

Palaščáková, Daniela

Article

Impact of the universities on regional development in the Slovak Republic

Reference: Palaščáková, Daniela (2021). Impact of the universities on regional development in the Slovak Republic. In: Technology audit and production reserves 6 (4/62), S. 32 - 36.
<http://journals.urau.ua/tarp/article/download/248815/246472/571843>.
doi:10.15587/2706-5448.2021.248815.

This Version is available at:
<http://hdl.handle.net/11159/7249>

Kontakt/Contact

ZBW – Leibniz-Informationszentrum Wirtschaft/Leibniz Information Centre for Economics
Düsternbrooker Weg 120
24105 Kiel (Germany)
E-Mail: [rights\[at\]zbw.eu](mailto:rights[at]zbw.eu)
<https://www.zbw.eu/econis-archiv/>

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UDC 332.1

JEL Classification: I23, O32, R11

DOI: 10.15587/2706-5448.2021.248815

Article type «Reports on Research Projects»

Daniela Palaščáková

IMPACT OF THE UNIVERSITIES ON REGIONAL DEVELOPMENT IN THE SLOVAK REPUBLIC

In contrast to the traditional view on economics, related to productivity and economic growth, we focus our attention on the development of modern technologies, services, and the knowledge economy. The fast pace of technology innovations requires higher-quality education. In this matter, the objects of the research are universities that influence the population and economic development as well as the regional development as one of the involved institutions. The paper deals with the contextual analysis of the university environment within the conditions of regions in the Slovak Republic upon the selected subindexes, such as macroeconomic performance and stability, innovation policy, institutional quality, and the quality of human resources. The differences between the regions are analyzed through the Index of the quality of regional university environment (IQRUE) that enabled to recognize these differences better. The ranking of the regions has been created according to a daily index when interpreting the results by the comparison of each region. The Pearson's correlation coefficient and Spearman's ranking correlation coefficient were used to testing the relationship between GDP and science and research expenses. The results are presented in the tables and graphs. The conducted research enabled the identification of the deficiencies of the university environment in every region of Slovakia. As a result, some universities are disadvantaged within the competition. Continuous elimination of deficiencies should not be a priority of universities only, however, the entire society should prioritize it. The state, local self-government bodies should play the leading role to create the conditions to improve the quality of the university environment and pay attention mostly to the disadvantaged regions.

Keywords: higher-quality education, regional development, university environment, Index of the quality of regional university environment (IQRUE).

Received date: 20.08.2021

Accepted date: 23.09.2021

Published date: 24.12.2021

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How to cite

Palaščáková, D. (2021). Impact of the universities on regional development in the Slovak Republic. *Technology Audit and Production Reserves*, 6 (4 (62)), 32–36. doi: <https://doi.org/10.15587/2706-5448.2021.248815>

1. Introduction

There was an opinion in the society for a long time that the traditional role of universities, which are formed since Medieval times, is education, science, and research. However, nowadays, the extent of university activities at the national level, as a consequence of integration and globalization, transcends these two primary roles. The request for the role of the university in the economic development of the country as well as the regional development becomes more intense. This role of the universities is related to the need for their constantly more intense approach and participation in the innovation and region growth process, as well as generating knowledge, related to the requirements of a particular region [1, 2]. We want to emphasize here that higher educational institutions are considered to be universities, and the term university denotes all educational institutions, providing higher educational studies according to paragraph 1 section 2 Act No. 131/2002 [3].

The universities are becoming a key factor in forming and executing the policies in the field of innovations,

clusters development, creation and development of human capital, and entrepreneurship in many countries. Extending the mission of universities comes along with giving them a more active task in economic development [4]. Therefore, we can state that higher education has significant importance for the national economy from several points of view, firstly, for the industry and secondly, for acquiring a qualified workforce. The graduates make better money for their living and have a higher chance to get employed than the less educated population. The universities are extensively significant social institutions, forming the local, regional and national environment that makes them driving powerhouses of sustainable future [1, 5, 6].

One of the most vulnerable effects of the social or economic transformation of Slovakia after 1989 has become the growth of regional divergence, creating extensive differences among the regions within a couple of years. It is followed by a variety of negative consequences. The main reasons for such divergence are different regional options to prepare for new economic and social conditions. Another regional difference is visible mostly in the unemployment rates, economic

productivity of regions, or extensive divergence in the essential information-communication technology equipment. We can also mention great differences at the educational level or about the interconnection of the regions to the traffic infrastructure and main metropolises of the country [7].

It is important to create a flexible system of institutions for regional development and solving disparities depending on the solution type [8]. Regional development in Slovakia is modified with two regulations:

1. Act 539/2008 Coll. on the support of regional development as amended, with its goal to eliminate the regional divergence among regions, increase the economic performance of the regions or increase the employment rates within regions [9];

2. Act 336/2015 Coll. on the support of developed counties and the amendment and completion of several acts, which modifies the conditions, system, and forms of providing the support to the least developed counties [10].

The contextual situational analysis in the field of higher education, international approaches and aspects in Slovakia in comparison to the trends in OECD (Organisation for Economic Co-operation and Development), Council of Europe and European Commission, analysis of higher education environment within the conditions of Slovakia in the context of competition, quality determinants of higher education and their characteristics in the conditions of Slovakia, were the scope for definition of subindexes and indicators, which resulted into the assessment and interpretation of the paper results [11–13].

The paper consists mostly in the application of the Index of the quality of regional university environment (hereinafter just «IQRUE») to the regions of Slovakia and testing the hypothesis regarding higher education and its impact on the economy of the Slovak Republic.

When setting the hypothesis (H1), we focused on the relationship between GDP and the expanses for science and research. The statement of the author of the paper [14] «*Every organization, not just a manufacture, must possess the essential competence to innovate*» has inspired us in doing so. Currently, many scientific disciplines are focusing on the innovations, such as sociology, technology, economy, and engineering. However, we focused on innovation in the economic sphere only. The innovations themselves and their impact on economic development caused an enormous interest of the economists, entrepreneurs, and politicians in developed countries. We encounter the term of innovations in professional and popular literature, mostly in the field of creating new technologies and policies of development at various levels (corporate, local, regional, national and multinational) [15].

The European Commission follows the innovative performance of the countries since 2001 with the assessment report *Innovation Union Scoreboard*. The General Innovation Index provides a picture of the innovation performance. We use the indicators of five fields to calculate the index: stimulating power of innovations, knowledge creation, entrepreneurship and innovation, knowledge utilization, and intellectual property [16, 17]. Within the index assessment, Slovakia has appeared among the countries, which reach much lower results in this field than expected concerning their development. According to many opinions, Slovakia will drop lower in the ranking in the upcoming years due to the restrictions and consequences of the COVID-19 pandemic. It is highly supposed, that financing the research

and development is unlikely to happen and will focus rather on the primary support of the population [18].

In this context the *object of research* is universities, which additionally have not only an impact on the population and economic development, but as one of the actors, they also have an impact on the development of the region. The *purpose of the paper* is to define the impact of universities on the development of individual regions in the Slovak Republic on the basis of selected subindexes and their indicators, which are: macroeconomic performance and stability, innovation policy, institutional quality and quality of human resources.

2. Methods of research

We used the IQRUE, consisting of several subindexes and their indicators, to follow the differences between the regions of Slovakia. We have selected 4 subindexes visible in Table 1 to compare regions in the university environment. We followed the ISO 3166-2 codes to represent 8 regions in Slovakia (the first part (SK) is an international code for Slovakia, the second part, made out of two letters, identifies the region): Bratislava – SK-BL, Trnava – SK-TA, Trenčín – SK-TC, Nitra – SK-NI, Žilina – SK-ZI, Banská Bystrica – SK-BC, Prešov SK-PV, Košice – SK-KI.

To calculate the indicator of subindexes, we followed the pattern, which we illustrate using the sample indicator for SK-BL:

$$\begin{aligned} \text{Regional GDP}(\text{SK} - \text{BL}) &= \\ &= \frac{\text{Regional GDP}(\text{SK} - \text{BL})}{\text{Regional GDP}(\text{SK}) / 8 \text{ regions}} \cdot \text{indicator strength}. \end{aligned}$$

We performed the calculations upon the databases of the statistical indicators of subindexes for every region of Slovakia in the researched years of 2017, 2018, and 2019. Consequently, we calculated the general IQRUE.

Table 1

Subindexes and indicators of IQRUE

	Sub-indexes	Indicators
IQRUE	MP&S	Regional GDP
		Regional added value
		Labor productivity
		Employment rate
		Unemployment rate
	IP	Science and research staff rates
		Science and research expenses
		Corporations focusing on science and research
	IQ	The number of universities in the region
		The number of faculties in the region
		The volume of paid social scholarships
		The economic outcome of public universities in the region
		Accommodation capacities of public universities
		The number of entrepreneur subjects in the region
	HRQ	Graduates number
		Economically active population with higher education
		Graduates unemployment

Note: own elaboration according to [11]; MP&S – macroeconomic performance and stability; IP – innovation policy; IQ – institutional quality; HRQ – human resources quality

Within the process of calculation upon the questionnaire survey, performed in the university environment, we defined the subindexes strength and particular indicators according to the significance, which the respondents from external and internal university environments attributed to them [11]. The results of the questionnaire survey were presented in other articles.

As we have mentioned in the introduction, we focused on the relationship between GDP and the science and research expenses in hypothesis (H1) testing. Consequently, we set the following hypothesis:

H₀: We suppose that there is not any statistically significant dependency between the indicators of GDP and science and research expenses.

H₁: We suppose that there is a statistically significant dependency between the indicators of GDP and science and research expenses.

We tested the hypotheses for the regions in Slovakia. We collected the data from 2002–2019 when the testing was conducted. We used Pearson's correlation coefficient and Spearman's sequential coefficient of correlation in testing. We performed the measuring of dependency and correlation between indicators with the R studio program. We turned the outcome into tables and graphs. We also used the methods of economic analysis, statistical analysis, comparison, and contrasting.

We mostly followed Act No. 131/2002 Coll. on higher education in resolving the issues. Data, used in our calculations, originated mostly from the databases of the Statistical Office of the Slovak Republic, Eurostat, The Institute of Information and Prognosis in Education of the Slovak Republic, National Bank of Slovakia (hereinafter «NBS»), annual reports of the Ministry of Education, Science, Research and Sport in the Slovak Republic (hereinafter just «MESRSSR») as well as the annual reports on the economy or the annual reports on the activity of universities in Slovakia.

3. Research results and discussion

After we had calculated the indicators and subindexes, we counted each value and enumerated the final IQRUE, which we present in this article for the regions of the Slovak Republic. The final results are presented in Table 2.

Based on the overall index for the regions and pre-set methodology for the calculation of IQRUE, we came to the final ranking of the regions, shown in Table 3 and Fig. 1.

Table 3

Ranking of the regions in Slovakia within IQRUE, 2017–2019

Region	2017		2018		2019	
	Rank	IQRUE value	Rank	IQRUE value	Rank	IQRUE value
SK-BL	1	2.22	1	2.21	1	2.22
SK-KI	2	0.63	2	0.65	2	0.69
SK-ZI	3	0.56	3	0.55	3	0.58
SK-NI	4	0.50	4	0.55	4	0.49
SK-TA	5	0.45	5	0.45	5	0.46
SK-TC	6	0.45	6	0.43	6	0.45
SK-BC	7	0.39	7	0.41	7	0.43
SK-PV	8	0.31	8	0.34	8	0.32

Note: own collaboration [19]

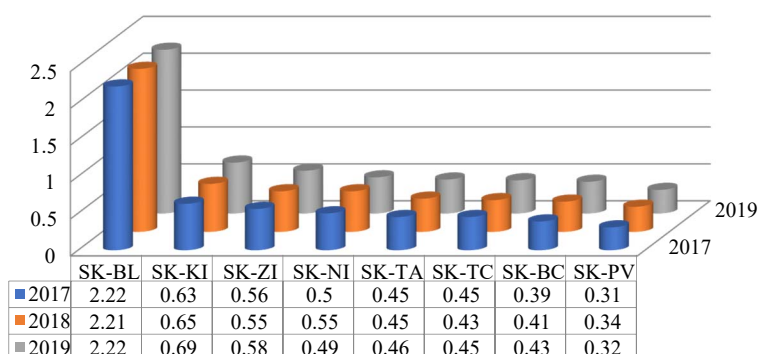


Fig. 1. Development of IQRUE in the regions of Slovakia, 2017–2019

As you can see, the ranking of the regions hadn't been changed throughout the entire research period. SK-BL ranked the first place. There was a visible dominance of this region within all subindexes, as the metropolis of Slovakia. In 2019, it offers the following:

- the highest GDP (26,379.56 mil EUR);
- the highest added value (23,603.02 mil EUR);
- the highest labor productivity (380,958 EUR);
- the highest employment rate (351.3 thousand people);
- the lowest unemployment rate (8.5 thousand people);
- most universities (12);
- most faculties (45);
- most entrepreneur subjects (82,645);
- the highest expenses for science and research (374,848.13 mil EUR);
- most graduates (12,269 thousand people), etc.

Table 2

Final values of subindexes IQRUE by the regions of the Slovak Republic

Region	2017				2018				2019			
	Subindexes/Strength (%)				Subindexes/Strength (%)				Subindexes/Strength (%)			
	MP&S 30 %	IP 35 %	IQ 15 %	HRQ 20 %	MP&S 30 %	IP 35 %	IQ 15 %	HRQ 20 %	MP&S 35 %	IP 30 %	IQ 15 %	HRQ 20 %
SK-BL	0.37	1.17	0.41	0.27	0.37	1.14	0.42	0.29	0.37	1.14	0.42	0.30
SK-TA	0.16	0.14	0.10	0.05	0.15	0.15	0.10	0.05	0.16	0.16	0.09	0.06
SK-TC	0.13	0.23	0.05	0.03	0.13	0.20	0.06	0.03	0.13	0.22	0.07	0.04
SK-NI	0.13	0.16	0.12	0.09	0.13	0.21	0.12	0.08	0.13	0.15	0.11	0.09
SK-ZI	0.16	0.21	0.13	0.07	0.15	0.22	0.11	0.07	0.16	0.23	0.10	0.08
SK-BC	0.07	0.15	0.11	0.06	0.07	0.15	0.12	0.07	0.08	0.16	0.12	0.08
SK-PV	0.06	0.09	0.08	0.08	0.07	0.10	0.08	0.08	0.06	0.10	0.08	0.09
SK-KI	0.12	0.25	0.20	0.09	0.11	0.23	0.20	0.11	0.11	0.24	0.21	0.13

Note: own collaboration [19]; MP&S – macroeconomic performance and stability; IP – innovation policy; IQ – institutional quality; HRQ – human resources quality

Recently, the only negative of this region is its relatively high unemployment rate of university graduates. It should have a lower unemployment rate of university graduates due to its position as the most developed region with the highest number of graduates, corporations, and the highest expenses for science and research.

SK-KI has ranked the second position, chasing SK-BL in several aspects, however, unsuccessfully. SK-ZI ranked the third position closely behind SK-KI. There is relatively high labor productivity due to the high unemployment rate. The greatest issue is long-term unemployment and it has lower GDP than SK-KI.

The least developed region is SK-PV, placed in the last position. There is a low rate of utilizing the workforce due to the high unemployment in the region. Long-term unemployment is the greatest issue of the region because it has a very high percentage of applicants with low qualifications. There are high interregional differences in the region and insufficient infrastructure, increasing the unemployment even higher, causing moving the workforce out of the region and depopulation of the region. Another problem can be inequality among the offer and demand in the labor market. One of the greatest issues of the SK-PV region is the university focus, located in the region. The only public educational institution is focused primarily on the education of future pedagogues in the arts. Consequently, there is an unbalance among the demand of entrepreneurial subjects and the university offer in the largest region in Slovakia. Regarding the university professional scope orientation in this region, there is an excess of graduates in the discipline of tourism, pedagogy, corporate economy, and business management. Therefore, graduates in the above-mentioned disciplines are looking for work out of their professional scope or leave the country or the region for the pursuit of their jobs. The situation in SK-PV requires the university environment in the region to adapt to the regional demand and enable the entire region to prosper.

The results of the hypothesis (H1) testing: We focused on the relationship between GDP and the expenses for science and research in Hypothesis (H1). We set the following hypothesis:

H₀: We suppose that there is not any statistically significant dependency between the indicators of GDP and science and research expenses.

H₁: We suppose that there is a statistically significant dependency between the indicators of GDP and science and research expenses.

As a result, we tested the hypotheses for the regions in Slovakia. Following the data from 2002–2019, we conducted the testing (Fig. 2).

We came to the value of Pearson's correlation coefficient 0.88, performing the data analysis to indicate high dependency between the researched values. We tested the hypotheses at the significance level $\alpha=0.05$. As the $P\text{-value}<\alpha$, we can reject a zero hypothesis. We demonstrated the statistical dependency between GDP and the expenses for science and research in Slovakia.

Likewise, the values of the Spearman ranking correlation coefficient in all the regions of the Slovak Republic showed the statistically significant importance between GDP and expenses for science and research. The values of Spearman's ranking correlation coefficient for Bratislava Region 0.96 Trnava Region 0.76; Trenčín Region 0.73; Nitra Region

0.85; Žilina Region 0.84; Banská Bystrica Region 0.91; Prešov Region 0.95 and Košice Region 0.85 indicated the significant dependency between the researched values. We tested the hypotheses at the significance level $\alpha=0.05$. Due to the $P\text{-value}<\alpha$, we can reject a zero hypothesis. We showed the statistically significant importance between GDP and expenses for science and research in all the regions of the Slovak Republic.

```
> cor.test(datahdp$SR, dataveda$SR)

Pearson's product-moment correlation

data: datahdp$SR and dataveda$SR
t = 7.2486, df = 16, p-value = 1.945e-06
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.6912102 0.9528992
sample estimates:
cor
0.8755391

> cor.test(datahdp$BASK, dataveda$BASK, method="spearman")

Spearman's rank correlation rho

data: datahdp$BASK and dataveda$BASK
S = 40, p-value = 5.547e-06
alternative hypothesis: true rho is not equal to 0
sample estimates:
rho
0.9587203
```

Fig. 2. The screenshot from R studio: coefficients of Pearson's and Spearman's correlation coefficient (own collaboration)

4. Conclusions

The conclusions from the assessment of particular IQRUE subindexes can help authorities in charge enhance the qualitative development of not only the university environment but even the entire region. However, we must be aware that the competitive environment and market play the main role. The role of the state and the self-governing body is to create the conditions to bring the university environment to higher quality and focus its emphasis mostly on the underdeveloped regions. The advantage of this index is its possibility to be constantly followed and the possibility of the application to more recent periods. We came to the following findings:

1. We confirmed great regional disparities within Slovakia using IQRUE.
2. SK-BL reaches the best results among all the regions in Slovakia. We can consider it as the most developed region in Slovakia and the center of innovation, progress, education, and entrepreneurship. The only negative can be the higher unemployment rate of university graduates.
3. On the other hand, the worst placed region is SK-PV which is the least developed region with many deficiencies, e. g. long-term unemployment, high inner-regional differences, and insufficient infrastructure built [20].
4. We found the dependency between GDP and expenses for science and research, testing the hypothesis (H1). The expenses for science and research reached the level of 0.83 % of GDP in 2019. It means that Slovakia constantly invests insufficient funds into this field. Therefore, Slovakia is behind the average of the EU with 1.65 % of GDP and is further away from its goal to reach 1.2 %, set within the strategy RIS3 SK for 2020. SK-BL with its value of 0.96 reaches the most powerful direct dependency, on the other hand, the least powerful is SK-TC with its value of 0.73.

4. The situation in Slovakia is serious, however, not irresolvable. Primarily, it is necessary to reduce the number of universities where their graduates find it hard to get employed in the labor market after their graduation. In this case, the positive news is that the Accreditation Agency of the Slovak Republic canceled 20 study programs in 2020 [21].

5. Right after we reduce the number of higher educational institutions, it is necessary to reform the university funding. Financing based on the number of students is not effective because universities are lowering the conditions for entrance exams as well as the education process.

6. Another problem is a relevant assessment of universities. Future students need to decide on a particular university, so they need the university assessment based on the logical indicators. It refers to future employers who would be able to assess the quality of graduates much better.

7. The last step, which is as important as the previous ones, is to lower the disparities between regions and insufficient execution of the projects for the support to create working positions.

We believe that the conclusions we found during the process of research and the problem-solving analysis help the authorities in charge increase the quality of the higher education environment and lower regional disparities within the Slovak Republic.

Quality assurance at universities is not only in the interest of Slovak or European schools, it is also a global problem. This is related to the growing demands on education and costs, needed to provide it. The obtained results of the quality assessment of the regional higher education environment confirmed the correctness of the construction and applicability of IQRUE in the context of qualitative competitiveness criteria. The proposed methodology can be used for this purpose in monitoring development trends within a longer time horizon, not only within individual regions of the Slovak Republic but also on an international scale.

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Daniela Palaščáková, PhD, Assistant Professor, Department of Economics, Technical University of Kosice, Košice, Slovak Republic, e-mail: daniela.palascakova@tuke.sk, ORCID: <https://orcid.org/0000-0002-2487-586X>