**
Headquarters: **Split, Livanjska 5**
OIB (tax number): **29845096215**
Tel. / fax: **021/348900 021/339369**
Internet adress: www.unist.hr
E-mail address: sbezic@oss.unist.hr

1.2. PERSON IN CHARGE OF CONTACT

Smiljana Bezić, dipl. iur.
sbezic@oss.unist.hr

1.3. PROCUREMENT NUMBER

PP2 1-15

1.4. LIST OF ECONOMIC OPERATORS THAT THE CLIENT IN CONFLICT OF INTEREST::

- Ave d.o.o., Split, Mihanovićeve 27, OIB 39999401629
- Spiritus Maris d.o.o., Split, R.Boškovića 16, OIB 23788400959
- Stabilnost d.o.o., Split, Kroz Smrdečac 41, OIB 20957579034
- Poliklinika Dr. Ljutić d.o.o., Split, Spinčičeva 2c, OIB 89617509231
- Nefron, obrt za posl.usluge i turizam, Podstrana, Grljevačka 2b, OIB 86556834883
- Centar za medicinsko vještačenje d.o.o., Split, Šime Ljubića 33a, OIB 93222342278
- B.T.Projekt d.o.o. za graditeljstvo i usluge, Solin, K.Zvonimira 73, OIB 93375161353
- Theatrum Somnii d.o.o., Split, Vrlička 31, OIB 84582483117

1.5. TYPE OF PROCEDURE OF PUBLIC PROCUREMENT

Negotiated procedure without prior publication

1.6. ESTIMATE THE VALUE PUBLIC PROCUREMENT

230.400,00 HRK

1.7. TYPE OF CONTRACT PROCUREME

Supply Contract

1.8. THE ELECTRONIC AUCTION

Not intended implementation of an electronic auction

II. INFORMATION ABOUT SUBJECT OF PROCUREMENT

2.1. DESCRIPTION OF THE SUBJECT OF PROCUREMENT

injector

CPV 38340000-0

2.2. DIVISION OF THE PROCUREMENT

It is not permitted to offer groups..

2.3. QUANTITY OF THE SUBJECT OF PROCUREMENT

According to the specifications

2.4. PLACE OF DELIVERY OF GOODS

Kopilica 5, Split, Croatia

2.5. DELIVERY

90 days of signing the contract

SPECIFICATIONS

Naziv	Tehničke specifikacije	Ponudeni model	Jed. mjere	Količina	jed. cijena u €	Ukupno u €
Injector Ubrizgavač	<p>Engleski/English:</p> <ul style="list-style-type: none"> • minimum ejection volume: 500 picoliters or less, • injection type: pressure pulses, • adjustable pressure range within the range from 0 mbar to at least 5 bar, • pulse initiation: front panel (included), remote (either included or option), • adjustable pulse duration, minimal pulse interval of at least 10 milliseconds, • one injection channel, optional second channel, • certified according to CE or equivalent requirements, • warranty period: at least one year. <p>Hrvatski/Croatian:</p> <ul style="list-style-type: none"> • najmanji volumen ubrizgavanja: 500 pikolitara ili manji, • način ubrizgavanja: postizanjem pulseva tlaka, • mogućnost promjene tlaka u rasponu od 0 do najmanje 5 bara, • okidanje tlačnog pulsa: na upravljačkoj ploči ubrizgavača (uključeno), daljinski (uključeno ili opcija), • mogućnost promjene trajanja pulsa, minimalno trajanje pulsa barem 10 milisekundi, • jedan kanal ubrizgavanja, mogućnost dodavanja dodatnog, • sustav treba biti sukladan sa CE ili jednakovrijednim zahtjevima, • jamstveni rok: najmanje jedna godina. 	Model offered	kom.	1	Price in EUR	Total price
TOTAL IN EUR						

1.1.1.1 III. MANDATORY REASONS FOR EXCLUSION

3.1. Impunity

The contracting authority shall exclude the tenderer from public procurement procedure if the economic entity or person authorized by law to represent the legal entity convicted of any of the following crimes or for relevant offenses under the regulations of the host state of the undertaking or the state whose citizen the person authorized by law to represent the legal entity:

a) fraud (Article 236), fraud in business activities (Article 247), accepting a bribe in business activities (Article 252), bribery in business transactions (Article 253), abuse in the public procurement procedure (Article 254th), tax evasion and customs duties (Article 256), subsidy fraud (Article 258), money laundering (article 265), abuse of office and powers (Article 291), unlawful preferential treatment (Article 292), bribery (Article 293), bribery (Article 294), trading in influence (Article 295), bribery of trading in influence (Article 296), criminal association (Article 328) and committing a crime within the criminal association (Article 329th) of the Criminal Code,

b) fraud (Section 224), money laundering (article 279), fraud in business activities (Article 293), bribery in business transactions (Article 294a), bribery in business transactions (Article 294b) , conspiracy to commit criminal acts (Article 333), abuse of office and powers (Article 337), abuse of public office (Article 338), illegal mediation (article 343), bribery (Article 347) and giving bribery (Article 348) of the Criminal Code ("Official Gazette", no. 110/97., 27/98., 50/00., 129/00., 51/01., 111/03., 190/03 ., 105/04., 84/05., 71/06., 110/07., 152/08., 57/11., 77/11. and 143/12.)

For the purposes of determining the circumstances mentioned under a) and b) the economic operator to offer to submit a declaration. A statement by a person legally authorized to represent the legal entity. The statement may not be older than three months following the commencement of the public procurement.

The contracting authority may, during the procurement procedure for checking the above circumstances of the body in charge of keeping criminal records and the exchange of such data with other states for any bidder or a person authorized by law to represent the legal entity apply for confirmation of the facts on which that authority keeps official records.

If the client is unable to obtain a certificate from the competent authority to verify the above circumstances the client may request the tenderer to that in due time deliver a valid:

The first document of the body responsible for keeping criminal records of the host state company or a state whose citizen the person authorized by law to represent the legal entity, or
2. an equivalent document issued by a competent judicial or administrative authority in the country where the economic operator or the country of his nationality a person authorized by law to represent the legal entity, if it does not issue the document from the criminal record, or
3. A statement under oath or a corresponding statement of the person who is legally authorized to represent the legal entity before a competent judicial or administrative authority or a notary or a competent professional or trade body in the country where the economic operator or the country of which the person is a citizen or with a certified statement signed by a notary, if in

the country where the economic operator or the country of which the person is a citizen do not issue the documents referred to in items 1 and 2, or they do not include all of these crimes.

Pay-one due tax liabilities and obligations for pension and health insurance

The contracting authority shall exclude the tenderer from the procurement procedure if you did not fulfill the obligation to pay outstanding tax liabilities and liabilities for pension and health insurance, unless a special law to pay these liabilities is not permitted or is granted a delay of payment (for example in the process of the pre-settlement).

For the purposes of determining the above circumstances the economic operator to offer submitted:

1. Confirmation of the Tax Administration on the debt, which must not be older than 30 days from the start of the procurement procedure, or
2. Current equivalent document of the competent authority of the host state of the undertaking, if it does not issue certificates in point 1, or
3. A statement under oath or a corresponding statement of the person who is legally authorized to represent the legal entity before a competent judicial or administrative authority or a notary or a competent professional or trade body in the country where the economic operator or a statement certified by a notary, which must not be older 30 days after the start of the procurement procedure, when in the country where the economic operator does not issue the certificate referred to in item 1 or equivalent document referred to in point 2.

False data

The contracting authority shall exclude the tenderer from the procurement procedure if submitted false information in the delivery of documents that are part of the offer in this tender.

1.1.1.2 IV. CONDITIONS AND LEGAL CAPACITY

Any candidate or tenderer entering the court, working, professional or other appropriate register of the host state of the undertaking must show that it is registered for performing activities related to the subject procurement.

Register for membership proves the appropriate copy, and if they are not issued in the country where the economic operator, the economic operator may submit a declaration to validate the signatures by the competent authority.

A copy or statement referred to in paragraph 2 of this Article shall not be older than three months from the date of the public procurement procedure.

V. INFORMATION ABOUT THE OFFER

5.1. INTRODUCTION

1. supply list
2. documents which the bidder proves that there are mandatory reasons is off of the
3. evidence of ability
4. filled tio Colonel.

5.2. MAKING OFFERS

1. offer must be made in the form of one f indicated w ith this documentation
2. offer must contain all attachments f Observe certain one f the documentation signed and certified by the bidder
3. offer must be printed or written in indelible ink
4. offer must be bound into a book on the F and to prevent ht and subsequently your ving or insertion of pages or parts supply
5. website offers are checked off alas number on the d and that the visible page number and total number of pages.
6. providers plaintiff not entitled to change, correct, amend, or delete or in any other way h and of the original text which gave the plaintiff ordering F in the tender documents, otherwise his bid not'll take into consideration
7. the offer must be fully completed and attached to EN original tio Colonel who is part of this Documentation
8. Corrections in the offer must be made on the one f h and that are visible. Corrections shall state the dates of the correction to be confirmed '1 one signed by the bidder.
9. offer must contain evidence of the tenderer f Observe that the conditions and requirements of the tender documents, the documents which the bidder proves that there are no mandatory or other reasons is off of the evidence of the tenderer for the execution of the contract w ponuda mora sadržavati dokaze ponuditelja o ispunjavanju uvjeta i zahtjeva iz dokumentacije za nadmetanje, dokumente kojima ponuditelj dokazuje da ne postoje obvezni i ostali razlozi isključenja i dokaze o sposobnosti ponuditelja za izvršenje ugovora

5.3. METHOD OF SUBMISSION OFFERS

- The bidder shall submit its bid on its own tio home without making compensation claims $\frac{1}{4}$ of Naru h teacher of any kind
- offer power train will be delivered after that or directly to the address ordering teachers h in a sealed envelope.
- On the envelope, and should specify the address

SVEUČILIŠTE U SPLITU
Projekt MEMSplit

Livanjska 5
21000 SPLIT

and in the lower right corner of the envelope should be an indication

« PONUDA ZA NADMETANJE »

PP2 _____

- the envelope must be given a complete name and address of the bidder.

5.4. ELECTRONIC SUBMISSION OF TENDERS

Not allowed

5.5. METHOD OF PRICING OFFERS

The bidder is required:

- specify only h no price for each item bid tio Lieutenant Colonel
- specify only h does not cost fittings exclusively for the type and quality of the materials mentioned in the descriptive part tio Lieutenant Colonel
- bid price expressed in tender list
- bid price expressed in euros figures
- offer price excluding VAT must contain f should include all costs incurred W and discounts

5.6. CURRENCY

in EUR

5.7. SHELF LIFE OFFERS

minimum 60 days from the day the offer.

VI. OTHER PROVISIONS

6.1. The deadline the decision on selection or cancellation

The selection decision shall be issued within 15 days.

6.2. The deadline, manner and terms of payment

All payments will be made on client business account of the successful tenderer within 15 days of receipt of the invoice.

6.3. Legal remedies

An aggrieved party can complaint to seek protection of their rights before the State Commission for Supervision of Public Procurement. An appeal to the State Commission, and submitted to the client in writing or by registered mail within 5 days in accordance with the provisions of the Public Procurement Act

The appellant shall deliver a copy of the appeal in the same way to the State Commission for Supervision of Public Procurement, Koturaška road 43 / IV, 10000 Zagreb.

The authorized representatives of the client

Smiljana Bezić, certified representative

Prof. Ph. D.. Ante Bilusic

Ivan Golub

Podučavanje održivosti kroz matematičke kolegije

Nada Roguljić

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Sažetak. Glavna ideja ovog rada ukazati je na načine kako uključiti održivost u kurikulum matematičkih kolegija. Problematika održivosti je u svojoj biti interdisciplinarno područje. Postoji mnoštvo prilika za uvođenje primjera održivosti u matematičke kolegije, počevši od algebre i geometrije sve do analize i statistike. Poučavanje o održivosti prirodnih resursa ima najveći utjecaj upravo na velikim dodiplomskim matematičkim kolegijima poput onih koji se izvode na Sveučilišnom odjelu stručnih studija. Preporučamo načine na koji sveučilišni nastavnici matematike mogu pružiti kvalitetnu i autentičnu poduku svojim studentima baziranu na stvarnim podacima, koja uključuje ideje o održivosti unutar matematičkog konteksta, a bez ugrožavanja obveznih matematičkih sadržaja. Kao dodatni ishod učenja možemo očekivati osvještavanje važnosti problematike brige o okolišu i podizanje ekološke svijesti studenata.

Ključne riječi: *podučavanje, matematika, održivost*

1. Uvod

Tema održivosti (eng. *sustainability*) tema je koja zadnjih desetljeća zadire u sve sfere ljudskog života i djelovanja pa tako i u obrazovanje. Svjesni smo činjenice da je ubrzani industrijski i tehnološki razvoj čovječanstva s jedne strane donio kvalitetu života u razvijenim zemljama, a s druge strane doveo u pitanje održivost života na našoj planeti budućim generacijama. Neracionalni pristup eksploataciji prirodnih resursa i nedostatak promišljanja vladajućih elita doveo nas je do trenutka kada je nužno potreban preokret u razmišljanju o sadašnjosti kako bi negativne trendove u budućnosti okrenuli u održive. Pojam održivosti se različito definira: kao neprekidno održavanje raznolikog i produktivnog okoliša o kojem sav život ovisi; odgovorno korištenje resursa na neodređeno vrijeme; zadovoljavanje potreba sadašnjosti bez ugrožavanja mogućnosti budućih generacija da zadovolje svoje potrebe. Zato održiva budućnost prvenstveno ovisi o spremnosti društva da educira stručnjake koji će znati voditi radne procese, stvoriti infrastrukturu potrebnu da se optimizira upravljanje resursima. Obrazovanje, bilo formalno ili neformalno ključ je razvoja znanja, tehnologija i vještina potrebnih za održivu budućnost. Svjesni globalnog problema i upitne budućnosti Ujedinjeni narodi su proteklo desetljeće (2005. – 2014.) proglasili desetljećem obrazovanja za održivi razvoj. Nizom lokalnih i globalnih aktivnosti promicali su obrazovanje i podizanje razine svjesnosti za održivi razvoj od pojedinca do šire društvene zajednice. Brojne su inicijative zaživjele u raznim obrazovnim sferama poglavito u matematičkom obrazovanju i srodnim prirodnim i tehničkim disciplinama. Matematika planeta Zemlje 2013. (MPE 2013) je inicijativa matematičkih znanstvenih organizacija u svijetu s ciljem pronalaženja načina na

koji matematičke discipline mogu biti korisne u rješavanju globalnog svjetskog problema. Ova inicijativa rezultirala je nizom tematskih događanja u 2013. godini, uključujući i više od 10 dugoročnih programa na institutima širom svijeta, više od 50 radionica, gostovanjima pozvanih predavača, brojnim javnim predavanjima, razvojem obrazovnih materijala, tematskim umjetničkim izložbama i međunarodnim nagradnim natječajem za razvoj inovativnih obrazovnih modula prikladnih za širu diseminaciju.

2. Matematika i održivost

Trend integriranja koncepta održivosti u matematičke kolegije i obrnuto sve je prominentniji na svim razinama obrazovanja. Razlog leži u njihovoj prirodnoj vezi. Doslovno sva pitanja u održivom razvoju zahtijevaju matematičke vještine: mjerenja, procjene, pretvorbe jedinica, skaliranja u jednodimenzionalnom, dvodimenzionalnom, trodimenzionalnom, a čak i četverodimenzionalnom prostoru, matematičkog modeliranja rasta ili pada, korištenja numeričkih podataka u različitim analizama i razumijevanju ograničenja [3]. Analize održivosti počivaju na tablicama, grafovima i matematičkim jednadžbama. Međutim, da bi ideja održivosti zaživjela u svojoj punini nije dovoljno da se integrira samo u postojeće STEM discipline, već je nužno da održivost postane nova obrazovna paradigma. Kao takva mogla bi transformirati ne samo suhoparne akademske discipline nego bi promijenila način na koji razmišljamo o svemu što nas okružuje. Analiziranje realnih problema iz područja održivosti donosi dodanu vrijednost nastavi matematike. Studenti dobivaju širu sliku, postaju svjesni ograničenja koje nam priroda postavlja, a i uviđaju važnost matematike na putu rješavanja gorućih problema. Održivost je autentični, zanimljivi i motivirajući kontekst u kojem matematika ima svoju nezamjenjivu ulogu.

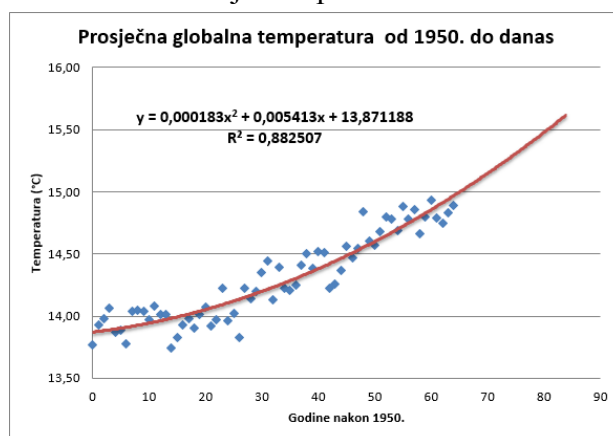
3. Primjeri integriranih sadržaja

U ovom ćemo poglavlju kroz više primjera sugerirati kako integrirati teme iz održivosti u nastavu matematike u visokom školstvu, ponajprije u području matematičke analize i statistike [2]. Za obradu realnih podataka koristit ćemo se MS Excelom 2007, standardnim i pristupačnim alatom koji je većina studenata u mogućnosti koristiti.

3.1 Prosječna globalna temperatura

Za potrebe ovog primjera potrebno je dohvatiti podatke o prosječnoj globalnoj temperaturi [9]. U radnom listu MS Excela kreira se točkasti dijagram. Uz pomoć opcije *Trendline* izabere se odgovarajuća funkcija koja najbolje modelira podatke. Kriterij odabira je iznos koeficijenta determinacije R^2 .

Tako za dohvaćene podatke dobivamo sljedeći prikaz:



Slika 1 Kretanje prosječne globalne temperature od 1950. do 2014. godine

Od studenata možemo očekivati da nađu rješenja sljedećih problema [4]:

- Odredite matematički model koji dobro opisuje kretanje prosječne globalne temperature kao funkcije vremena.

Dane podatke sa zadovoljavajućim iznosom koeficijenta determinacije R^2 modelira kvadratna funkcija

$$f(x) = 0,000183 \cdot x^2 + 0,005413 \cdot x + 13,871188.$$

- Upotrebom dobivenog modela prognozirajte globalnu prosječnu temperaturu za navedeni niz godina, kao i porast temperature u odnosu na 2014. godinu (t_1).

Tablica 1

Godina	Prognozirana temperatura t_2	$\Delta t = t_2 - t_1$
2020.	15,15	0,26
2040.	15,84	0,95
2100.	18,80	3,91

- Odredite godišnju stopu promjene prosječne globalne temperature u 2014. godini. Kada se stopa promjene ne bi mijenjala, tj. kada bi ostala na nivou one u 2014. godini izvršite predviđanja iz gornje tablice.

Odgovarajuće rješenje nalazi se određivanjem nagiba tangente na krivulju u danoj točki. Stoga je potrebno odrediti prvu derivaciju dobivene funkcije i njenu vrijednost za 2014. godinu ($x = 64$).

$$f'(x) = 0,000366 \cdot x + 0,005413$$

$$f'(64) = 0,0288$$

Možemo reći da je 2014. prosječna globalna temperatura bila 14,89°C uz stopu godišnjeg rasta 0,0288°C.

Tablica 2

Godina	Prognozirana temperatura t_2	$\Delta t = t_2 - t_1$
2020.	15,06	0,17
2040.	15,64	0,75
2100.	17,37	2,48

- Prema danom modelu odredite koje bi godine očekivana prosječna globalna temperatura iznosila 20°C.

$$y = 20^\circ\text{C}$$

Rješavanjem kvadratne jednadžbe dolazimo do rješenja $x = 168,81$ (2119. godina).

Obradi ovakvog sadržaja može slijediti kraća rasprava o uzrocima globalnog zatopljenja, posljedicama na okoliš i život na zemlji, mogući scenariji, osobnoj odgovornosti pojedinca za moguće promjene. Zainteresirane studente može se uputiti na daljnje proučavanje problematike [10].

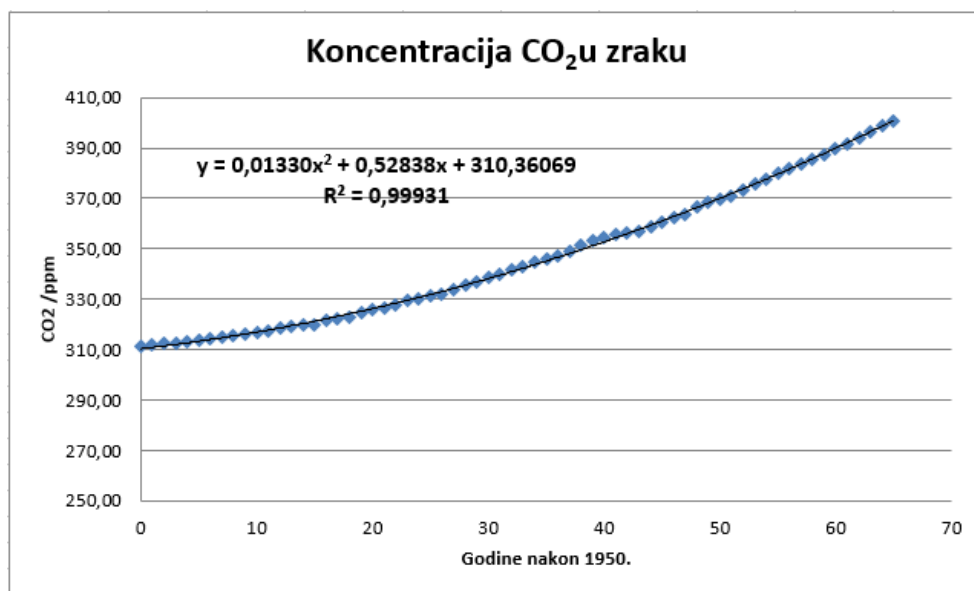
3.2 Koncentracija CO₂ u zraku

Za potrebe ovog primjera potrebno je dohvatiti podatke o koncentraciji CO₂ u zraku. Podaci su mjereni u atmosferskom opservatoriju na Havajima Mauna Loa i dohvaćeni s web stranice [11] za razdoblje od 1959. do 2015., a od 1950. do 1958. povijesni podaci sa [13] (godišnje prosječne vrijednosti CO₂). Podaci su:

	A	B	C	D	E	F	G	H	I
1	Godina	Godine nakon 1950.	CO2 ppm	Godina	Godine nakon 1950.	CO2 ppm	Godina	Godine nakon 1950.	CO2 ppm
2	1950	0	311,26	1973	23	329,68	1996	46	362,59
3	1951	1	311,74	1974	24	330,17	1997	47	363,71
4	1952	2	312,22	1975	25	331,08	1998	48	366,65
5	1953	3	312,70	1976	26	332,05	1999	49	368,33
6	1954	4	313,22	1977	27	333,78	2000	50	369,52
7	1955	5	313,73	1978	28	335,41	2001	51	371,13
8	1956	6	314,25	1979	29	336,78	2002	52	373,22
9	1957	7	314,77	1980	30	338,68	2003	53	375,77
10	1958	8	315,28	1981	31	340,10	2004	54	377,49
11	1959	9	315,98	1982	32	341,44	2005	55	379,80
12	1960	10	316,91	1983	33	343,03	2006	56	381,90
13	1961	11	317,64	1984	34	344,58	2007	57	383,76
14	1962	12	318,45	1985	35	346,04	2008	58	385,59
15	1963	13	318,99	1986	36	347,39	2009	59	387,37
16	1964	14	319,62	1987	37	349,16	2010	60	389,85
17	1965	15	320,04	1988	38	351,56	2011	61	391,63
18	1966	16	321,38	1989	39	353,07	2012	62	393,82
19	1967	17	322,16	1990	40	354,35	2013	63	396,48
20	1968	18	323,04	1991	41	355,57	2014	64	398,61
21	1969	19	324,62	1992	42	356,38	2015	65	400,83
22	1970	20	325,68	1993	43	357,07			
23	1971	21	326,32	1994	44	358,82			
24	1972	22	327,45	1995	45	360,80			

Slika 2 Koncentracija CO₂ u zraku, od 1950. do 2015. godine

U radnom listu MS Excela kreira se točkasti dijagram. Uz pomoć opcije *Trendline* izabere se odgovarajuća funkcija koja najbolje modelira podatke. Kriterij odabira je iznos koeficijenta determinacije R^2 . Tako za dohvaćene podatke dobivamo sljedeći prikaz:



Slika 3 Koncentracija CO₂ u zraku, od 1950. do 2015. godine podaci modelirani kvadratnom funkcijom

Od studenata možemo očekivati da odgovore na sljedeća pitanja:

- Odredite matematički model koji dobro opisuje kretanje koncentracije CO₂ kao funkcije vremena.

Dane podatke sa zadovoljavajućim iznosom koeficijenta determinacije R^2 modelira kvadratna funkcija:

$$f(x) = 0,01330 \cdot x^2 + 0,52838 \cdot x + 310,36069$$

- Upotrebom dobivenog modela prognozirajte kolika bi bila očekivana vrijednost koncentracije CO₂ 2050. godine?

$$f(100) = 496,20 \text{ ppm}$$

- Odredite godišnju stopu promjene koncentracije CO₂ u 2015. godini. Kada se stopa promjene ne bi mijenjala, tj. kada bi ostala na nivou one u 2015. godini izvršite predviđanja očekivane vrijednosti koncentracije CO₂ 2050. godine.

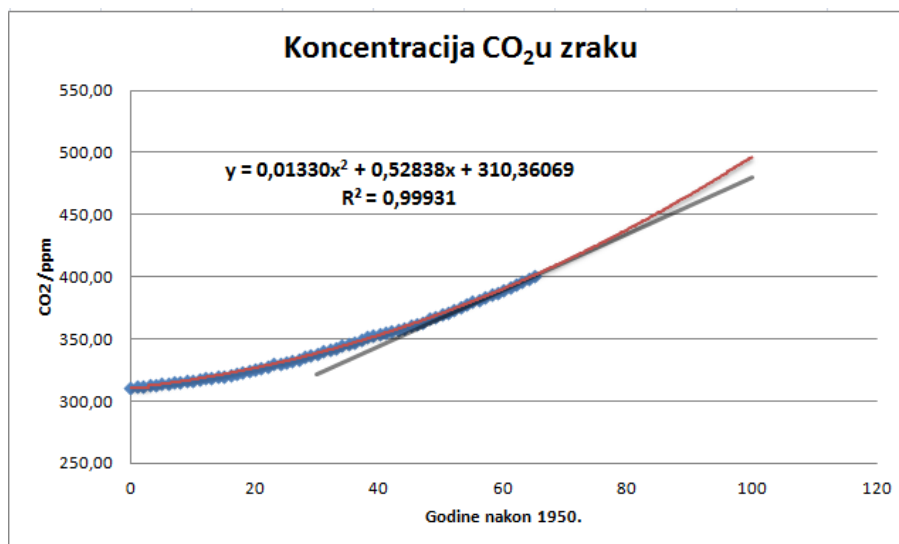
$$f'(x) = 0,0266 \cdot x + 0,52838$$

$$f'(65) = 2,25738$$

Predviđanje za 2050. godinu na bazi stope rasta iz 2015. dobit ćemo uvrštavanjem dobivenih podataka u jednadžbu tangente.

$$y = f'(x_0) \cdot (x - x_0) + y_0$$

gdje je $f'(x_0)$ stopa promjene (nagib tangente) u $x_0 = 65$ (2015. godina), $y_0 = 400,83 \text{ ppm}$ koncentracija CO₂ u 2015. godini, a $x = 100$ (2050. godina), y tražena koncentracija u 2050. godini. Tako bi, uz istu stopu promjene iz 2015., koncentracija CO₂ 2050. iznosila 479,84 ppm.



Slika 4 Koncentracija CO₂ u zraku, od 1950. do 2015. godine modelirana kvadratnom funkcijom; tangenta na krivulju u $x = 65$

- Prema [7] pri koncentraciji CO₂ od 450 ppm vjerojatnost globalnog zatopljenja od 2°C iznosi 50 %. Procijenite koje bi se godine mogla doseći ta vrijednost i prema dobivenom modelu, kao i prema kontinuiranom rastu stopom iz 2015. godine.

$$y = 450 \text{ ppm}$$

Rješenje ćemo dobiti rješavanjem jednadžbe. U prvom slučaju kvadratne, a u drugom slučaju linearne. Možemo zatražiti od studenata da napišu kratki tekst u kojem objašnjavaju dobivene vrijednosti.

Ako trend porasta koncentracije CO₂ nastavi slijediti dobiveni model s 50 % sa sigurnošću se tijekom 2035. godine može očekivati globalno zatopljenje od 2°C, a ako pak nastavi rast s konstantnom stopom iz 2015. Godine, taj porast može se očekivati u 2037. godini. Objasnite odakle razlika?

Prema [1] porast temperature od 1°C na današnju vrijednost globalne prosječne temperature značio bi daljnje zakiseljavanje oceana, slom prirodnih ekosustava, a značio bi i novih 18 – 60 milijuna gladnih u nerazvijenim zemljama. Porast od 1,5°C mogao bi dovesti do smanjenja ledenog pokrivača na Grenlandu i podizanja razine

mora za 7 m te posljedičnog poplavljanja obalnog pojasa. Porast od 2°C doveo bi do smanjenja poljoprivrednog prinosa u bogatim zemljama kao i ugroženost nedostatkom pitke vode za 1 – 3 milijardu stanovništva. Porast od 3°C značio bi propast ekološkog sustava Amazonske prašume. Porast od 4°C značio bi potpuni gubitak poljoprivredne proizvodnje za čitavu Afriku i Australiju.

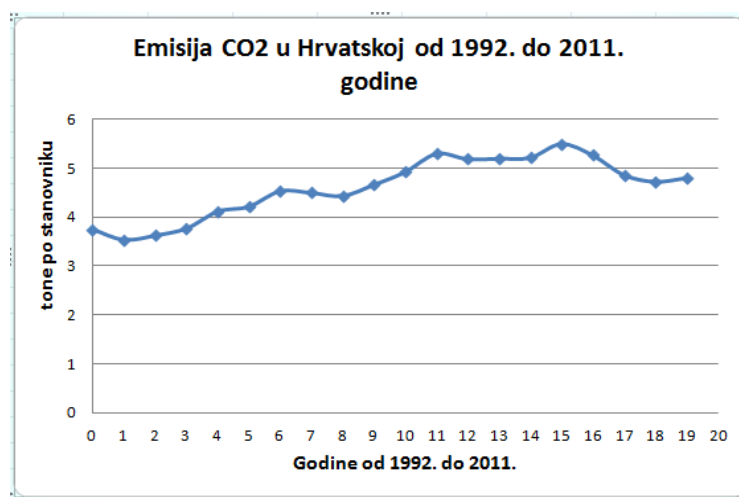
Kakav bi trebao biti trend promjene koncentracije CO₂ da bi izbjegli ovakav scenarij?

3.3 Emisija CO₂ u atmosferu (podaci za Hrvatsku)

Za potrebe ovog primjera potrebno je dohvatiti podatke o emisiji CO₂ u atmosferu. Kako bi se studenti lakše identificirali s problemom dobro je preuzeti podatke za Hrvatsku. Podaci su dohvaćeni s web stranice [6]. Obuhvaćena je emisija CO₂ koja nastaje zbog sagorijevanja fosilnih goriva i proizvodnje cementa. Ona uključuje i ugljični dioksid proizveden tijekom potrošnje krutog, tekućeg i plinovitog goriva.

Godina	Xt	CO2 emisija tona/stanovniku
1992	0	3,752
1993	1	3,541
1994	2	3,629
1995	3	3,772
1996	4	4,121
1997	5	4,220
1998	6	4,536
1999	7	4,500
2000	8	4,438
2001	9	4,666
2002	10	4,927
2003	11	5,302
2004	12	5,192
2005	13	5,202
2006	14	5,220
2007	15	5,501
2008	16	5,269
2009	17	4,867
2010	18	4,729
2011	19	4,802

Slika 5 Emisija CO₂ u RH



Slika 6 Emisija CO₂ u RH u tonama po stanovniku

Moguća pitanja koja se mogu postaviti studentima su:

- Koje je godine (od početka mjerenja) zabilježena maksimalna emisija CO₂ i koliko je ona iznosila? U usporedbi s 1992. godinom koliki je porast zabilježen?

Vidljivo je i iz tablice kao i grafa da je dosadašnji maksimum dosegnut 2007. godine i iznosi 5,501 tona/stanovniku. U odnosu na 1993. zabilježen je porast emisije od 1,049 tona/stanovniku

- Izračunajte postotnu promjenu emisije u svim godinama promatranog perioda u odnosu na početnu 1992. godinu. Interpretirajte stope promjene za 1994. i 2008. godinu!

1994. godine zabilježeno je smanjenje emisije CO₂ za 3,28 % u odnosu na 1992. godinu, a 2008. godine zabilježen je porast emisije CO₂ u odnosu na 1992. godinu za 40,42 %.

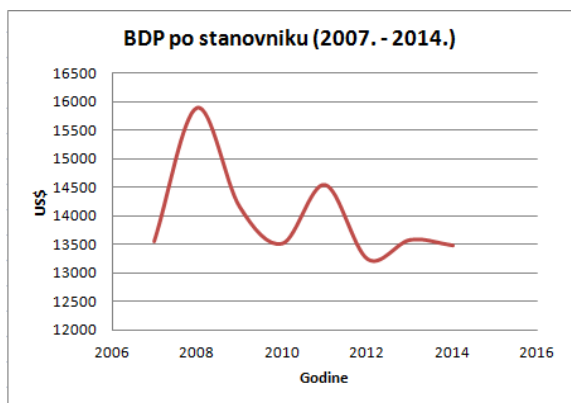
- Izračunajte postotnu promjenu emisije u nizu uzastopnih godina (lančane indekse) i pronađite te interpretirajte one indekse koji ukazuju na najveće smanjenje, odnosno povećanje emisije u promatranom vremenskom periodu.

Najveći pad emisije zabilježen je 2009. godine kada je, u odnosu na 2008., emisija smanjena za 7,64 %. Najveći se pak skok u emisiji dogodio 1996. godine kada je zabilježen porast emisije za 9,24 % u odnosu na 1995. godinu.

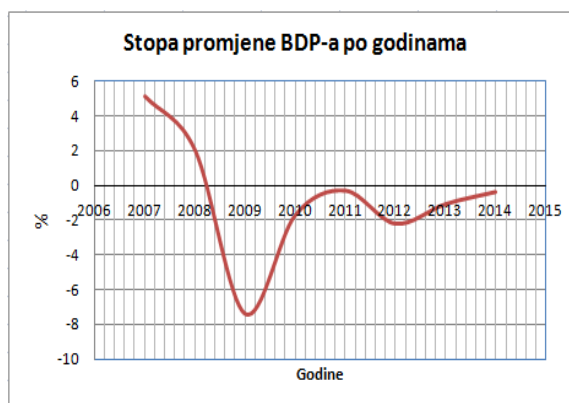
Godina	t	CO2 emisija tona/stanovniku	I(t) 1992.=100	S(t)	V(t)	S*(t)
1992	0	3,752	100,00	0,00	-	-
1993	1	3,541	94,36	-5,64	94,36	-5,64
1994	2	3,629	96,72	-3,28	102,50	2,50
1995	3	3,772	100,53	0,53	103,94	3,94
1996	4	4,121	109,82	9,82	109,24	9,24
1997	5	4,220	112,47	12,47	102,42	2,42
1998	6	4,536	120,89	20,89	107,48	7,48
1999	7	4,500	119,92	19,92	99,19	-0,81
2000	8	4,438	118,28	18,28	98,64	-1,36
2001	9	4,666	124,34	24,34	105,12	5,12
2002	10	4,927	131,31	31,31	105,61	5,61
2003	11	5,302	141,31	41,31	107,61	7,61
2004	12	5,192	138,37	38,37	97,92	-2,08
2005	13	5,202	138,63	38,63	100,19	0,19
2006	14	5,220	139,11	39,11	100,35	0,35
2007	15	5,501	146,59	46,59	105,38	5,38
2008	16	5,269	140,42	40,42	95,79	-4,21
2009	17	4,867	129,70	29,70	92,36	-7,64
2010	18	4,729	126,02	26,02	97,17	-2,83
2011	19	4,802	127,96	27,96	101,54	1,54

Slika 7 Emisija CO_2 u RH u tonama po stanovniku od 1992. do 2011, bazni indeksi na nivou 1992. godine i lančani indeksi te pripadne stope promjene

Daljnja rasprava može ići u smjeru pronalaženja razloga za najveći pad emisije 2009. godine u odnosu na 2008., pogotovo sa studentima ekonomskih usmjerenja. Kako bi se usmjerilo studente mogu im se podastrijeti podaci o kretanju BDP-a u tom promatranom razdoblju [6]. Evidentno je naime da je u tom periodu u RH došlo do pada gospodarske aktivnosti, a posljedično i smanjenja rasta emisije CO_2 .



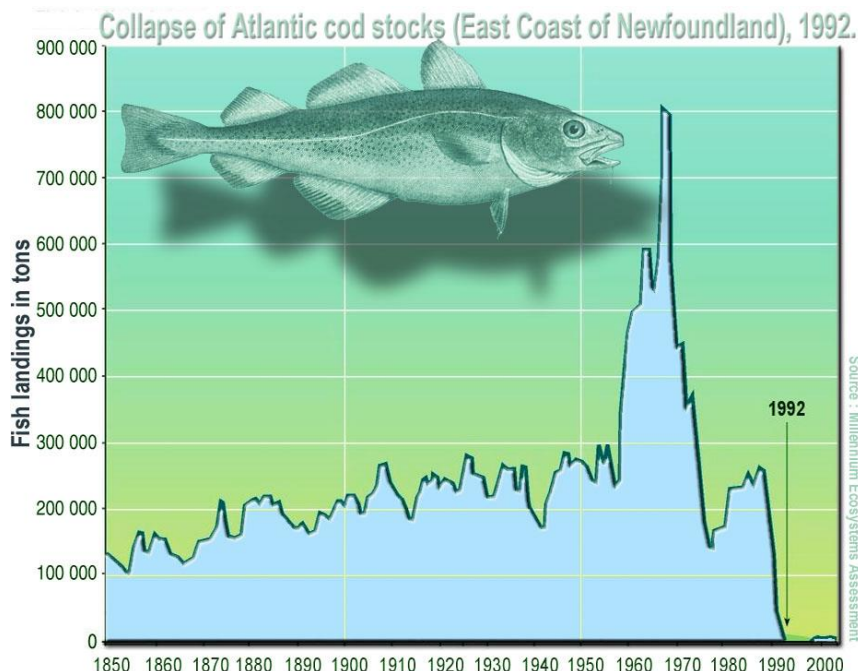
Slika 8 BDP per capita (US\$) za RH 2007. - 2014.



Slika 9 Stopa promjene BDP-a od 2007. do 2014.

3.4 Održivo ribarstvo

Recentna povijest zabilježila je više slučajeva kolapsa ribljeg fonda nekih vrsta, primjerice norveške haringe, bakalara, peruanskih incuna, pogotovo u razdoblju od 1960. do kraja prošlog stoljeća.



Slika 10 Kolaps ribljeg fonda atlantskog bakalara [12]

Tako je izlov atlantskog bakalara s održivog nivoa oko 250 000 tona godišnje narastao na visokih 800 000 tona godišnje što je dovelo do potpunog kolapsa u 1992. godini. Ovakve su pojave posljedica pretjeranog izlova, ali i klimatskih promjena, promjene temperature svjetskih mora te nedovoljne brige o akvakulturi. No, moguće je imati održivo ribarstvo pravilnim gospodarenjem i striktnim provođenjem lovnih kvota. Danas postoje institucije čija je to primarna zadaća. Jedan od načina da se postigne kvalitetno i promišljeno planiranje je modeliranje ulaznih varijabli (dostupnost hrane, stopa uzgoja, temperatura vode, onečišćenja) i izlaza (prirodna smrt, komercijalni ribolov). Takvo modeliranje moguće je pomoću diferencijalnih jednačbi [5].

3.4.1 Model kretanja količine ribe u ograničenom prirodnom okolišu

Ponudit ćemo posve pojednostavljen model količine ribljeg fonda u nekom geografski ograničenom području (npr. uvala).

$$\frac{dx}{dt} = x \cdot \left(1 - \frac{x}{12}\right)$$

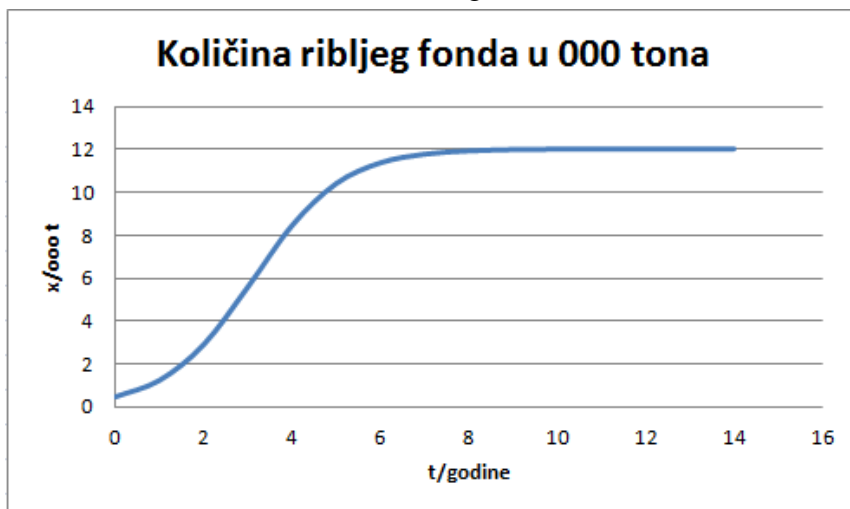
U ovom modelu x predstavlja količinu ribe (masu u tisućama tona), t vrijeme (u godinama). Faktor x s desne strane modela predstavlja rast ribljeg fonda, a izraz u zagradama smanjenje zbog ograničavajućih utjecaja. Broj 12 predstavlja stabilni (održivi) nivo ribljeg fonda.

Postavimo početni uvjet. Neka je početna količina ribe 500 t. Pišemo onda $x(0) = 0,5$.

Studenti kojima se ovo gradivo izlaže trebali bi biti u stanju riješiti diferencijalnu jednačbu uz zadani početni uvjet. Ovo je diferencijalna jednačba sa separiranim varijablama. Njeno rješenje uz zadani početni uvjet je:

$$x(t) = \frac{12}{1 + 23 \cdot e^{-t}}$$

Dobiveni model u MS Excelovom radnom listu izgleda:



Slika 11 Model kretanja ribljeg fonda u geografski ograničenom području (uvala)

- Kako se mijenja količina ribe u prve četiri godine? Koja funkcija opisuje takvo ponašanje?
- Kako se mijenja količina ribe za $t > 6$? Oko koje vrijednosti se stabilizira?
- Odredite točku infleksije za dani model?
- Dodatno istražite kakva je to logistička funkcija i koje se pojave njom modeliraju?

3.4.2 Model održivog ribarenja

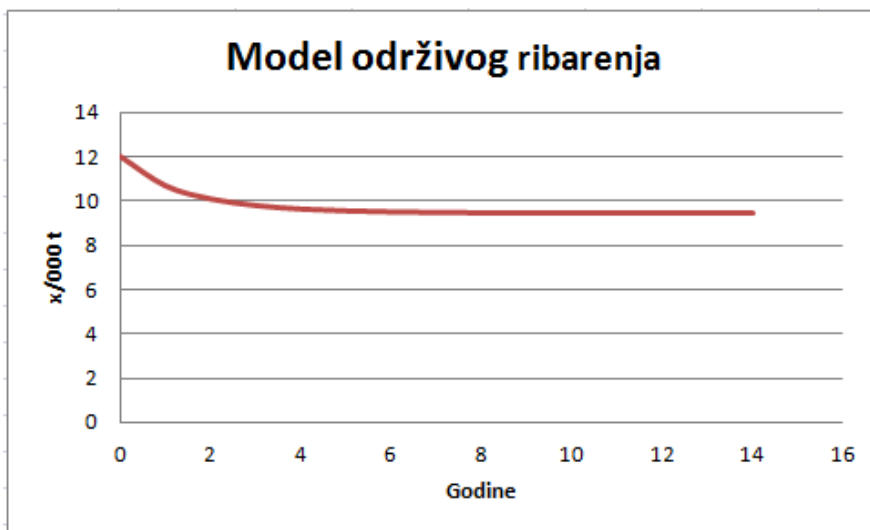
Pretpostavimo dalje da u naš morski zaljevski ekosustav dođe ribarski brod koji lovi 2000 t ribe godišnje. Tada model u diferencijalnom obliku izgleda:

$$\frac{dx}{dt} = x \cdot \left(1 - \frac{x}{12}\right) - 2$$

Neka je početna vrijednost održivi iznos u tom sustavu 12 000 tona.

$$x(0) = 12$$

Uz zadani početni uvjet dobivamo model koji u MS Excelu izgleda:



Slika 12 Model održivog ribarenja u geografski ograničenom području (uvala)

Uočimo da je riblji fond smanjen u odnosu na prvotnu količinu (za nešto više od 2000 tona godišnjeg ulova), ali je riblji fond i dalje stabilan (stacionaran).

3.4.3 Model neodrživog ribarenja

Pretpostavimo sada da u naš morski zaljevski ekosustav dođe ribarski brod koji lovi 6000 t ribe godišnje. Tada model u diferencijalnom obliku izgleda:

$$\frac{dx}{dt} = x \cdot \left(1 - \frac{x}{12}\right) - 6$$

Neka je početna vrijednost ovog puta 20 000 tona.

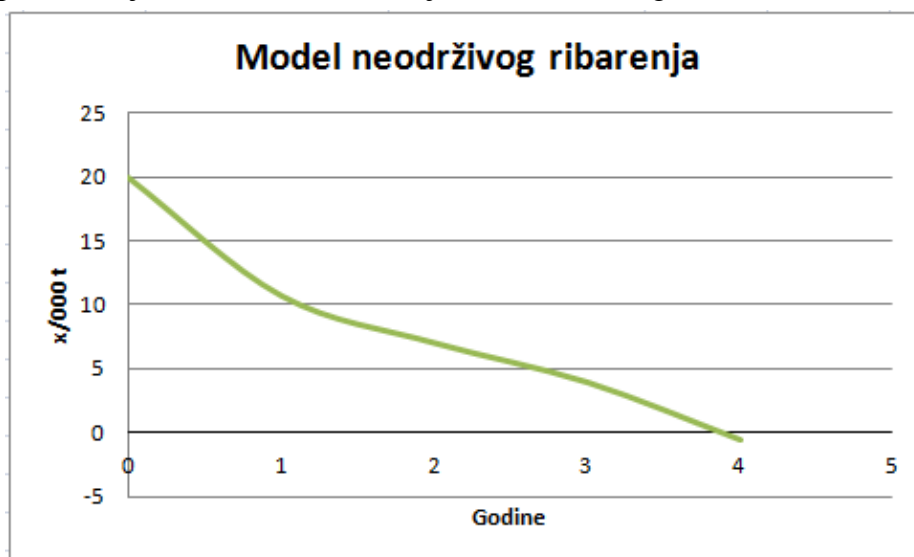
$$x(0) = 20$$

Rješenje ove diferencijalne jednačbe s danim početnim uvjetom je:

$$x(t) = 20 - \frac{116}{7 + 3 \cdot \operatorname{ctg}\left(\frac{t}{2}\right)}$$

Ukoliko rješavanje ovakvog problema izlazi van okvira kolegija moguće je koristiti neki od računalnih “solvera” diferencijalnih jednačbi.

Uz zadani početni uvjet dobivamo model koji u MS Excelu izgleda:



Slika 13 Model neodrživog ribarenja u geografski ograničenom području (uvala)

- Kada će doći do potpunog kolapsa ribljeg fonda?
- Koji je uzrok tome?

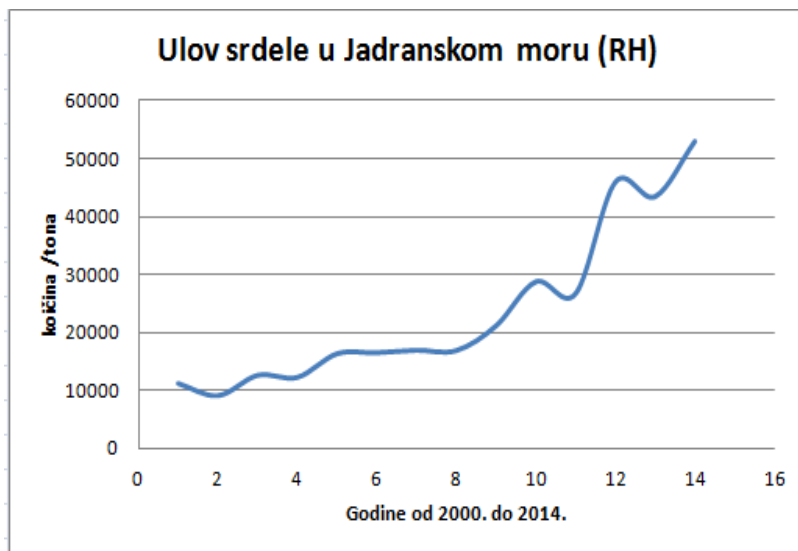
Na ovaj način studentima približavamo ovu problematiku i neophodnost matematičkog modeliranja i kao posljedicu toga razumno gospodarenje ribljim fondom, uvođenje kvota, kao i perioda dopuštenog ribolova.

Daljnja rasprava može ići prikazom podataka o izlovu sardine iz Jadranskog mora [8].

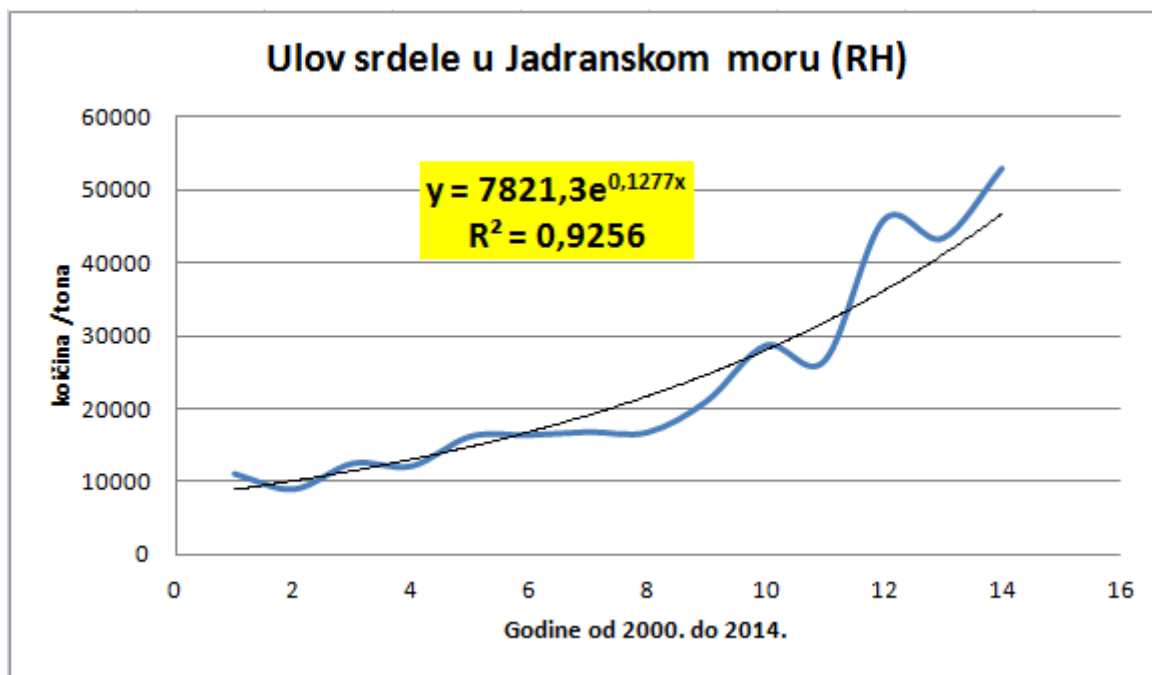
- Kojom funkcijom možemo modelirati rast količine izlovljene sardine?
- U kojem je periodu zabilježen najveći rast? Koliki je on u apsolutnom, a koliki u postotnom iznosu?
- U radnom listu MS Excela modelirajte podatke eksponencijalnom funkcijom.
- Kada bi rast zadržao taj trend koliki bi bio godišnji ulov 2025. godine?
- Mislite li da jadranskoj srdeli prijeti slični kolaps?
- Razmislite o mogućim rješenjima!

Godina	Srdela/tona
2000	11226
2001	9097
2002	12626
2003	12271
2004	16357
2005	16521
2006	16950
2007	16900
2008	21194
2009	28815
2010	26749
2011	46051
2012	43527
2013	53085
2014	55783

Slika 14 Ulov srdele u RH



Slika 15 Kretanje ulova srdele u Jadranskom moru od 2000. do 2014.



Slika 16 Ulov srdele u RH modeliran eksponencijalnim modelom

4. Zaključak

Iz gore prezentiranih primjera vidljiva je snažna veza između matematičkih modela i alata i problematike održivosti prirodnih resursa. Vjerujemo da uključivanjem ovakvih sadržaja, u ponekad suhoparne akademske kolegije, možemo postići sinergiju pozitivnih učinaka. Podučavati matematiku kroz održivost i održivost kroz matematiku. Upotrebom realnih primjera u nastavi matematika postaje i društveno angažirana disciplina. Studenti prepoznaju korisnost izučavanja matematike, a pri tome im raste svijest o ograničenim resursima koje nam planet pruža za život. Time potičemo i njihovu osobnu odgovornost te proaktivno djelovanje za održivu budućnost kako lokalne tako i globalne zajednice. S obzirom na to da je održivost izrazito interdisciplinarno područje, smatramo da je upravo Sveučilišni odjel za stručne studije, zbog svoje politehničke prirode, idealno mjesto za razvoj novih interdisciplinarnih modula kojim će se sveobuhvatno pristupiti problemu održivosti.

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Teaching sustainability in mathematics

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Abstract. The main aim of this paper is to show how to incorporate sustainability into a Mathematics courses curriculum. Sustainability issues are inherently interdisciplinary. There are ample opportunities for introducing sustainability examples in math courses, from algebra and geometry to calculus and statistics. Teaching environmental sustainability to the large undergraduate math courses, as they are at the Department of Professional Studies of the University of Split, will have the greatest reach, due to their size. We suggest ways in which university mathematics teachers can provide a quality learning experience for their students that includes notions of sustainability within the mathematical context, without compromising the mathematical content of their courses. As an additional learning outcome, we can expect embedding the importance of these matters into the minds of the students and raising their environmental awareness.

Key words: *teaching, mathematics, sustainability*

The limits of mathematical models of cities - an example from the Mediterranean region

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Abstract. In this article we explain the metaphor of living in living cities. Urban problems such as traffic congestion can be considered and possibly solved involving living technology. We also introduce the notion of urban scaling - the idea that certain properties of all cities change, on average, with their size in predictable scale-invariant way. We question this hypothesis by measuring some traffic-dependent quantities for several urban scales. Specifically, we investigate the limits of traffic capacity as a feature of Mediterranean cities, questioning simplifications of mathematical model of cities.

Keywords: *living technology, urban scaling, complexity, traffic congestion*

1. Scale invariance emerges from collected data

Scale invariance is a feature of laws that do not change if scales of length (or other variables) are multiplied with some parameter. Examples of power law are:

Newton's law of gravitation

$$F(\lambda r) = \text{const} \cdot (\lambda r)^{-2} = \text{const} \cdot \lambda^{-2} \cdot r^{-2} = \lambda^{-2} \cdot F(r), \text{ for any } \lambda > 0,$$

or Kleiber's law (Kleiber, 1932) that animal's metabolic rate scales to the $\frac{3}{4}$ power of the animal's mass for 27 orders of scale.

Inspired by metaphor of cities as living organisms, Bettencourt L. and all (Bettencourt et al, 2007) collected huge amount of data about some macroscopic aspects of cities and concluded that all cities realize, as they grow, some spatial economies of scales and, simultaneously, attain general socioeconomic productivity gain: volume of infrastructure-roads, pipes, cables-per capita is smaller, wages, patents and crime rate per capita are bigger. Doubling of city population, a city contains about 10-20 % less infrastructure volume per capita.

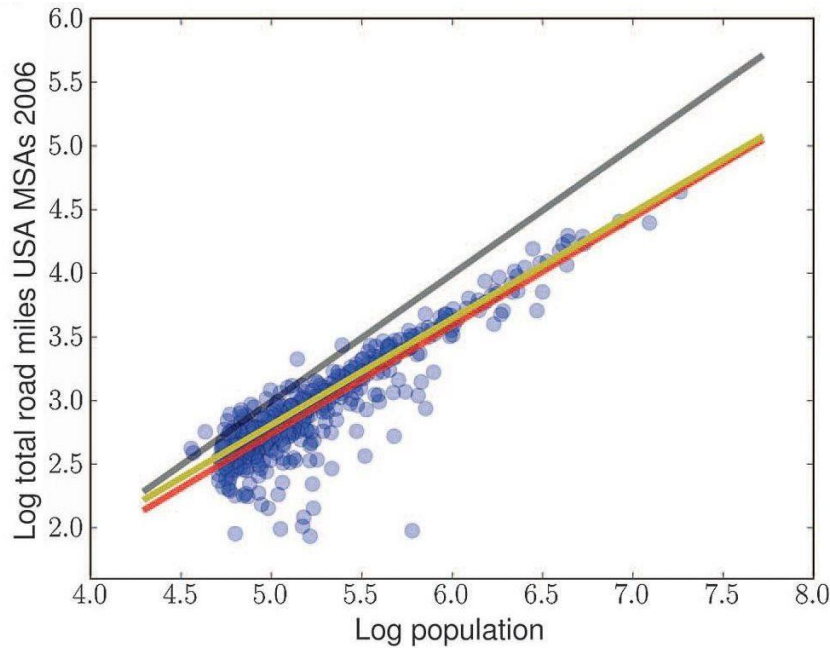


Figure 1. Scaling of urban infrastructure. Total lane miles (volume) of roads in U.S. metropolitan areas (MSAs) in 2006 (blue dots). Lines show the best fit to a scaling relation

$$Y = Y_0 \cdot N^\beta, \beta = 0.85 \pm 0.04 \text{ (red); theoretical prediction } \beta = 5/6 \text{ (yellow); linear scaling } \beta = 1 \text{ (black). (Bettencourt, 2013b, page 1438).}$$

It also displays a 10-20 % increase in rates of wealth production and innovation, but also, less benign fruits of human socioeconomic interactions, crime and traffic congestion (Bettencourt et al, 2013).

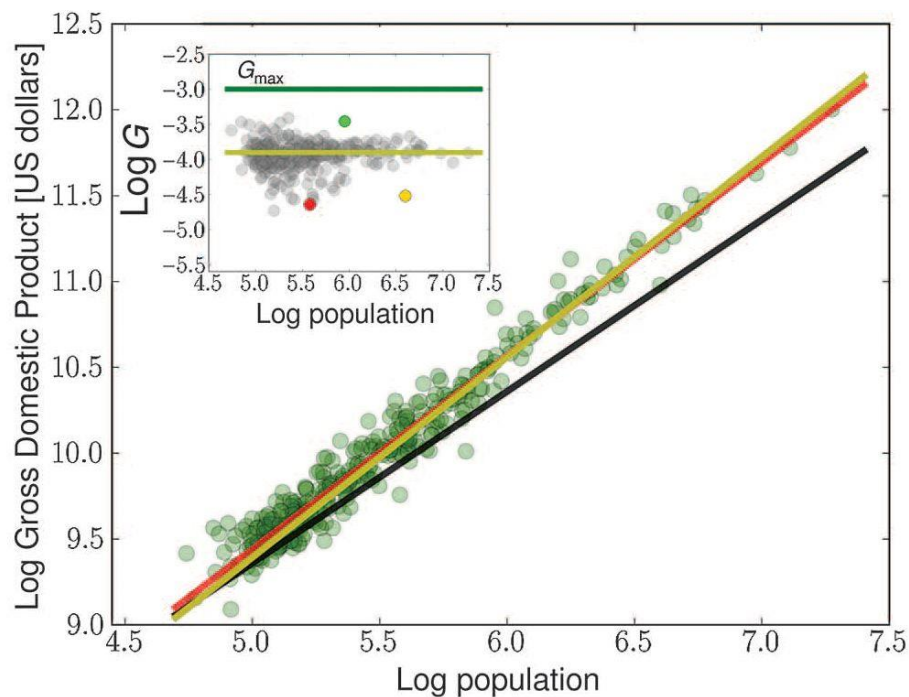


Figure 2. Scaling of socioeconomic variable. Gross metropolitan product of MSAs in 2006 (green dots). Lines describe best fit (red) to data, $\beta = 1.13 \pm 0.02$; theoretical prediction $\beta = 7/6$ (yellow) ; linear scaling $\beta = 1$ (black). (Bettencourt, 2013b, page 1438).

2. Models explaining scale invariance of some city characteristics

Model, introduced by West GB and others (West et al, 1997), explained $\frac{3}{4}$ exponent as emerging from network theory. We will not focus on critics of their approach, which are serious, but on similar models explaining the origins of scaling in cities. After mention of phenomenological model developed by Bettencourt L. (Bettencourt, 2013b), we accentuated some specific features of Mediterranean cities which question author's mathematical simplifications. Instead of original model in (Bettencourt, 2013b), we review slightly simpler derived models (Cesaretti et al, 2015) developed by same author. Namely, in (Cesaretti et al, 2015) authors examine relationship between the population size and settled area in sample of 169 European medieval cities. On base of inferred data of population and cities area in 14. Century, they concluded that population size-settled area relation is sublinear (density of cities grow faster than population).

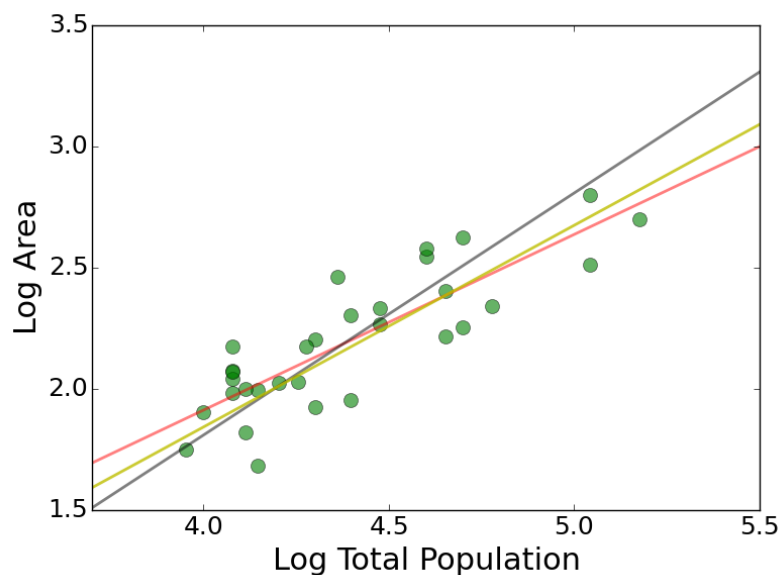


Figure 3. These data refer to cities in Northern and Central Italy. (Cesaretti, 2015, page 3)

In Figure 3. black line is linear relation, red line indicate slower increase of settled area (sublinear), i.e. faster increase of density of city centers as population size increase. It is example of economies of scales.

Similar relationship is valid for contemporary cities. This relation is near linear for some French and Belgian cities, indicating more hierarchical political structure impeding spatial economies of scales. This inspired authors (Cesaretti et al) to explain origin of empirical power law for relation population size-city area developing two models: model of city as social reactor (enforcing movement and social interaction) and the alternative structured interaction model (channeling interactions through strong hierarchical institutions). The second model predicts attenuation of agglomeration effect more the stronger institutional constraints are. Yet, empirical data don't support significantly structured interaction model, so authors in (Cesaretti et al, 2015) suggest social reactor model as unified theoretical framework stressing social networking processing as key factor through history of cities development generating scaling regularities.

2.1 Qualitative remarks on model assumptions

Our critique is related on neglecting costs of area in Mediterranean zone. Although Bettencourt's claim "that cities, at their most fundamentals, are not really agglomerations of people; they are agglomerations of connections between people" is good metaphor which

underline social components, this claim underscores sparsity of resources what, finally, influence quality of connections enabled in cities. Sublinear relation between population size and settled area can be realized so that growing of city causes interpolation of buildings in old center, making city denser. But historic Mediterranean agglomerations, even very small one, were unusually dense from first settlement because of lack of flat terrain. The consequence would be relative independence of settled area on population size. In contemporary context, this density stimulate social connections (desirable in touristic purpose) but make problems in traffic, causing congestion, challenge nonconventional methods of solving traffic sustainability.

2.2 Social reactor model

Here we give summary of the model of city as social reactor as proposed by Cesaretti et al.

City is complex system in state of temporary equilibrium when socioeconomics interactions force appropriate change of land and transportation costs, influencing higher or smaller city population density.

City space is social network where y denotes average benefit that a citizen accrues from interactions. Rate of interactions is proportional to density N/A (A is settled area of city):

$$y = G \cdot \frac{N}{A}, \text{ where parameter } G \text{ denotes net benefit per interaction.}$$

The per capita cost of transportation is c :

$c = \varepsilon \cdot A^{H/2}$, where parameter ε is cost of movement per unit length (depending on technology, e.g. walking vs. horse-riding), H is fractal dimension with values $[0, 2]$. Remark on value of fractal dimension. Point has $H = 0$, line $H = 1$, plane $H = 2$, Koch curve $H = 4/3$.

Equating benefits to costs for individual, and solving for area as function of population one obtains:

$$A = a \cdot N^\alpha, a = \left(\frac{G}{\varepsilon} \right)^\alpha, \alpha = \frac{2}{H+2}$$

If $H = 0$, no agglomeration effects are present. It is characteristic of segregated settlement with minimal or zero connections leading on $A \sim N$.

If $H=1$, $A^{1/2} \sim L$, where L is city diameter, leading to sublinear dependence of area with population :

$$A = a \cdot N^{2/3} \quad (\alpha = 2/3 < 1) \text{ (sublinear)}$$

Population density will rise strongly in such cities:

$$n = \frac{N}{A} = \frac{N}{a \cdot N^{2/3}} = a^{-1} \cdot N^{1/3}$$

Total average socioeconomic output of city (wages, creativity, crime rate) is $Y = N \cdot y$ what, after rearrangement ($Y = Y_0 \cdot N^\beta$, where $\beta = 2 - \alpha = 1 + 1/3 > 1$ and $Y_0 = G^{1-\alpha} \cdot \varepsilon^\alpha$) leads to superlinear dependence on population:

$$Y = Y_0 \cdot N^{4/3} \quad (\beta = 4/3 > 1) \text{ (superlinear)}$$

This model originated from notion of network density is in agreement with power law derived from empirical data.

2.3 Limits of mathematical model of cities

Fractal dimension is included in model, but is not discussed case $H > 1$. $H > 1$ enables more connections in network. For example, Koch curve has $H = 4/3$, $\alpha = 2/3.33$ leading on even faster rise of population density with population

$$n = \frac{N}{A} = \frac{N}{a \cdot N^{2/3.33}} = a^{-1} \cdot N^{1.33/3.33}$$

This stronger confirms our qualitative objection that model is not sensitive in case of Mediterranean cities, which geometry is often fractal, even filling volume with high and narrow buildings (H between 2 and 3), obvious in slum-like old cities centers. In (Cesaretti et al, 2015) is discussed case of medieval cities where social benefits are small compared with costs of transportation leading to small value of a :

$$a = \left(\frac{G}{\varepsilon}\right)^\alpha \leq 1.$$

Because of it:

$$n = \frac{N}{A} \sim \frac{1}{a},$$

and all settlements will be quite dense. Precisely, power of a isn't 1 but $(H+2)/2$, which has neglecting effect on population density change.

Applying this situation on Mediterranean cities founded on scarce terrain, often very steep (Dubrovnik, Hvar on Hvar island, Korčula, Assisi in Italy) we want to conclude that rise of population will not increase population density of old, yet over dense, cities centers, because this not increase socioeconomic benefit but cause traffic congestion. Violent interpolation of new objects in such old cities centers decrease socioeconomic benefit degrading rich network of social connections formed in fractal-like city volume.

Bettecourt and West (TED, 2011) made gigantic effort describing quantitatively cities. Sublinear power law indicating economies of scales (population density, infrastructure) similar to biology organisms and superlinear socioeconomic behavior (wages, creativity) specific for human agglomeration are empirical facts. Models explaining origins of power law in cities give rise understanding city as social reactor capable of building desirable but also adverse complex networks. Now we, followers, can elaborate what cities are not or help refine notion about cities.

3. The science of cities

Emphasizing the trend of global urbanization (currently about 80% of the US and 50% of the world population reside in urban areas) we extend perspective of concerning with cities not as a problem alone, but more as a “social reactor” which can solve unintended consequences of using technology. This perspective include notion of the science of cities (especially urban physics) and metaphor of living cities.

3.1 The new branch of science

Scale invariance characteristics of cities are but only one facet of their complex existence. Short introduction in the new branch of science is properly began quoting Michael Batty (2011):

“A *Science of Cities* has taken a long time coming but there is now considerable momentum in developing formal ideas about how cities are ordered and structured which are part of the rapidly expanding Science of complexity. Cities do not exist in benign environments and cannot be easily closed from the wider world, they do not automatically return to equilibrium

for they are forever changing, indeed they are far-from-equilibrium. Nor are they centrally ordered but evolve mainly from the bottom up as the products of millions of individual and group decisions with only occasional top down centralised action. In short, cities are more like biological than mechanical systems and the rise of the sciences of complexity which has changed the direction of systems theory from top down to bottom up is one that treats such systems as open, based more on the product of evolutionary processes than one of grand design. During the last half century, the image of a city as a ‘machine’ has been replaced by that of ‘organism’ “

3.2 Urban physics

Physics is a science, but is also a set of tools and habit of mind. Similar to applying physics to explain biology or economy, the study of city is successful example of applying physics methods (modeling, approximating and dynamics) to understand hidden underpinnings of human agglomerations. Solving problems of too dense urbanization (noise, transportation, infrastructure), energy use of buildings, emergence response on fire, anticipated sea level rise as a consequence of global climate change are some of challenge which urban physics can help. What makes the science of cities more worthy of physicists attention is enormous quantity of urban data. Rapid proliferation of sensors throughout of society, digitization of commercials records and advances in computing power and computational methods can be combined to create insights into urban dynamics. New scientific centers, like CUSP (the Center for Urban Science and Progress) in New York, apply methods and instruments, developed in astrophysics to understand stars, to explain city.(APS, 2015)

Urban problems as traffic congestion can be considered and possibly solved involving living technology (Gershenson, 2013), concept borrowing meaning from essential features of living systems: adaptive, learning, robust, autonomous, self-repairing and self-reproducing. All different approaches mentioned are but different aspects of science of complexity which methods (sensors, big data, networks, computational modeling and emergent phenomena) give hope of understanding cities as sustainable organism.

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Novi pristup problemu snježne ralice – modeliranje i vizualizacija

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Sažetak. Problem snježne ralice R. P. Agnewa klasičan je uvodni problem u gradivo običnih diferencijalnih jednadžbi i ima više varijanti, među kojima je i problem triju ralica M. S. Klamkina. Po razmatranju problema, u radu se problematiziraju neki nedostaci klasičnog modela i diskutiraju se drugačiji pristupi. Programski paket *Wolfram Mathematica* iskorišten je za vizualizaciju, provjeru i poopćavanje rezultata.

Ključne riječi: *problem snježne ralice, obične diferencijalne jednadžbe, modeliranje, vizualizacija, Wolfram Mathematica.*

1. Uvod

Matematičko modeliranje je važan dio posla jednog inženjera. On mora biti sposoban realne situacije prikazivati na apstraktan način te mora znati iščitavati, razumjeti i kreirati njihove matematičke modele. Otvoreno je pitanje koliko matematičko obrazovanje koje se trenutno nudi na tehničkim studijima u Republici Hrvatskoj odgovara takvom izazovu, odnosno koliko osposobljava studenta za buduće samostalno i inventivno služenje matematičkim alatima i modelima. Pošteno govoreći, samo učenje složenih matematičkih i drugih koncepata neophodnih za razumijevanje matematičkih modela tijekom školovanja traje toliko dugo da do kraja studija i ne ostane mnogo vremena za njihovo razvijanje. Studenta se tako naoruža naprednim alatima matematike i fizike, ali mu se ne objasni kako će ih samostalno kombinirati i primijeniti. To je slično kao da se kandidata priprema za vozački ispit tako da mu se u detalje opiše funkcioniranje automobilskeg motora i tipovi auta na tržištu, ali mu se ne da ni sata vožnje.

Ovaj rad na jednom izdvojenom primjeru (donekle utopijski) promišlja kako bi mogao izgledati matematički kolegij koji bi poučavao matematičko modeliranje na stručnim studijima. Izabran je jednostavni problem koji se često koristi kao uvod u kolegij diferencijalnih jednadžbi. Odabrani problem se analizira, prilagođava, modelira i računalno vizualizira korištenjem programskog paketa *Wolfram Mathematica*. Zatim se uočavaju nedostaci modela, poboljšava ga se i ponovo vizualizira. Konačno, promatraju se složenije situacije, u modeliranju kojih se koriste i alati numeričke matematike pristupačni slušaču stručnih studija.

Wolfram Mathematica (u daljem tekstu WM) programski je paket kojeg je razvila kompanija Wolfram Research. Prva mu je verzija izdana 1998., a od tada je postao jedan od najnaprednijih i najkorištenijih softvera u tehničkim i znanstvenim područjima, a posebno u matematici i fizici. Pored mogućnosti simboličkog i numeričkog računanja, snaga mu je strukturiranost i velika prilagodljivost pa služi kao podloga brojnim aplikacijama. Zbog lakoće kojom se računanja provode moguće je lako napraviti korak od korištenja osnovnih modela k modeliranju složenijih i specijalnih slučajeva. Također, interaktivno sučelje novih programa omogućava da se problem na elegantan način vizualizira, da se mijenja parametre i promatra ishode u animaciji. Treba međutim naglasiti da je WM samo jedan od popularnih programskih paketa integriranih u radno okruženje (drugi takvi programi su *Matlab*, *Maple*, *Sage* itd). Autori su stjecanjem okolnosti koristili baš programski paket WM i nemaju osobnog interesa u njegovom propagiranju.

2. Problem snježne ralice

Profesori matematike često otvaraju kolegij diferencijalnih jednadžbi ovim zanimljivim i isprva ne baš očiglednim problemom koji se pripisuje Ralphu Palmeru Agnewu [1]:

Originalni problem snježne ralice (R. P. Agnew): Snijeg je počeo padati ujutro i padao je gusto, stalnim intenzitetom. Snježna ralica krenula je u podne, prevalivši dva kilometra u prvom satu, a jedan kilometar u drugom satu. U koliko je sati počeo padati snijeg?

Označimo s t [h] vrijeme, s t_0 [h] trenutak u kome je počeo padati snijeg, s $x(t)$ prevaljeni put ralice [km], s $h(t)$ [m] visinu snijega i s w [m] širinu pluga ralice. Problem se klasično rješava tako da se pretpostavi kako je količina snijega koju ralica očisti u jedinici vremena $wh(t)x'(t)$ konstantna, odakle je za neku pozitivnu konstantu k , $x'(t) = \frac{k}{h(t)}$. Uzimajući u

obzir stalan intenzitet padanja snijega, u oznaci a [m/h], dobiva se da je
$$h(t) = \begin{cases} 0 & , \text{ za } t < t_0 \\ a(t - t_0) & , \text{ za } t \geq t_0 \end{cases}$$
 i konačno $x'(t) = \frac{k}{a(t - t_0)}$, za $t > 12$. Integriranjem, slijedi da je

$x(t) = \frac{k}{a} \ln(t - t_0) + C$, odakle se uvrštavanjem početnog uvjeta $x(12) = 0$ odmah dobije da je

$C = -\frac{k}{a} \ln(12 - t_0)$ pa je dakle $x(t) = \frac{k}{a} \ln\left(\frac{t - t_0}{12 - t_0}\right)$ jednadžba gibanja ralice. Da se ustanovi

vrijeme t_0 kad je počeo padati snijeg, koriste se uvjeti $2 = x(13) = \frac{k}{a} \ln\left(\frac{13 - t_0}{12 - t_0}\right)$,

$3 = x(14) = \frac{k}{a} \ln\left(\frac{14 - t_0}{12 - t_0}\right)$ pa se dijeljenjem i raspisivanjem dolazi do jednadžbe

$t_0^2 - 25t_0 + 155 = 0$. Slijedi da je $t_0 = \frac{25 - \sqrt{5}}{2} \approx 11.382$ što znači da je snijeg počeo padati u 11 sati, 22 minute i 55,2 sekundi.

Murray Seymour Klamkin postavio je ovakvu varijantu problema snježne ralice [2]:

Velika utrka snježnih ralica (M. S. Klamkin): Snijeg je počeo padati ujutro i padao je gusto, stalnim intenzitetom. Prva snježna ralica krenula je u podne, druga ju je slijedila u 13 sati, a treća u 14 sati i susrele su se u istom trenutku. U koliko je sati počeo padati snijeg?

Uz iste pretpostavke kao u prethodnom modelu, korisno je umjesto $x(t)$ promatrati $t(x)$. Ako je, naime, snijeg počeo padati u t_0 [h], a vremena stizanja i -te ralice u točku x su $t_i(x)$, $i = 1, 2, 3$ diferencijalne jednačbe kretanja glase:

$$t_1'(x) = \frac{a}{k}(t_1(x) - t_0), \quad t_1(0) = 12$$

$$t_2'(x) = \frac{a}{k}(t_2(x) - t_1(x)), \quad t_2(0) = 13$$

$$t_3'(x) = \frac{a}{k}(t_3(x) - t_2(x)), \quad t_3(0) = 14.$$

Integriranjem i uvrštavanjem izlazi da je u trenutku susreta $t_1(x) = t_2(x) = t_3(x) = t \approx 15.1945$, odakle je $t_0 = 11.5$ što znači da je snijeg počeo padati u 11:30 sati.

3. Računalna vizualizacija problema snježne ralice

U originalnom Agnewljevom problemu uvjet da ralica prevali dva kilometra u prvom satu, a jedan kilometar u drugom satu služi uglavnom zato da bi se dobili “zgodni” koeficijenti u kvadratnoj jednačbi, no to bi istovremeno značilo da se ralica do podneva idućeg dana neće probiti ni do osmog kilometra ceste, pošto zbog $\frac{k}{a} = 2 \ln^{-1} \left(\frac{13 - t_0}{12 - t_0} \right) \approx 2.0780$ izlazi da je

$$x(12 + 24) = \frac{k}{a} \ln \left(\frac{12 + 24 - t_0}{12 - t_0} \right) \approx 7.657.$$

Zbog toga ćemo za naše potrebe osmisliti realniju, malo manje arktičku situaciju, primjereniju uvjetima na domaćim cestama koju ćemo moći zgodno računalno modelirati te mijenjanjem parametara detaljnije proučiti.

Modificirani problem snježne ralice: Gračac i Udbina međusobno su udaljeni 35 km. Snijeg je počeo padati u t_0 sati ujutro, stalnim intenzitetom a [m/h]. Ralica kreće iz Gračaca u $t_s > t_0$ sati i poznato je da do $t_1 > t_s$ sati prevali $x_1 > 0$ kilometara. Modelirajte i vizualizirajte kretanje ralice.

Model 1: Označi li se ponovo s $x(t)$ [km] prevaljeni put ralice, s $h(t)$ [m] visina snijega i s w [m] širina pluga ralice, uzimajući da je količina očišćenog snijega u jedinici vremena $wh(t)x'(t)$ konstantna, slijedi da je za neku pozitivnu konstantu k , $x'(t) = \frac{k}{h(t)}$. Uzimajući u

obzir stalan intenzitet padanja snijega, u oznaci a [m/h], dobiva se da je
$$h(t) = \begin{cases} 0, & \text{za } t < t_0 \\ a(t - t_0), & \text{za } t \geq t_0 \end{cases}$$
 i konačno $x'(t) = \frac{k}{a(t - t_0)}$, za $t > t_s$. Integriranjem, slijedi da je

$x(t) = \frac{k}{a} \ln(t - t_0) + C$, odakle se uvrštavanjem početnog uvjeta $x(t_s) = 0$ odmah dobije da je

$C = -\frac{k}{a} \ln(t_s - t_0)$ pa je dakle $x(t) = \frac{k}{a} \ln \left(\frac{t - t_0}{t_s - t_0} \right)$ jednačba gibanja ralice. Da se dobije

iznos konstante k , uvrsti se da je $x_1 = x(t_1) = \frac{k}{a} \ln\left(\frac{t_1 - t_0}{t_s - t_0}\right)$, iz čega je $k = ax_1 \ln^{-1}\left(\frac{t_1 - t_0}{t_s - t_0}\right)$ pa

$$\text{je jednačica gibanja ralice } x(t) = x_1 \frac{\ln\left(\frac{t - t_0}{t_s - t_0}\right)}{\ln\left(\frac{t_1 - t_0}{t_s - t_0}\right)}.$$

Ovaj je model zgodno vizualizirati korištenjem WM programa prikazanog na slici 1. Isječak vizualizacije (crtanog filma s ralicom u glavnoj ulozi) za slučaj $a=0.02$, $t_0=6$, $t_s=8$, $t_1=10$, $x_1=12$ vidi se na slici 2.

4. Nedostatak klasičnog modela gibanja snježne ralice

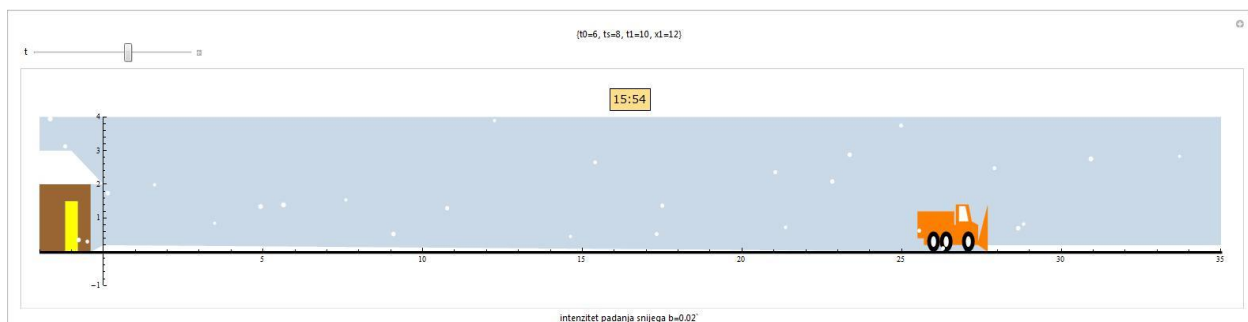
Opisani model gibanja snježne ralice klasično korišten za rješavanje problema snježne ralice Agnewa i Klamkina ima najmanje jedan ozbiljan nedostatak: za taj model bitno je da snijeg pada gusto, a da ralica krene neko vrijeme nakon što snijeg počne padati. Naime, iz jednačice

$x'(t) = \frac{k}{h(t)}$ slijedi da kad visina snijega $h(t) \rightarrow 0$, $x'(t) \rightarrow \infty$. Prema takvom modelu, ralica

koja bi krenula čistiti snijeg iz prošlog primjera minutu nakon što on počne padati, kretala bi se imponantnom brzinom od 1308.9 km/h. To znači da je takvim modelom praktično nemoguće opisati slučaj da ralica krene u trenutku kad snijeg počne padati ili čak ranije. Zato se u nastavku razmatra nešto drukčiji model.

```
Clear["Global`*"]
f = Interpolation[{{1, 1, 1, 1, 0.9, 0.4, 0.2, 0.2, 0.1, 0.05, 0, 0, 0, 0, 0.05, 0.1, 0.2, 0.4, 0.8, 0.9, 1, 1, 1, 1}}, InterpolationOrder -> 1];
t0 = Input["Vrijeme t0 u kojem je počeo padati snijeg je..."]; a = Input["Upišite intenzitet padanja snijega a=0 [m/h]"];
ts = Input["Vrijeme ts=t0 u kojem je ralica krenula je..."]; t1 = Input["Vrijeme t1>ts u kojem je dan uvjet je..."];
x1 = Input["Duljina dijela ceste x1 očišćena u vremenu t1 je..."]; h[t_] = Piecewise[{{0.00001, t < t0}, {a*(t - t0), t >= t0}}];
sol1 = DSolve[{h[t]*Derivative[1][x][t] == k, x[ts] == 0}, x[t], t]; x[t_, k_] = x[t] /. sol1[[1]]; sol2 = Solve[x[t1, k] == x1, k]; k = Re[k] /. sol2[[1]];
x[t_] = Re[x[t, k]];
t2 = t0 + (ts - t0)*E^((35*a)/k);
Manipulate[Show[Graphics[{Darker[LightBlue, f[Mod[t, 24] + 1]], Polygon[{{-2, 0}, {35, 0}, {35, 4}, {-2, 4}, {-2, 0}}], Yellow,
Polygon[{{-1.2, 0}, {-1.2, 1.5}, {-0.8, 1.5}, {-0.8, 0}, {-1.2, 0}}], Brown, Polygon[{{-1.3, 1.5}, {-0.8, 1.5}, {-0.8, 0}, {-0.4, 0}, {-0.4, 2}, {-1.3, 2},
{-1.3, 1.5}}], Black, Thickness[0.002], Line[{{-2, -0.02}, {35, -0.02}}], White, Polygon[{{-0.4, 0}, {x[t], 0}, {0, h[t]}, {-0.4, 0}}], Orange,
Polygon[{{x[t] - 1.8, 0.2}, {x[t] - 0.3, 0.2}, {x[t], 0}, {x[t], 1.4}, {x[t] - 0.3, 0.3}, {x[t] - 0.3, 0.8}, {x[t] - 0.5, 0.9}, {x[t] - 0.6, 1.4},
{x[t] - 1, 1.4}, {x[t] - 1, 0.8}, {x[t] - 1.05, 0.8}, {x[t] - 1.05, 1.2}, {x[t] - 2.2, 1.2}, {x[t] - 2.2, 0.4}, {x[t] - 2, 0.4}, {x[t] - 2, 0.2}}], White,
Polygon[{{x[t], 0}, {35, 0}, {35, h[t]}, {x[t], h[t]}, {x[t], 0}}], Black, Disk[{x[t] - 1.7, 0.3}, {0.2, 0.3}], Disk[{x[t] - 1.3, 0.3}, {0.2, 0.3}],
Disk[{x[t] - 0.6, 0.3}, {0.2, 0.3}], White, Polygon[{{x[t] - 0.9, 0.9}, {x[t] - 0.6, 0.9}, {x[t] - 0.7, 1.35}, {x[t] - 0.9, 1.35}}],
Disk[{x[t] - 1.7, 0.3}, {0.08, 0.16}], Disk[{x[t] - 1.3, 0.3}, {0.08, 0.16}], Disk[{x[t] - 0.6, 0.3}, {0.08, 0.16}], Lighter[Red, Clip[8*a*(t - t0)]],
Polygon[{{-2, 2}, {0, 2}, {-1, 3}, {-2, 3}, {-2, 3}}], Brown, Polygon[{{-2, 0}, {-1.2, 0}, {-1.2, 2}, {-2, 2}, {-2, 0}}],
Table[{White, Disk[RandomReal[{-2, 35}], RandomReal[4]], RandomReal[0.05, 0.08]]}, {30}]], PlotRange -> {{-2, 35}, {-1, 4}}, Axes -> True,
ImageSize -> 1500, PlotLabel -> Style[Framed[DateString[{0, 0, 0, Floor[t], 60*(t - Floor[t]), 0}, {"Hour24", ":", "Minute"}]], 14, "Label",
Background -> RGBColor[1, 0.875, 0.537]], ImageMargins -> 8], {{t, ts, "t"}, ts, t2, 0.001},
FrameLabel -> {StringForm["intenzitet padanja snijega a="], a, "", {StringForm["t0=", t0], StringForm["ts=", ts], StringForm["t1=", t1],
StringForm["x1=", x1]}}]
```

Slika 1 – WM program za vizualizaciju modela 1 modificiranog problema snježne ralice



Slika 2 – WM simulacija modela 1 modificiranog problema snježne ralice

Modificirani problem – model 2: neka je v_0 [km/h] brzina kojom se ralica kreće po očišćenoj cesti. Uz iste oznake kao u prvom modelu, slijedi da je prethodnu jednadžbu $x'(t) = \frac{k}{h(t)}$

zgodno korigirati, tako da dobijemo $x'(t) = \frac{k}{h(t)} \cdot \left(1 - \frac{x'(t)}{v_0}\right)$. Dodani faktor će osigurati da

brzina ne premaši maksimalnu brzinu v_0 . Raspisivanjem jednadžbe $x'(t) = \frac{kv_0}{v_0 h(t) + k}$

uzimajući u obzir stalan intenzitet padanja snijega, u oznaci a [m/h], dobiva se $h(t) = \begin{cases} 0, & \text{za } t < t_0 \\ a(t - t_0), & \text{za } t \geq t_0 \end{cases}$ i slijedi da je za $t \geq t_0$, $x'(t) = \frac{kv_0}{av_0(t - t_0) + k}$, odakle je

$$x(t) = \frac{k}{a} \ln \left[t - t_0 + \frac{k}{av_0} \right] + C.$$

U slučaju da ralica krene nakon što snijeg počne padati, $t_0 < t_s$, početni uvjet daje

$$0 = x(t_s) = \frac{k}{a} \ln \left[t_s - t_0 + \frac{k}{av_0} \right] + C \text{ pa je } x(t) = \frac{k}{a} \ln \left[\frac{av_0(t - t_0) + k}{av_0(t_s - t_0) + k} \right].$$

U protivnom, za $t_s \leq t_0$, $x'(t) = \begin{cases} 0, & \text{za } t < t_s \\ v_0, & \text{za } t_s \leq t < t_0 \\ \frac{kv_0}{v_0 h(t) + k}, & \text{za } t > t_0 \end{cases}$ i početni uvjet daje

$$v_0(t_0 - t_s) = x(t_0) = \frac{k}{a} \ln \left[t_0 - t_0 + \frac{k}{av_0} \right] + C,$$

$$\text{pa je } x(t) = \begin{cases} 0, & \text{za } t < t_s \\ v_0 t, & \text{za } t_s \leq t < t_0 \\ \frac{k}{a} \ln \left[\frac{av_0(t - t_0) + k}{k} \right] + v_0(t_0 - t_s), & \text{za } t > t_0 \end{cases}.$$

Korištenjem uvjeta $x(t_1) = x_1$ i neke od metoda numeričkog rješavanja jednadžbi npr. metodu bisekcije, dolazi se do iznosa konstante k . Na slici 3 je WM program korišten za vizualizaciju, a na slici 4 vidi se rezultat za slučaj da je granična brzina ralice $v_0 = 30$, $a = 0.02$, $t_0 = 6$, $t_s = 8$, $t_1 = 10$, $x_1 = 12$ (izlazi da je $k \approx 0.4363$). Na slici 5 su grafovi puta i brzine ralice.

Dodatno, na slici 6 su grafovi puta $x(t)$ i brzine $x'(t)$ ralice za slučaj da je ralica krenula u 5 sati i 45 minuta, brzinom od 30 km/h, a snijeg počeo padati u 6 sati, uz uvjete $a = 0.02$, $t_1 = 9$, $x_1 = 28$. Ovo potvrđuje da model dobro opisuje i slučaj da je ralica na cesti i prije početka padanja snijega.

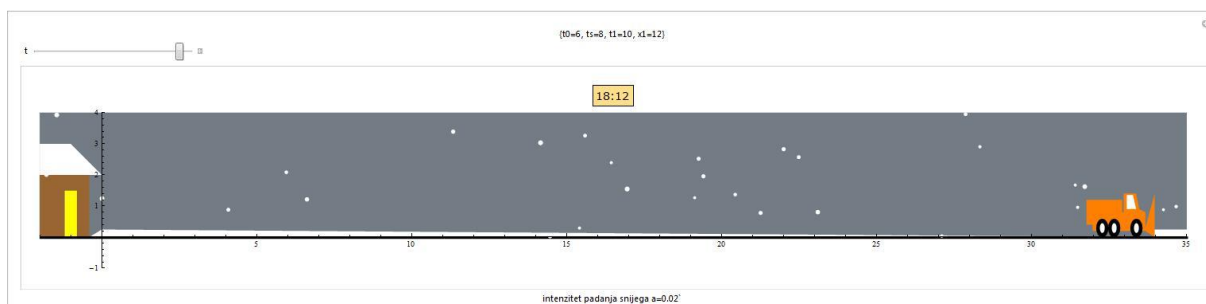

```

Clear["Global`*"]

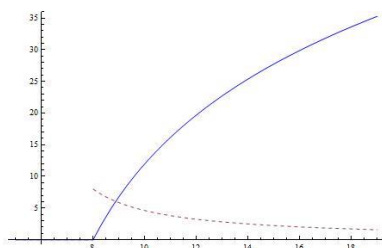
f = Interpolation[{{1, 1, 1, 0.9, 0.4, 0.2, 0.2, 0.1, 0.05, 0, 0, 0, 0, 0.05, 0.1, 0.2, 0.4, 0.8, 0.9, 1, 1, 1, 1}, InterpolationOrder -> 1];
v0 = Input["Maksimalna brzina v0 [km/h] ralice je..."]; t0 = Input["Vrijeme t0 u kojem je počeo padati snijeg je..."];
a = Input["Upišite intenzitet padanja snijega a=0 [m/h]"]; ts = Input["Vrijeme ts=t0 u kojem je ralica krenula je..."];
t1 = Input["Vrijeme t1>ts u kojem je dan uvjet je..."]; x1 = Input["Duljina dijela ceste x1 očišćena u vremenu t1 je..."];
h[t_] = Piecewise[{{0, t < t0}, {a (t - t0), t >= t0}}]; If[t0 < ts, {sol1 = DSolve[{x'[t] ==  $\frac{k(v0 - x'[t])}{a v0 (t - t0)}$ , x[ts] = 0}, x[t], t]; x[t_, k_] = x[t] /. sol1[[1]]};
sol2 = FindRoot[x[t1, k] == x1, {k, 1}]; k = Re[k]; sol2[[1]]; x[t_] = Piecewise[{{0, t < ts}, {x[t, k], t >= ts}}];
{sol1 = DSolve[{x'[t] ==  $\frac{k(v0 - x'[t])}{a v0 (t - t0)}$ , x[t0] == 0}, x[t], t]; x[t_, k_] = x[t] /. sol1[[1]]; sol2 = FindRoot[x[t1, k] + v0 (t0 - ts) == x1, {k, 1}]; k = Re[k]; sol2[[1]]};
x[t_] = Piecewise[{{v0 (t - ts), ts <= t < t0}, {x[t, k] + v0 (t0 - ts), t >= t0}, {0}]; sol3 = FindRoot[x[t2] == 35, {t2, t1}]; t2 = Re[t2] /. sol3[[1]];
Manipulate[
Show[Graphics[{{Darker[LightBlue, f[Mod[t, 24] + 1]], Polygon[{{-2, 0}, {35, 0}, {35, 4}, {-2, 4}, {-2, 0}}], Yellow,
Polygon[{{-1.2, 0}, {-1.2, 1.5}, {-0.8, 1.5}, {-0.8, 0}, {-1.2, 0}}],
Brown, Polygon[{{-1.3, 1.5}, {-0.8, 1.5}, {-0.8, 0}, {-0.4, 0}, {-0.4, 2}, {-1.3, 2}, {-1.3, 1.5}}], Black, Thickness[.002], Line[{{-2, -0.02}, {35, -0.02}}],
White, Polygon[{{-0.4, 0}, {x[t], 0}, {0, h[t]}, {-0.4, 0}}],
Orange, Polygon[{{(x[t] - 1.8, 0.2), (x[t] - 0.3, 0.2), (x[t], 0), (x[t], 1.4), (x[t] - 0.3, 0.3), (x[t] - 0.3, 0.8), (x[t] - 0.5, 0.9), (x[t] - 0.6, 1.4),
(x[t] - 1, 1.4), (x[t] - 1, 0.8), (x[t] - 1.05, 0.8), (x[t] - 1.05, 1.2), (x[t] - 2.2, 1.2), (x[t] - 2.2, 0.4), (x[t] - 2, 0.4), (x[t] - 2, 0.2)}}], White,
Polygon[{{(x[t], 0), {35, 0}, {35, h[t]}, {x[t], h[t]}, {x[t], 0}}], Black, Disk[{(x[t] - 1.7, 0.3), {0.2, 0.3}}, Disk[{(x[t] - 1.3, 0.3), {0.2, 0.3}},
Disk[{(x[t] - 0.6, 0.3), {0.2, 0.3}}, White, Polygon[{{(x[t] - 0.9, 0.9), (x[t] - 0.6, 0.9), (x[t] - 0.7, 1.35), (x[t] - 0.9, 1.35)}], Disk[{(x[t] - 1.7, 0.3), {0.08, 0.16}},
Disk[{(x[t] - 1.3, 0.3), {0.08, 0.16}}, Disk[{(x[t] - 0.6, 0.3), {0.08, 0.16}}, Lighter[Red, Clip[8 a (t - t0)]], Polygon[{{-2, 2}, {0, 2}, {-1, 3}, {-2, 3}, {-2, 3}},
Brown, Polygon[{{-2, 0}, {-1.2, 0}, {-1.2, 2}, {-2, 2}, {-2, 0}}], Table[{White, Disk[(RandomReal[{-2, 35}], RandomReal[{0.05, 0.08}])], {30}} ]}],
PlotRange -> {{-2, 35}, {-1, 4}}, Axes -> True, ImageSize -> 1450,
PlotLabel -> Style[Framed[DateString[{0, 0, Floor[t], 60 (t - Floor[t]), 0}, {"Hour24", ":", "Minute"}], 14, "Label", Background -> RGBColor[1, .875, .537]], ImageMargins -> 8],
{{t, ts, "t"}, ts, t2, 0.001},
FrameLabel -> {StringForm["intenzitet padanja snijega a="], a, "", {StringForm["t0="], t0, StringForm["ts="], ts, StringForm["t1="], t1, StringForm["x1="], x1}}]

```

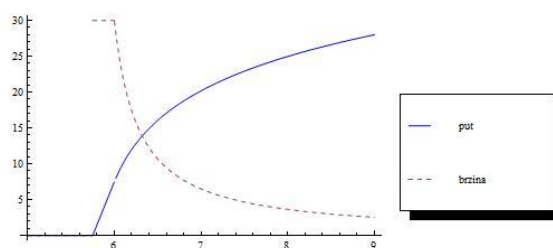
Slika 3 – WM program za vizualizaciju modela 2 modificiranog problema snježne ralice



Slika 4 – WM simulacija modela 2 modificiranog problema snježne ralice



Slika 5 – Grafovi puta i brzine ralice, $t_0 < t_s$



Slika 6 – Grafovi puta i brzine ralice, $t_s \leq t_0$

5. Modificirani problem snježne ralice – dvije složenije situacije

Od Gračaca do Udbine i natrag: Snijeg je počeo padati u t_0 sati ujutro, stalnim intenzitetom a [m/h]. Ralica kreće iz Gračaca u t_s sati i poznato je da do $t_1 > t_0$ sati prevali $x_1 > 0$ kilometara. Kad stigne do Udbine, vozač ode nešto pojesti, da bi nakon $T \geq 0$ [h] vremena ponovo krenuo put Gračaca. Modelirajte i vizualizirajte kretanje ralice.

Model: Ako je $x_1(t)$ put koji ralica prevali u smjeru Udbine, a $x_2(t)$ put koji ista ralica prevali

u smjeru Gračaca, imamo da je $x_i'(t) = \frac{k}{h(t)} \cdot \left(1 - \frac{x_i'(t)}{v_0}\right)$, $i=1,2$. Slično kao u analizi

Klamkinova modela, ovdje je zgodnije umjesto $x_i(t)$ razmatrati $t_i(x)$. U slučaju da je $t_0 \leq t_s$,

gibanje ralice opisano je jednačbama $t_1'(x) = \frac{h(t_1(x))}{k} + \frac{1}{v_0}$, gdje je

$$h(t_1(x)) = \begin{cases} 0, & \text{za } t_1(x) < t_0 \\ a(t_1(x) - t_0), & \text{za } t_0 \leq t_1(x) \leq t_s \end{cases}, \quad t_1(0) = t_s, \quad t_2'(x) = \frac{a}{k}(t_2(x) - t_1(35 - x)),$$

$t_2(0) = t_1(35) + T$. Na slici 7 je WM program korišten za vizualizaciju, a na slici 8 vidi se njegov rezultat za slučaj da je granična brzina ralice $v_0 = 30$, $a = 0.02$, $t_0 = 6$, $t_s = 8$, $t_1 = 10$, $v_1 = 12$, $T = 2$.

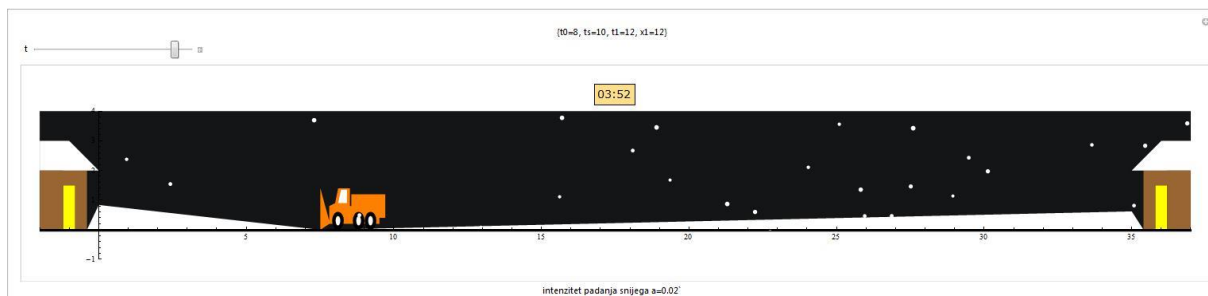
```
Clear["Global`*"]

f = Interpolation[{{1, 1, 1, 1, 0.9, 0.4, 0.2, 0.2, 0.1, 0.05, 0, 0, 0, 0, 0.05, 0.1, 0.2, 0.4, 0.8, 0.9, 1, 1, 1, 1}, InterpolationOrder -> 1];
v0 = Input["Maksimalna brzina v0 [km/h] ralice je..."];
t0 = Input["Vrijeme t0 u kojem je počeo padati snijeg je..."];
a = Input["Upišite intenzitet padanja snijega a=0 [m/h]"]; ts = Input["Vrijeme ts=t0 u kojem je ralica krenula je..."]; t1 = Input["Vrijeme t1=ts u kojem je dan uvjet je..."];
x1 = Input["Duljina dijela ceste x1 očišćena u vremenu t1 je..."]; T = Input["Vrijeme T [h] u kojem se vozač odmarā je..."];

sol1 = DSolve[{tt1'[z] == -\frac{a(tt1[z]-t0)}{k} + \frac{1}{30}, tt1[0] == ts}, tt1[z], z]; tt1[x_] := tt1[z] /. sol1[[1]];
sol2 = FindRoot[tt1[x1, k] == t1, {k, 1}]; k = k /. sol2[[1]]; tt1[x_] := tt1[x, k]; t2 = tt1[35];
sol3 = DSolve[{x'[t] == -\frac{k(30-x'[t])}{30a(t-t0)}, x[ts] == 0}, x[t], t]; x[t_] = Re[x[t]] /. sol3[[1]];

If[ts < t0, x[t] = v0 (ts - t0) + x[t]; sol4 = DSolve[{tt2'[y] == -\frac{a(tt2[y]-tt1[y])}{k} + \frac{1}{30}, tt2[0] == t2}, tt2[y], y];
tt2[y_] := tt2[y] /. sol4[[1]]; tt2[y_] := tt2[35 - y]; t3 = tt2[0];
h1[x_, t_] = Piecewise[{{0, xx < 0 || xx > 35 || tt < t0}, {a (tt - t0), 0 ≤ xx ≤ 35 && t0 ≤ tt < ts},
{a (tt - t0), 0 ≤ xx ≤ 35 && ts ≤ tt < tt1[xx]}, {a (tt - tt1[xx]), 0 ≤ xx ≤ 35 && tt1[xx] ≤ tt < t2},
{a (tt - tt1[xx]), 0 ≤ xx ≤ 35 && t2 ≤ tt < tt2[xx]}, {a (tt - tt2[xx]), 0 ≤ xx ≤ 35 && tt2[xx] ≤ tt}}];
sol5 = NDSolve[{y'[t] == -\frac{k(30-y'[t])}{a(t-tt1[y[t])30}, y[t2+T] == 0}, y, {t, t2+T-20, t3+10}]; y[t_] = y[t] /. sol5[[1]]; y[t_] = 35 - y[t];
z[t_] = Piecewise[{{x[t], ts ≤ t < t2}, {35, t2 ≤ t < t2+T}, {y[t], t2+T ≤ t ≤ t3}}];
Manipulate[Show[Graphics[{{Darker[LightBlue, f[Mod[t, 24] + 1]}, Polygon[{{-2, 0}, {37, 0}, {37, 4}, {-2, 4}, {-2, 0}}],
Yellow, Polygon[{{-1.2, 0}, {-1.2, 1.5}, {-0.8, 1.5}, {-0.8, 0}, {-1.2, 0}}],
Yellow, Polygon[{{36.2, 0}, {36.2, 1.5}, {35.8, 1.5}, {35.8, 0}, {36.2, 0}}],
Brown, Polygon[{{-1.3, 1.5}, {-0.8, 1.5}, {-0.8, 0}, {-0.4, 0}, {-0.4, 2}, {-1.3, 2}, {-1.3, 1.5}}],
Brown, Polygon[{{36.3, 1.5}, {35.8, 1.5}, {35.8, 0}, {35.4, 0}, {35.4, 2}, {36.3, 2}, {36.3, 1.5}}],
Black, Thickness[.002], Line[{{-2, -0.02}, {37, -0.02}}],
White, Polygon[{{-0.4, 0}, {z[t], 0}, {0, h1[0, t]}, {-0.4, 0}}],
Orange, Polygon[{{x[t], -1.8, 0.2}, {x[t], -0.3, 0.2}, {x[t], 0}, {x[t], 1.4}, {x[t], -0.3, 0.3}, {x[t], -0.3, 0.8}, {x[t], -0.5, 0.9}, {x[t], -0.6, 1.4},
{x[t], -1, 1.4}, {x[t], -1, 0.8}, {x[t], -1.05, 0.8}, {x[t], -1.05, 1.2}, {x[t], -2.2, 1.2}, {x[t], -2.2, 0.4}, {x[t], -2, 0.4}, {x[t], -2, 0.2}}],
Orange, Polygon[{{y[t], 1.8, 0.2}, {y[t], 0.3, 0.2}, {y[t], 0}, {y[t], 1.4}, {y[t], 0.3, 0.3}, {y[t], 0.3, 0.8}, {y[t], 0.5, 0.9}, {y[t], 0.6, 1.4},
{y[t], 1, 1.4}, {y[t], 1, 0.8}, {y[t], 1.05, 0.8}, {y[t], 1.05, 1.2}, {y[t], 2.2, 1.2}, {y[t], 2.2, 0.4}, {y[t], 2, 0.4}, {y[t], 2, 0.2}}],
White, Polygon[{{x[t], 0}, {35.4, 0}, {35, h1[35, t]}, {z[t], h1[x[t], t]}, {z[t], 0}}],
Black, Disk[{x[t], -1.7, 0.3}, {0.2, 0.3}], Disk[{x[t], -1.3, 0.3}, {0.2, 0.3}], Disk[{x[t], -0.6, 0.3}, {0.2, 0.3}], White,
Polygon[{{x[t], -0.9, 0.9}, {x[t], -0.6, 0.9}, {x[t], -0.7, 1.35}, {x[t], -0.9, 1.35}], Disk[{x[t], -1.7, 0.3}, {0.08, 0.16}], Disk[{x[t], -1.3, 0.3}, {0.08, 0.16}],
Disk[{x[t], -0.6, 0.3}, {0.08, 0.16}], Black, Disk[{y[t], 1.7, 0.3}, {0.2, 0.3}], Disk[{y[t], 1.3, 0.3}, {0.2, 0.3}], Disk[{y[t], 0.6, 0.3}, {0.2, 0.3}],
White, Polygon[{{y[t], 0.9, 0.9}, {y[t], 0.6, 0.9}, {y[t], 0.7, 1.35}, {y[t], 0.9, 1.35}], Disk[{y[t], 1.7, 0.3}, {0.08, 0.16}], Disk[{y[t], 1.3, 0.3}, {0.08, 0.16}],
Disk[{y[t], 0.6, 0.3}, {0.08, 0.16}], Lighter[Red, Clip[8 a (t - t0)], Polygon[{{-2, 2}, {0, 2}, {-1, 3}, {-2, 3}, {-2, 3}}, Lighter[Red, Clip[8 a (t - t0)],
Polygon[{{37, 2}, {35, 2}, {36, 3}, {37, 3}, {37, 3}],
Brown, Polygon[{{-2, 0}, {-1.2, 0}, {-1.2, 2}, {-2, 2}, {-2, 0}}],
Brown, Polygon[{{37, 0}, {36.2, 0}, {36.2, 2}, {37, 2}, {37, 0}], Table[{White, Disk[{RandomReal[{-2, 37}], RandomReal[4]}, RandomReal[{0.05, 0.08}]}], {30}]]],
PlotRange -> {{-2, 37}, {-1, 4}}, Axes -> True, ImageSize -> 1450,
PlotLabel -> Style[Framed[DateString[{0, 0, Floor[t], 60 (t - Floor[t]), 0}, {"Hour24", ":", "Minute"}]], 14, "Label", Background -> RGBColor[1, .875, .537]], ImageMargins -> 8],
{{t, ts, "t"}, ts, t3, 0.001],
FrameLabel -> {StringForm["intenzitet padanja snijega a="], a}, {"", {StringForm["t0="], t0}, StringForm["ts="], ts}, StringForm["t1="], t1}, StringForm["x1="], x1]]]
```

Slika 7 – WM program za vizualizaciju modela problema ralice koja se vraća



Slika 8 – WM simulacija modela problema ralice koja se vraća

Problem dviju snježnih ralica: Snijeg je počeo padati u t_0 sati ujutro, stalnim intenzitetom a [m/h]. Prva ralica kreće iz Gračaca u t_s sati i poznato je da do $t_1 > t_0$ sati prevali $x_1 > 0$ kilometara. $T \geq 0$ [h] vremena nakon polaska prve ralice, iz Udbine kreće druga ralica, u smjeru prve ralice. Modelirajte i vizualizirajte kretanje ralica.

Model: Ako je $x_1(t)$ put koji prva ralica prevali u smjeru Udbine, a $x_2(t)$ put koji druga ralica prevali u smjeru Gračaca, označimo li opet imamo da je $x_i'(t) = \frac{k}{h(t)} \cdot \left(1 - \frac{x_i'(t)}{v_0}\right)$, $i = 1, 2$.

U slučaju da je $t_0 \leq t_s$, gibanje ralica opisano je s $t_1'(x) = \frac{h(t_1(x))}{k} + \frac{1}{v_0}$, gdje je

$$h(t_1(x)) = \begin{cases} 0, & \text{za } t_1(x) < t_0 \\ a(t_1(x) - t_0), & \text{za } t_0 \leq t_1(x) \end{cases}, \quad t_1(0) = t_s, \quad t_2'(x) = \frac{h(t_2(x))}{k} + \frac{1}{v_0},$$

$$h(t_2(x)) = \begin{cases} a(t_2(x) - t_0), & \text{za } t_2(x) < t_2 \\ a(t_2(x) - t_1(35 - x)), & \text{za } t_2 \leq t_2(x) \end{cases}, \quad t_2(0) = t_s + T, \quad \text{gdje je } t_2 \text{ numeričko rješenje}$$

jednadžbe $x_1(t) = 35 - x_2(t)$.

Na slici 9 je WM program korišten za vizualizaciju, a na slici 10 vidi se njegov rezultat za slučaj da je granična brzina ralice $v_0 = 30$, $a = 0.02$, $t_0 = 6$, $t_s = 8$, $t_1 = 10$, $x_1 = 12$.

```
Clear["Global`*"]

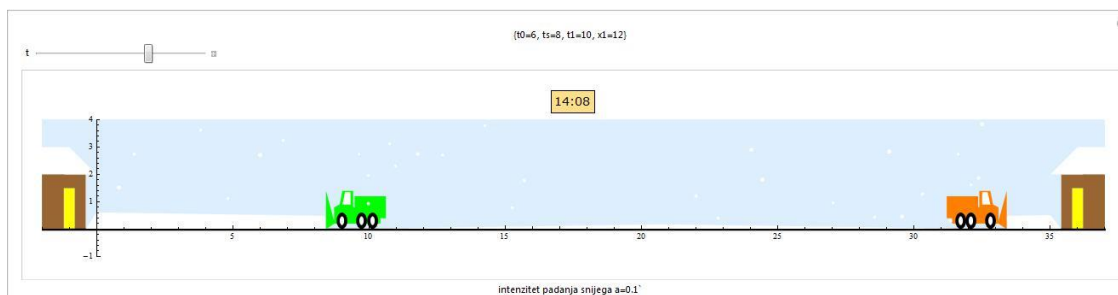
f = Interpolation[{{1, 1, 1, 1, 0.9, 0.4, 0.2, 0.2, 0.1, 0.05, 0, 0, 0, 0, 0.05, 0.1, 0.2, 0.4, 0.8, 0.9, 1, 1, 1, 1}, InterpolationOrder -> 1];
v0 = Input["Maksimalna brzina v0 [km/h] ralice je..."]; t0 = Input["Vrijeme t0 u kojem je počeo padati snijeg je..."];
a = Input["Opisite intenzitet padanja snijega a=0 [m/h]"]; ts = Input["Vrijeme ts=t0 u kojem je ralica krenula je..."];
t1 = Input["Vrijeme t1=ts u kojem je dan uvjet je..."]; x1 = Input["Duljina dijela ceste x1 očišćena u vremenu t1 je..."];
T = Input["Vrijeme T koje protekne između polaska prve i druge ralice je..."];

sol1 = DSolve[{tt1'[z] == \frac{a (tt1[z] - t0)}{k} + \frac{1}{30}, tt1[0] == ts}, tt1[z], z]; tt1[x_] = tt1[z] /. sol1[[1]]; sol2 = FindRoot[tt1[x1] == t1, {k, 1}];
k = k /. sol2[[1]]; tt1[x_] = tt1[x, k]; sol3 = DSolve[{tt2'[z] == \frac{a (tt2[z] - t0)}{k} + \frac{1}{30}, tt2[0] == ts + T}, tt2[z], z]; tt2[x_] = tt2[z] /. sol3[[1]];
sol6 = FindRoot[tt1[xx] == tt2[35 - xx], {xx, 12}]; xx = xx /. sol6[[1]]; t2 = tt1[xx];
sol7 = DSolve[{tt12'[x] == \frac{a (tt12[x] - tt2[35 - x])}{k} + \frac{1}{30}, tt12[xx] == t2}, tt12[x], x]; tt12[x_] = tt12[x] /. sol7[[1]];
sol8 = DSolve[{tt22'[y] == \frac{a (tt22[y] - tt1[35 - y])}{k} + \frac{1}{30}, tt22[35 - xx] == t2}, tt22[y], y]; tt22[y_] = tt22[y] /. sol8[[1]];

t3 = tt12[35]; t4 = tt22[35]; tt1[x_] = Piecewise[{{tt1[x], x < xx}, {tt12[x], x >= xx}}]; tt2[y_] = Piecewise[{{tt2[y], y < 35 - xx}, {tt22[y], y >= 35 - xx}}];
x[t_] = InverseFunction[tt1][t]; y[t_] = 35 - InverseFunction[tt2][t];
h[x_, t_] = Piecewise[{{0, x < 0 || x > 35 || t < t0}, {a (t - t0), 0 <= x <= 35 && t0 <= t <= ts}, {a (t - t0), 0 <= x <= xx && ts < t <= tt1[x]}, {a (t - tt1[x]), 0 <= x <= xx && tt1[x] < t <= t2},
{a (t - t0), xx <= x <= 35 && ts <= t <= T}, {a (t - t0), xx <= x <= 35 && ts + T < t <= tt2[35 - x]},
{a (t - tt2[35 - x]), xx <= x <= 35 && tt2[35 - x] < t <= t2}, {a (t - tt1[x]), 0 <= x <= xx && t2 < t <= tt2[35 - x]}, {a (t - tt2[35 - x]), 0 <= x <= xx && tt2[35 - x] < t},
{a (t - tt2[35 - x]), xx <= x <= 35 && t2 < t <= tt1[x]},
{a (t - tt1[x]), xx <= x <= 35 && tt1[x] < t}}];

Manipulate[Show[Graphics[Darken[LightBlue, f[Mod[t, 24] + 1]], Polygon[{{-2, 0}, {37, 0}, {37, 4}, {-2, 4}, {-2, 0}}],
Yellow, Polygon[{{-1.2, 0}, {-1.2, 1.5}, {-0.8, 1.5}, {-0.8, 0}, {-1.2, 0}}],
Yellow, Polygon[{{36.2, 0}, {36.2, 1.5}, {35.8, 1.5}, {35.8, 0}, {36.2, 0}}],
Brown, Polygon[{{-1.3, 1.5}, {-0.8, 1.5}, {-0.8, 0}, {-0.4, 0}, {-0.4, 2}, {-1.3, 2}, {-1.3, 1.5}}],
Brown, Polygon[{{36.3, 1.5}, {35.8, 1.5}, {35.8, 0}, {35.4, 0}, {35.4, 2}, {36.3, 2}, {36.3, 1.5}}],
Black, Thickness[.002], Line[{{-2, -0.02}, {37, -0.02}}], White,
If[t < t2, Polygon[{{Max[Min[x[t], y[t]], 0], 0}, {Min[Max[x[t], y[t]], 35], 0}, {Min[Max[x[t], y[t]], 35], h[Min[Max[x[t], y[t]], 35], t]},
{Max[Min[x[t], y[t]], 0], 0}, {h[Max[Min[x[t], y[t]], 0], t]}, {Max[Min[x[t], y[t]], 0], 0}}],
Polygon[{{Max[Min[x[t], y[t]], 0], 0}, {Min[Max[x[t], y[t]], 35], 0}, {Min[Max[x[t], y[t]], 35], h[Min[Max[x[t], y[t]], 35], t]},
{Max[Min[x[t], y[t]], 0], 0}, {Max[Min[x[t], y[t]], 0], h[Max[Min[x[t], y[t]], 0], t}}],
If[t < t2, Polygon[{{-0.4, 0}, {Min[x[t], y[t]], 0}, {0, h[0, t]}, {-0.4, 0}}],
Polygon[{{-0.4, 0}, {Min[x[t], y[t]], 0}, {Min[x[t], y[t]], h[Min[x[t], y[t]], t]}, {0, h[0, t]}, {-0.4, 0}}],
If[t < t2, Polygon[{{35.4, 0}, {35, h[35, t]}, {Min[Max[x[t], y[t]], 35], 0}, {Min[Max[x[t], y[t]], 35], 0}, {35.4, 0}}],
Polygon[{{35.4, 0}, {Min[Max[x[t], y[t]], 35], 0}, {Min[Max[x[t], y[t]], 35], h[Min[Max[x[t], y[t]], 35] + 0.01, t]}, {35, h[35, t]}, {35.4, 0}}], Orange,
Polygon[{{x[t] - 1.8, 0.2}, {x[t] - 0.3, 0.2}, {x[t], 0}, {x[t], 1.4}, {x[t] - 0.3, 0.3}, {x[t] - 0.3, 0.8}, {x[t] - 0.5, 0.9}, {x[t] - 0.6, 1.4}, {x[t] - 1, 1.4},
{x[t] - 1, 0.8}, {x[t] - 1.05, 0.8}, {x[t] - 1.05, 1.2}, {x[t] - 2.2, 1.2}, {x[t] - 2.2, 0.4}, {x[t] - 2, 0.4}, {x[t] - 2, 0.2}}],
Green, Polygon[{{y[t] + 1.8, 0.2}, {y[t] + 0.3, 0.2}, {y[t], 0}, {y[t], 1.4}, {y[t] + 0.3, 0.3}, {y[t] + 0.3, 0.8}, {y[t] + 0.5, 0.9}, {y[t] + 0.6, 1.4},
{y[t] + 1, 1.4}, {y[t] + 1, 0.8}, {y[t] + 1.05, 0.8}, {y[t] + 1.05, 1.2}, {y[t] + 2.2, 1.2}, {y[t] + 2.2, 0.4}, {y[t] + 2, 0.4}, {y[t] + 2, 0.2}}], Black,
Disk[{x[t] - 1.7, 0.3}, {0.2, 0.3}], Disk[{x[t] - 1.3, 0.3}, {0.2, 0.3}], Disk[{x[t] - 0.6, 0.3}, {0.2, 0.3}], White,
Polygon[{{x[t] - 0.9, 0.9}, {x[t] - 0.6, 0.9}, {x[t] - 0.7, 1.35}, {x[t] - 0.9, 1.35}}], Disk[{x[t] - 1.7, 0.3}, {0.08, 0.16}], Disk[{x[t] - 1.3, 0.3}, {0.08, 0.16}],
Disk[{x[t] - 0.6, 0.3}, {0.08, 0.16}],
Black, Disk[{y[t] + 1.7, 0.3}, {0.2, 0.3}], Disk[{y[t] + 1.3, 0.3}, {0.2, 0.3}], Disk[{y[t] + 0.6, 0.3}, {0.2, 0.3}], White,
Polygon[{{y[t] + 0.9, 0.9}, {y[t] + 0.6, 0.9}, {y[t] + 0.7, 1.35}, {y[t] + 0.9, 1.35}}], Disk[{y[t] + 1.7, 0.3}, {0.08, 0.16}], Disk[{y[t] + 1.3, 0.3}, {0.08, 0.16}],
Disk[{y[t] + 0.6, 0.3}, {0.08, 0.16}], Lighter[Red, Clip[8 a (t - t0)]]], Polygon[{{-2, 2}, {0, 2}, {-1, 3}, {-2, 3}, {-2, 3}}, Lighter[Red, Clip[8 a (t - t0)]]],
Polygon[{{37, 2}, {35, 2}, {36, 3}, {37, 3}, {37, 3}}],
Brown, Polygon[{{-2, 0}, {-1.2, 0}, {-1.2, 2}, {-2, 2}, {-2, 0}}], Brown, Polygon[{{37, 0}, {36.2, 0}, {36.2, 2}, {37, 2}, {37, 0}}],
Table[White, Disk[RandomReal[{-2, 37}], RandomReal[4]], RandomReal[{0.05, 0.08}]], {30} ]], PlotRange -> {{-2, 37}, {-1, 4}}, Axes -> True, ImageSize -> 1250,
PlotLabel -> Style[Framed[DateString[{0, 0, Floor[t], 60 (t - Floor[t]), 0}, {"Hour24", ":", "Minute"}]], 14, "Label", Background -> RGBColor[1, .875, .537]], ImageMargins -> 8],
{{t, ts, "t"}, ts, t4, 0.001],
FrameLabel -> {StringForm["intenzitet padanja snijega a="], a, "", {StringForm["t0="], t0, StringForm["ts="], ts, StringForm["t1="], t1, StringForm["x1="], x1}}]
```

Slika 9 – WM program za vizualizaciju modela dviju ralica



Slika 10 – WM simulacija modela dviju ralica

6. Zaključak

Treba uočiti da se zadani problem rješava matematičkim modeliranjem, ali da računalna simulacija donosi sasvim novu kvalitetu: ona vizualizira problem, omogućava proučavanje alternativnih scenarija promjenom vrijednosti parametara, kao i eksperimentiranje s promjenom postavki. Sve ovo pobuđuje zanimanje studenata i otvara neslućene mogućnosti za nastavu i istraživanje. To će još više doći do izražaja u narednim godinama, kako programi za računanje i simulaciju budu još snažniji i pristupačniji.

Idući korak u našem zamišljenom kolegiju predstavljalo bi samostalno zadavanje i razrada problema. Primjerice, evo nekih pravaca razmišljanja koji bi se u opisanom problemu mogli ostaviti studentima za samostalni rad:

1. Računalno vizualizirati originalni Klamkinov model problema triju ralica.
2. Modificirati originalni Klamkinov model, računalno ga vizualizirati i usporediti rezultate.
3. Što bi se u Klamkinovu problemu triju ralica dogodilo nakon trenutka kad se ralice susretnu? Čiste li ralice tada trostruko efikasnije ili smetaju jedna drugoj? Kako bi mogle nesmetano čistiti zajedno? Koji je granični broj ralica nakon kojeg nove ralice postaju smetnja?
4. Realizirati model i računalnu simulaciju ralice koja stalno ide od Gračaca prema Udbini i natrag.
5. Na istu cestu pustiti više ralica, koje se kreću pravilnim ili nepravilnim ritmom, modelirati i vizualizirati. Razmotriti rekurzivne formule za n ralica.
6. Uvesti “dispečera” koji pokreće i zaustavlja ralice klikom miša. Postoji li neka optimalna strategija čišćenja? Kako ocijeniti optimalnost strategije?
7. Razmotriti i vizualizirati modele koji bi opisivali situacije s promjenjivim intenzitetom padanja snijega ili različite dubine snijega u startu te situaciju kad snijeg počinje ili prestaje padati na klik miša.
8. Razmotriti i vizualizirati drugačije (primjerice, fizikalne) modele kretanja ralice kroz snijeg.
9. Razmisliti može li se koji od korištenih modela upotrijebiti za rješavanje nekog drugog problema: na primjer, može li model gibanja snježne ralice poslužiti za modeliranje dinamike rješavanja predmeta na sudu opterećenom velikim zaostacima?

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Snow plow problem: a new approach - modeling and visualization

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Abstract. The snow plow problem, usually attributed to R. P. Agnew is a classic introductory problem in the textbooks of ordinary differential equations. It has several variants, including The great snow plow chase problem by M. S. Klamkin. After investigating the problems, the paper discusses some shortcomings of the classical model and proposes different approaches. The software package Wolfram Mathematica is used for the visualization, verification and generalization of the results.

Key words: *snow plow problem, ordinary differential equations, modeling, visualization, Wolfram Mathematica*

Teškoće u savladavanju i upotrebi engleskog jezika za posebne namjene

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Sažetak. Zadnjih dvadeset godina raste svijest o važnosti usvajanja leksičkih kolokacija u učenju stranog jezika. Kolokacijska se kompetencija očituje u upotrebi kombinacija riječi koje se na sintagmatskoj razini pojavljuju zajedno i pri tome ulaze u različite semantičke odnose. Svojom kolokacijskom kompetencijom izvorni govornici prepoznaju kolokacije, dok neizvorni korisnici kolokacijsko slaganje moraju učiti, te nije dovoljno usvojiti samo značenje riječi nego i njen kolokacijski raspon. Kolokacije predstavljaju veliki problem za neizvorne korisnike zbog utjecaja materinskog jezika. Ovo se istraživanje bavi glagolskim kolokacijama engleskog jezika medicinske struke, najčešćim greškama u njihovoj upotrebi, percepcijom studenata o načinu na koji najčešće usvajaju kolokacije te pojavljuju li se greške češće na receptivnoj ili produktivnoj razini.

Ključne riječi: kolokacije, kolokacijska kompetencija, medicinski engleski, studenti

1. Uvod

Poznavanje engleskog jezika medicinske struke je od presudne važnosti za praćenje razvoja medicine znajući da je gotovo cjelokupna medicinska literatura napisana na engleskom jeziku i da je službeni jezik većine medicinskih konferencija engleski. Višerječne jedinice, koje uključuju kolokacije, imaju vrlo značajnu ulogu i u učenju i u upotrebi jezika (Nation i Webb, 2011). Veliki dio engleskog jezika s kojim se učenici susreću i koriste u stvarnom engleskom se sastoji od takvih leksičkih isječaka (Biber, Conrad i Cortes, 2004. u Phoocharoensil, 2014). Iz ovog proizlazi da učeničko razumijevanje i produkcija engleskog kao stranog jezika mogu biti olakšani znanjem višerječnih jedinica. Inkorporiranje kolokacija u nastavne planove i programe engleskog jezika je sada i u budućnosti neizbježno; štoviše, istraživanje višerječnih jedinica će, prema Nation i Webbu i dalje biti središnji dio istraživanja izrade kurikuluma i teorije i prakse učenja jezika (Phoocharoensil, 2014).

2. Teorijski okvir

2.1. Definicija i klasifikacija kolokacija

J. R. Firth je prvi put upotrijebio termin kolokacija pedesetih godina prošlog stoljeća. Firth (1957) kolokaciju ne smatra samo jednom razinom značenja, već i sintagmatskom kombinacijom dviju riječi. Ivir pojam kolokacije definira kao susmjestaj (prema latinskom *com* 'zajedno' + *locare* 'smjestiti'), odnosno suprotstavljanje ili kombiniranje riječi u sintagmatskome nizu (Ivir, 1992–1993). „U literaturi prevladava binarni pristup raščlanjivanju kolokacijske sveze na njezine sastavnice, prema kojemu se razlikuje glavna sastavnica čiji se značenjski potencijal prilagođuje značenjskomu potencijalu promjenjivih sastavnica s kojima

tvori svezu. Ustaljeni i najfrekventniji naziv za promjenjivu sastavnicu jest kolokat“ (Siepmann i dr. u Blagus Bartolec, 2012). Hausmann (1984) je prvi uveo nazive baza i kolokator za jedinice koje tvore kolokaciju, a koji se koriste još i danas. Podjela kolokacije na njezine sastavnice bitna je i za klasifikaciju strukture kolokacija koja se može odrediti prema gramatičkoj strukturi ili prema vrsti riječi kojoj pripada baza. Uvriježena strukturna klasifikacija kolokacija je Bensonova (Benson prema Stojić i Murica, 2010). Temelji se na vrsti riječi koja dominira u kolokacijskoj svezi. Benson tako razlikuje gramatičke i leksičke kolokacije. Gramatičkim kolokacijama smatra sveze riječi koje se sastoje od dominirajućega dijela (glagola, imenice ili pridjeva) i podređenog dijela (prijedloga), a leksičkim kolokacijama one sastavljene od dviju ravnopravnih leksičkih jedinica (Benson u Stojić i Murica, 2010). Najvažnije leksičke kolokacije su pridjev + imenica, imenica + glagol, glagol + imenica, prilog + pridjev i glagol + prilog. Rečenice, infinitivi ili prijedlozi obično nisu među njima (Duplančić Rogošić, 2014).

2.2. Važnost kolokacija u usvajanju jezika

Pri usvajanju jezika upotreba kolokacija predstavlja poseban problem za neizvorne korisnike zbog oslanjanja na materinski jezik. Istraživanje je pokazalo da su pogreške u kolokacijama među najučestalijim pogreškama neizvornih korisnika.

NAJOZBILJNIJE:

Rječnik > pisanje > negacija > redoslijed riječi > prijedlozi >

NAJMANJE OZBILJNE:

glagolski oblici > slaganje

Hijerarhija grešaka prema McCretton and Rider. Preuzeto od James (1998, p. 229)

Prema McCrettonu i Rideru (Sl.1) leksičke greške su najozbiljnije. „Govornika se može razumjeti ako upotrijebi krivo vrijeme, ali upotreba krive riječi može izazvati nerazumjevanje“ (McCretton i Rider u James, 1998). Neizvorni korisnik mora prepoznati kolokaciju kao vezanu sintagmu da bi izbjegao prevođenje svake pojedinačne sastavnice ili istovjetne strukture u materinskome jeziku. Nepostojanje kolokacijske kompetencije dovodi do pogrešaka jer načelna sloboda biranja riječi u svakome jeziku podliježe raznim leksičkim i morfosintaktičkim selekcijskim ograničenjima, što implicira da nije dovoljno učiti pojedine riječi, već i kolokacijski sklop (Stojić i Murica, 2010). Neizvorni korisnici ponekad tvore kombinacije leksičkih jedinica koje zvuče neprirodno i pogrešno izvornom govorniku, pa ako nisu upoznati s pojmom kolokacija i sa svim posebnostima vezanima za njihovo uspješno prevođenje, napraviti će pogreške koje ponekad zvuče smiješno (Leonardi, 2000). To je razlog zbog kojeg je Hill (1999) predložio termin „kolokacijska kompetencija“ i insistirao na usvajanju rječnika ne samo učenjem značenja riječi, već i njenog kolokacijskog raspona.

2.3. Prethodna relevantna istraživanja o usvajanju engleskih kolokacija u stranom jeziku

Mnogi istraživači su proučavali kolokacijsku kompetenciju kao važnu komponentu usvajanja vokabulara. Brashi (2012) je u svom istraživanju pokazao da ispitanici postižu bolje rezultate u receptivnim vještinama slušanja i čitanja, dok je u produktivnim vještinama govora i pisanja upotreba širokog raspona kolokacija uglavnom ograničena. To je razlog zašto je to jedno od područja kojem je potrebno pokloniti više pažnje u istraživanju i nastavi.

Glavni problem leži, dakle, ne samo u razumijevanju značenja kolokacija, već i u njihovoj sposobnosti da ih koriste na odgovarajući način u pisanju i govoru. Čini se da je transfer s materinskog jezika najvažniji faktor kolokacijskih pogrešaka. Studenti uvelike ovise o kolokacijskim uzoracima iz njihovog materinskog jezika i oslanjaju se na sinonimiju i poopćenje Phoocharoensil (2014). Antle (2013) uspoređuje učenje vokabulara individualnim riječima sa učenjem vrlo učestalih glagolskih kolokacija. Rezultati su pokazali da studenti percipiraju učenje vokabulara putem kolokacija mnogo korisnijim. Henriksen (2013) napominje kako bi učenici trebali biti dovoljno izloženi kolokacijama da bi stvarali, jačali i

održavali asocijativne veze između sastavnih dijelova, što uglavnom nije slučaj. Laufer i Waldman (2011) u svom istraživanju pokazuju da skoro polovina pogrešnih kolokacija proizlazi iz utjecaja materinskog jezika te da se te greške ne smanjuju tijekom učenja.

Među istraživanjima nema puno onih koje se bave kolokacijama u engleskom jeziku medicinske struke. U Hrvatskoj se Pavičić Takač i Miščin (2014) u svom istraživanju bave leksemima engleskoga jezika medicinske struke i njihovim glagolskim kolokatima. Različite grupe neizvornih korisnika engleskog jezika medicinske struke, studenti medicine i liječnici, su rješavale zadatke na receptivnoj i produktivnoj razini. Bolji rezultati su sveukupno postignuti na receptivnoj razini, a liječnici su pokazali veći nivo znanja kolokacija na produktivnoj razini od studenata, što autorice objašnjavaju duljom i intenzivnijom izloženosti medicinskom engleskom jeziku pisanjem i čitanjem stručnih članaka neophodnim za njihov profesionalni razvoj i zaključuju da se poznavanje kolokacija povećava kontinuiranom i aktivnom upotrebom medicinskog engleskog jezika.

3. Istraživanje

3.1. Ispitanici

Ispitanici su bili redoviti studenti pete i šeste godine studija medicine Medicinskog Fakulteta Sveučilišta u Splitu akademske godine 2014/2015. Sudjelovalo su 84 ispitanika. Predmet medicinski engleski jezik je obavezan za sve studente bez obzira na duljinu prethodnog učenja. Broj godina učenja je prikazan u tablici 1.

Tablica 1. *Broj godina učenja engleskoga jezika*

Godine učenja	N	%
0 – 4	3	3,6
5 – 10	32	38,1
11 – 15	42	50
16 – 20	7	8,3
Ukupno	84	100,0

Studenti imaju po 20 sati nastave medicinskog engleskog jezika na svakoj od 6 godina studija. Izabrani su studenti završnih godina kako bi se provjerilo stečeno znanje kolokacija. Tijekom nastave prepoznavali su kolokacije u izabranim nastavnim tekstovima te ih upotrebljavali u simuliranim situacijama.

3.2. Cilj istraživanja

Glavni cilj ovog istraživanja je istražiti razinu kolokacijske kompetencije studenata 5. i 6. godine medicine. U skladu s tim postavljena su ova istraživačka pitanja:

Koje se greške najčešće pojavljuju u upotrebi kolokacija u engleskom jeziku medicinske struke? Pojavljuju li se greške češće na receptivnoj ili produktivnoj razini?

Kakva je percepcija studenata o načinu na koji najčešće usvajaju kolokacije?

3.3. Instrument

Instrument mjerenja kolokacijske kompetencije ispitanika bio je test s dva zadatka i upitnikom. Informacije o testu su bile na hrvatskom jeziku, a zadaci i upute za njihovo rješavanje na engleskom. Kolokacije su odabrane prema kriteriju njihovog pojavljivanja u nastavnim materijalima. Prvi zadatak sadržavao je deset pitanja i testirao je receptivnu razinu poznavanja kolokacija, a sastavljen je od pitanja višestrukog izbora. Drugi zadatak je također sadržavao

deset pitanja. Podijeljen je u dva dijela koja su provjeravala produktivnu razinu znanja, a činili su ih prijevod s hrvatskog na engleski jezik i s engleskog na hrvatski. Treći dio testa je bio upitnik na hrvatskom jeziku koji se sastojao od četiri čestice u kojima su studenti procjenjivali na Likertovoj skali od 1 do 5 (od 1 – nikad do 5 – uvijek) koliko često i na koji način smatraju da usvajaju kolokacije u engleskom jeziku medicinske struke.

3.4. Postupak

Testiranje je provedeno za vrijeme redovite nastave na Medicinskome fakultetu u Splitu. Nakon što je ispitanicima na hrvatskome jeziku objašnjen način rješavanja testa, imali su 30 minuta na raspolaganju za odgovore. Svaki točan odgovor je vrednovan jednim bodom. Svaka skupina zadataka je imala maksimalno 10 bodova, ukupno 20.

Točnim odgovorom priznavale su se kolokacije iz rječnika kolokacija (Oxford Collocations Dictionary, 2002) i Glosara najčešćih glagolskih kolokacija u engleskom jeziku medicinske struke (Miščin E., 2012). U prijevodu se pazilo na potertane kolokacije i nije se provjeravala točnost prijevoda ostalih dijelova rečenice već samo razina poznavanja kolokacija.

3.5. Analiza podataka

Rezultati testiranja analizirani su programom SPSS (Statistički paket za društvene znanosti, engl. Statistical Package for Social Sciences, version 20, pomoću kojeg je izvedena statistička analiza podataka (deskriptivna statistika i korelacija).

3.6. Rezultati i rasprava

Da bismo odgovorili na prvo istraživačko pitanje, analizirani su odgovori na postavljene zadatke. Rezultati su prikazani u tablicama 2., 3. i 4.

I. Zadatak višestrukog izbora

Ispitanici su dobili zadatak u kojem su u svakoj od 10 rečenica morali izabrati jedan od 3 ponuđena odgovora.

U tablici 2. predstavljeni su rezultati zadatka višestrukog izbora.

Tablica 2. Rezultati zadatka višestrukog izbora

Ciljana kolokacija	Hrvatski prijevod	Točno (%)	Najčešće pogreške
Establish the diagnosis	Postaviti dijagnozu	69	Make the diagnosis
Develop headache	Dobiti glavobolju	77,4	Acquire headache
Contract influenza	Dobiti gripu	53,6	Collect influenza
Excrete water	Izlučiti vodu	70,2	Evacuate water
Affect growth	Utjecati na rast	79,8	Disturb growth
Aggravate injury	Pogoršati ozljedu	56	Impair injury
Vomit blood	Povraćati krv	73,8	Throw up
Cause seizures	Izazvati epileptični napadaj	46,4	Provoke seizures
Feel the abdomen	Opipati trbuh	72,6	Palpitate
Provide relief	Pružiti olakšanje	76,2	Give relief

II. Zadaci s prijevodom

Studenti su dobili dva zadatka koji su provjeravali njihovo poznavanje kolokacija u engleskom jeziku medicinske struke i sposobnost točnog prevođenja na hrvatski jezik. U prvom su morali prevesti pet rečenica s engleskog na hrvatski, a u drugom s hrvatskog na engleski jezik. Studenti su upozoreni da pri prijevodu posebnu pažnju obrate na potcrtane kolokacije. Greške koje se nisu odnosile na kolokacije nisu analizirane.

Tablica 3. *Rezultati zadatka s prijevodom kolokacija s engleskoga na hrvatski jezik*

Ciljana kolokacija	Hrvatski prijevod	Točan prijevod	Najčešće pogreške	Ostali odgovori
Abort migraine headache	Zaustaviti migrenu	61,9%	Spriječiti migrenu 7%	Spriječiti migrenu, ublažiti migrenu, uzrokovati migrenu, omogućiti prestanak migrene, smanjiti migrenu, poništiti migrenu, izazvati migrenu, dovesti do prestanka migrene, prevenirati migrenu
Sustain a broken arm	Pretrpjeti prijelom ruke	6%	Slomiti ruku 40%	Zadobiti prijelom, zaraditi prijelom, završiti sa prijelomom
Release into the bloodstream	Otpustiti u krvotok	79,8%	Osloboditi u krvotok 2%	Lučiti u krvotok, povisiti u krvotoku, uzrokovati u krvotoku, poticati lučenje u krvotok, izazvati izlučivanje u krvotok, uzrokovati porast u krvotoku
Develop bedsores	Dobiti dekubitus	16,7%	Razviti dekubitus 60%	Javiti se, dobiti ozljede ležanja, oboliti od dekubitusa, osjećati se loše
Precipitate an attack	Ubrzati, pospješiti napad	4,8%	Uzrokovati napad 27%	Dovesti do napada, izazvati napad, prethoditi napadu, provocirati napad, <i>precipitirati</i> napad, ukazati na napad, pogodovati napadu, rizici napada, okidači napada,

Tablica 4. *Rezultati zadatka s prijevodom kolokacija s hrvatskog na engleski jezik*

Ciljana kolokacija	Engleski prijevod	Točan prijevod	Najčešće pogreške	Ostali odgovori
Suzbiti simptome	Suppress the symptoms	14,3%	Stop the symptoms 8%	Prevent the symptoms, abort the symptoms, decrease the symptoms, alleviate the symptoms, eliminate the symptoms, deprive of the symptoms, reduce the symptoms, provide relief, lower the symptoms

Podvrgnuti kirurškom zahvatu	Have / Undergo surgery	20,2%	Will be operated 9,6%	Undertake surgery, go on surgery, apply surgery, go under surgery, obtain surgery, set for surgic procedure, surgery will be made, will have surgery, will be subjected to surgery, will be taken to the operation, go through surgery, go to surgery, will be admitted for surgery
Nadražiti želudac	Irritate the stomach	14,3%	Upset the stomach 17,8%	Affect the stomach, cause nausea, provoke stomach, aggravate the stomach, cause sore stomach, harm the stomach, arouse the stomach, stomach is bad
Naškoditi fetusu	Harm a foetus	47,6%	Affect a foetus 8,3%	Damage a foetus, hurt a foetus, make trouble to a foetus, cause damage to a foetus
Naručiti ultrazvuk	Order ultrasound	57,1%	Request ultrasound 2,4%	Ask ultrasound, offer ultrasound, make ultrasound, ordinate ultrasound, receive ultrasound, schedule ultrasound, sign for ultrasound

Drugo istraživačko pitanje se odnosilo na učestalost grešaka na receptivnoj i produktivnoj razini. Tablica 5. pokazuje rezultate deskriptivne statistike za receptivnu, produktivnu i sveukupnu kolokacijsku kompetenciju

Tablica 5. Kolokacijska kompetencija

	Broj	Minimalna vrijednost %	Maksimalna vrijednost %	Srednja vrijednost %	Standardna devijacija
Receptivno znanje kolokacija	84	20	100	67,38	17,977
Produktivno znanje – prijevod na hrvatski jezik	84	0	80	33,81	16,998
Produktivno znanje – prijevod na hrvatski jezik	84	0	100	30,71	24,729
Produktivno znanje kolokacija – ukupno	84	0	80	31,90	17,526
UKUPNO	84	10	85	49,76	14,560

Ispitanici su postigli bolje rezultate na receptivnoj razini, na kojoj su trebali izabrati točnu kolokaciju između tri ponuđene. Ovi su rezultati kompatibilni s prethodnim istraživanjima (Brashi, 2012; Duplančić Rogošić, 2014; Pavičić Takač i Miščin, 2013) koja su također pokazala da je kolokacijska kompetencija ispitanika veća na receptivnoj razini. Ipak se mora naglasiti činjenica da su neki od odgovora mogli biti i slučajno pogodeni. Puno je teži zadatak za ispitanike predstavljao prijevod jer su trebali proizvesti točnu kolokaciju i na materinskom i na stranom jeziku. Strategije kojima su najčešće služili u situacijama kad nisu znali točan

odgovor su bile doslovan prijevod s prvog jezika i aproksimacija. Ispitanici su često pribjegavali doslovnom prijevodu kad se nisu mogli sjetiti odgovarajućeg glagola (npr. doslovni prijevod glagola develop kao razviti u kolokaciji develop bedsores – dobiti dekubitus), što su pokazala i prijašnja istraživanja (Laufer i Waldman, 2011; Phoocharoensil, 2014). Često su imali problema i u pronalaženju pravog kolokata u materinskom jeziku, npr. sustain a broken arm je kolokacija koja je zadala muke velikom broju studenata jer im nije bio poznat glagol sustain. Samo 6% ispitanika ga je točno prevelo, a 40% ih se fokusiralo na broken arm i cijelu kolokaciju prevelo sa slomiti ruku ili kolokacijama zadobiti, zaraditi prijelom. Ispitanici su se također služili aproksimacijom kad ne bi znali točan odgovor, tj. upotrijebili bi riječ sa sličnim značenjem (npr. upset umjesto irritate u kolokaciji irritate the stomach). Iako to može ponekad biti uspješno, istraživanja su pokazala manjkavosti takve strategije (Boonyasquan, 2006; Howarth, 1996; 1998; Mongkolchai, 2008, u Phoocharoensil, 2014), jer među jezicima nema simetrije i često dolazi do udaljavanja od pravog značenja (Štefić i sur., 2010).

U nastavku će biti prikazani rezultati korelacijske analize koja je imala za cilj pokazati odnos između pokazanog receptivnog i produktivnog znanja.

Tablica 6. Vrijednosti Pearsonovih koeficijenata korelacije između receptivnog i produktivnog znanja kolokacija

	Receptivno znanje kolokacija	Produktivno znanje– prijevod na hrvatski jezik	Produktivno znanje – prijevod na engleski jezik
Receptivno znanje kolokacija	1	0,412 ^{xx}	0,191
Produktivno znanje – prijevod na hrvatski jezik		1	0,357 ^{xx}
Produktivno znanje – prijevod na engleski jezik			1

Napomena: ^{xx} $p < 0,01$

Studenti koji su postigli bolje rezultate u prevođenju kolokacija s engleskog jezika na hrvatski, pokazali su se uspješnijima i u prijevodima s hrvatskog na engleski jezik ($r=0,412$; $p<0,01$). Također, oni s boljim uspjehom u prevođenju kolokacija s engleskog na hrvatski jezik ostvarili su bolje rezultate i na receptivnoj razini u zadacima višestrukog izbora ($r=0,357$; $p<0,01$).

III. Percepcija ispitanika

U trećem zadatku ispitanici su procjenjivali na Likertovoj skali od 1 do 5 (1 – nikad, 2 – rijetko, 3 – ponekad, 4 – često, 5 – uvijek) koliko često i na koji način, po njihovom mišljenju, usvajaju kolokacije u engleskom jeziku medicinske struke. U tablici 7. su prikazane dobivene vrijednosti.

Tablica 7. Stavovi ispitanika o načinu usvajanja kolokacija

	Mean	Std. deviation	Minimum	Maximum
Pohađanjem kolegija medicinskog engleskog na fakultetu	2,89	2,07	2,52	3,46
Čitanjem obvezne ispitne literature	1,042	1,015	1,103	1,069

Čitanjem znanstvenih/ stručnih radova	1	1	1	1
Gledanjem tv sadržaja medicinske tematike	5	5	5	5

Prema mišljenju studenata, oni najčešće usvajaju kolokacije putem *gledanja tv sadržaja medicinske tematike*, a najrjeđe čitanjem obvezne ispitne literature. Mogući razlog ovakvim rezultatima leži u činjenici da je većina obvezne ispitne literature na hrvatskom jeziku, pa studenti nemaju dojam da na taj način usvajaju kolokacije. S druge strane, učestalost izloženosti tv sadržajima medicinske tematike ispitanici izjednačavaju s usvajanjem, tj. što više gledaju takve sadržaje, više imaju dojam da su naučili. Međutim, da to nije tako potvrđuju rezultati prema kojima su bili znatno uspješniji u rješavanju zadatka na receptivnoj razini znanja kolokacija u usporedbi sa produktivnom razinom.

Nadalje, u tablici 8. se nalaze rezultati povezanosti različitih razina poznavanja kolokacija s percepcijom ispitanika o načinu usvajanja.

Tablica 8. Vrijednosti Pearsonovih koeficijenata korelacije između rezultata na receptivnoj i produktivnoj razini i načina usvajanja kolokacija

	Receptivno znanje kolokacija	Produktivna razina – prijevod na hrvatski jezik	Produktivna razina – prijevod na engleski jezik
Pohađanjem kolegija medicinskog engleskog na fakultetu	0,002	0,003	-0,067
Čitanjem obvezne ispitne literature	0,024	-0,072	-0,021
Čitanjem znanstvenih/ stručnih radova	0,070	0,059	0,127
Gledanjem tv sadržaja medicinske tematike	0,120	-0,052	0,074

Napomena: ^{xx} $p < 0,01$

Iz tablice 8. se vidi da percepcija studenata o usvajanju kolokacija pohađanjem kolegija medicinskog engleskog jezika na fakultetu, čitanjem obvezne ispitne literature, čitanjem znanstvenih stručnih radova i gledanjem tv sadržaja medicinske tematike nije statistički značajno povezana s uspjehom ni na receptivnoj ni na produktivnoj razini. Ovakvi rezultati ukazuju na to da studente treba eksplicitno poučavati kolokacijama, upozoravati ih na mogućnost transfera elemenata iz materinskog jezika u strani i obrnuto te da sama izloženost kolokacijama nije preduvjet i njihovoga usvajanja.

4. Zaključak

Kolokacije često predstavljaju problem za neizvorne korisnike jezika. Učenje individualnih riječi i njihovog značenja nije dovoljno da bi se postigla fluentnost u stranom jeziku, potrebno je poznavati način na koji se riječi kombiniraju u leksičke isječke, jer što je riječnik bogatiji kolokacijama, veća je preciznost, točnost i vjerodostojnost govora (Martyńska, 2004). Rezultati ovog istraživanja su pokazali da se neizvorni govornici u upotrebi kolokacija jako oslanjaju na materinski jezik i upotrebu riječi sa sličnim značenjem. Nastava medicinskog engleskog se nije na Likertovoj skali pokazala kao najčešći oblik usvajanja medicinskih kolokacija, što implicira da se u upotrebi kolokacija uglavnom oslanjaju na već naučeno. Također se pokazalo da se s

godinama učenja ne poboljšava razina poznavanja kolokacija, što su potvrdila i druga istraživanja (Martynska, 2004; Phoocharoensil, 2014).

Od početka učenja medicinskog engleskog potrebno je postepeno uvoditi leksičke kolokacije i u materinskom i engleskom jeziku i pritom upozoravati studente na kolokacije koje su nespojive u oba jezika, komparirajući različite upotrebe istog para sinonima ukazujući na to da se riječi slične po značenju ne mogu upotrijebiti u svim kontekstima.

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Difficulties in mastering and using English for specific purposes

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Abstract. In the last two decades there has been a growing awareness of the importance of acquisition of lexical collocations in learning a foreign language. Collocational competence is evident in using combination of words that appear together on the syntagmatic level and thereby enter into various semantic relations. By their collocational competence native speakers recognize collocation, while non-native users must learn them. It is not enough to acquire only the meaning of the word but also its collocational span. Collocation is a big problem for non-native users due to the influence of their mother tongue. This research deals with verb collocations in English language of medical profession, the most common mistakes, perceptions of students about the way they usually acquire collocations and whether the mistakes appear more frequently at receptive or productive level.

Key words: *collocation, collocational competence, medical English, students*