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Article

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MANAGEMENT OF DIGITISATION PROCESSES IN THE FIELD OF SOCIAL SERVICES

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Abstract: *Thanks to digital technologies, social spheres become increasingly mobile and resistant to transformational processes. Modern society needs to receive high-quality social services in a 24-hour format. It is essential to understand that digitalisation needs to be more socially neutral. On the one hand, digital technologies provide society with new perspectives, opportunities, and solutions, and on the other hand, they can cause the emergence of various risks. Management of the processes of digitalisation of social services involves not only the implementation of digital innovations but also the assessment of the consequences for society and the state. Thus, this article aims to analyse modern trends in digitalisation in the social services field and develop a scientific and methodological approach that will formalise the functional connections between digitalisation and the spheres of education, healthcare, and social protection. In the article, these statements are confirmed by the bibliometric analysis of keywords co-occurrence. It made it possible to identify the following vectors among studies of digitalisation in the field of social services: education, health care, and social protection, which foresee a change in the very essence of digitalisation through the prism of different scientifical approaches. In this regard, this article is devoted to studying the influence of digitalisation on critical indicators of education, health care, and social protection using Principal Component Analysis, Canonical Correlation Analysis and Multiple Regression Modelling. Based on a sample of 35 European countries in 2020-2022. Three canonical models were built, each of which tested the functional relationship between the indicators of the information and communication sector of the studied countries (Percentage of the ICT sector on GDP, Percentage of the ICT personnel in total employment, Percentage change of value added by ICT sector at current prices) and selected indicators of education, health care and social protection. As a result, it was found that, in general, the development of digital technologies has a positive effect on social services—still, the most significant relationship between digitalisation and the sphere of education and health care. As a result of regression modelling, it was found that the Percentage of the ICT personnel in total employment and the Percentage change of value added by the ICT sector at current prices are positively influenced by the Employment rates of recent graduates and negatively by Hospital beds and Expenditure on social protection.*
Keywords: digitalisation, innovation, social services, education, healthcare, social protection, canonical correlation analysis.
JEL Classification: L91, R40

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Introduction. Promoting the sustainable integration of education, health, and social services can contribute to the country's recovery from economic recession, and digital power plays a critical game-changer in this process. The digitisation of the economy, the global pandemic of COVID-19, and the rapid development of scientific and technological progress force the state and company-level leadership to look at the management process otherwise. In the conditions of digitalisation, part of the daily powers of leaders around the world in various sectors of the economy is expanding, focusing on human values. Many social problems (unemployment, issues of state pension provision, etc.) require a unified approach to the solution. Higher education institutions can use different techniques for pedagogical principles and methods in combination with digitalisation methods. These methods include a variety of digital technologies and online communication. It facilitates distance learning and provides quick access to the necessary information. The COVID-19 pandemic forced the educational environment to be completely reconfigured, and the direction of digitalisation of the academic climate gained particular popularity. Nowadays, when the pandemic is on the decline, the implementation of digitisation tools continues to be actively used by teachers and students. Digitalisation provides all the opportunities to revolutionise healthcare by transforming various aspects of the industry. It ensures a seamless exchange of medical information and improves communication between healthcare providers and patients. Digital healthcare technologies increase the efficiency, accuracy and availability of medical services. In addition, data analytics empowers healthcare professionals to make informed decisions, predict outcomes, and personalise treatment plans. Overall, digitisation promises to improve care outcomes, reduce costs, and enable more proactive, patient-centred care.

Literature Review. The publishing activity of scientists from this or that topic is a vivid reflection of the relevance of a specific socially significant problem. Such international scientometric databases as Scopus and Web of Science accumulate millions of scientific works (articles, report abstracts, book chapters, etc.) on various topics. The issue of digitalisation in multiple spheres of human activity, including in the sphere of social services, is actively discussed by the scientific community and acquires new relevant aspects. Given the results of searches for keywords that are directly related to the topic of this article, the following number of scientific works (in the official English language) are currently available in the Scopus and Web of Science databases (Table 1).

Table 1. The number of scientific works in the Scopus and Web of Science (WoS) databases by search queries that reflect the relationship between digitalisation, the spheres of education, health care and social protection

Key words	Scopus	WoS
Digitalisation and social services	35	35
Digitalisation and education	1960	2267
Digitalisation and healthcare	555	432
Digitalisation and social protection	22	20

Sources: developed by the authors based on Scopus and Web of Science.

Based on the results presented in Table 1, the most popular search query for both scientometric databases today is the query «Digitalisation and education», followed by the search query «Digitalisation and healthcare» in terms of popularity, followed by «Digitalisation and social services» and in the last place – «Digitalisation and social protection». Digitalisation processes were most integrated into the educational process among the studied spheres of social services. It especially gained popularity during the active phase of the COVID-19 pandemic in 2019-2021, when the traditional format of interaction between the teacher and students moved to an online form with the active involvement of special software and technical support. Speaking about the increased interest of the world's scientists in the use of digitalisation in the healthcare field, one cannot ignore the topic of COVID-19 since diagnostic and treatment processes for sick people are carried out with the help of digital technologies. A relatively low number of publications on the topic of digitalisation and social protection indicates that this research direction is only at the initial stage and needs incremental updating, especially in the context of the post-Covid period and several socio-economic changes taking place in the world today and causing the emergence of a large number of socially vulnerable sections of society.

It is necessary to consider in more detail what modern scientists write specifically from the standpoint of four vectors:

- **Digitalisation and the Sphere of social services.** Based on the logical findings in the study by Zhao et al. (2023), they presented four theoretical mechanisms of digitisation that contribute to the sustainable integration of culture and tourism. The relationship between digitalisation and the areas of health and social

protection is presented in the work of Sibilla and Gorgoni (2023). Scientists have proposed an approach that sheds light on the transformations in these areas due to the operational and ethical consequences of digitisation in the post-war period. Scientists from Finland, Choroszewicz and Alastalo (2023) also continued to study the impact of digitalisation on the development of health care and social protection. Using the example of their country, scientists are conducting an ethnographic study of cooperation between public sector organisations and private IT companies that develop data management systems in regional healthcare organisations and the provision of social services. A group of scientists led by Wei et al., 2022 proved the need to implement the model of teacher competence as an innovative tool in personnel management. In other words, increasing the level of teacher competence in the conditions of digitalisation will strengthen all other spheres of social services due to the training of highly qualified employees.

- **Digitalisation and education.** In the work of Dziubaniuk et al. (2023) explores the concept of «connective» as a conceptual framework that promotes students' motivation to develop knowledge with the help of digital tools and social This research makes several interdisciplinary contributions, deepening the understanding of digital pedagogical methods. A group of researchers (Engel et al., (2023); Rasiah et al. (2022)) developed guidelines on what aspects modern higher education institutions need to focus on when developing and updating digitisation strategies in the context of recovery from the COVID-19 pandemic. A scientific article by Anton-Sancho et al. needs special attention. (2022), which is devoted to a quantitative study of the level of stress of professors in Venezuela due to the digitalisation of their teaching activities during the COVID-19 pandemic, in comparison with the level of stress of professors in countries where the level of digitalisation is much lower. Venezuelan professors were found to have a low level of digital competence and a correspondingly lower level of digital stress than professors from other countries that participated in the study. In a subsequent paper, Wang et al. (2023) developed a new framework for assessing the main drivers of digital transformation in higher education institutions in the era of Industry 4.0. The digitalisation process of higher education institutions has the most significant impact on the curriculum's development, updating and adaptation, integrating digital technologies for general education and cloud computing. Eton and Chance (2022) scholars from Africa were interested in the financial implications of e-learning methods in Ugandan universities. It was found that there is a noticeable cause-and-effect relationship between the investigated issues, which confirms its importance during the formation of political decisions within the country.
- **Digitalisation and healthcare.** In their work, two scientists from Norway et al. (2022), consider the introduction of digital tools during assessment in the Norwegian Correctional Service, chronic obstructive pulmonary disease monitoring and digital medication management at home. In all cases, clients were found to have a positive attitude towards implementing such tools. Using the example of artificial intelligence, a group of scientists introduced digital technologies in the healthcare field, Mikkelsen et al. (2023) and Abadie et al. (2023). They tested how artificial intelligence can influence patient and doctor trust. In another scientific paper, Dobson et al. (2021) investigated the attitude of patients to the use and access to their medical information in the conditions of digitisation of their data. No less interesting is the study of Swedish scientists (Backstorm et al. (2022)), who investigated parents' experience regarding the use of digital tools in connection with pregnancy and childbirth. The researchers analysed new parents based on how they found the information they needed using digital health tools, materials received from professionals, and personal opinions and experiences.
- **Digitalisation and social protection.** The study of the influence of the modern digital era on the peculiarities of conducting social work on the example of monitoring the creation and implementation of the information system of social services in some areas of Italy is presented in the scientific work of Zenarolla (2023). In another study, Leite (2023) discusses several opportunities and challenges for transitioning to active and autonomous digitalisation to support public social assistance. A survey by Ridde et al. (2022) was devoted to analysing factors (subsidies and government supply of drugs, partnership with the health care system, household savings, and digitalisation of administration) that contributed to the sustainability of health insurance systems in Senegal. The existence of a positive circle, which is determined by the combination of contributions to social protection with innovative policies that reduce social inequality in society, is presented in the work of Biurrun (2022).

However, the introduction of digital technologies, in addition to technological expertise, requires appropriate theoretical foundations for understanding how the social services sector develops. Hence, this article aims to create a scientific and methodological approach that will allow formalising the functional links between digitalisation and the spheres of education and health care and and social security.

Methodology and research methods. The identification of functional relationships between digitalisation and the sphere of social services, education, the health care sector and social protection will be carried out using a progressive scientific and methodological approach, which is based on a combination of canonical analysis, the method of principal components and linear multivariate regression modeling.

At the first step of the research, it is necessary to form an array of input data. The statistical data of the Eurostat international database were used as input variables and, in particular, the indicators sections «Science, technology, digital society», «Health», «Education and training», and «Social protection». Three key indicators were selected, describing digitalisation and the investigated areas of social services. Selected indicators and their notations are presented in Table 2.

Table 2. The array of input data

Indicator	Notation	Unit of measurement
Percentage of the ICT sector on GDP	dig1	%
Percentage of the ICT personnel in total employment	dig2	%
Percentage change of value added by the ICT sector at current prices	dig3	%
Participation in early childhood education	edu1	%
At least upper secondary educational attainment, age group 20-24	edu2	%
Employment rates of recent graduates	edu3	%
Total healthcare expenditure	health1	million euro
Hospital beds	health2	beds per hundred thousand inhabitants
Healthy life years at age 65	health3	years
Expenditure on social protection	soc1	% of GDP
Social benefits by function	soc2	% of total benefits
Social protection receipts	soc3	% of GDP

Sources: developed by the authors based on Eurostat.

A total of thirty-five European countries are participating in the study for the period 2020-2022. In the second step, a canonical analysis will be performed. The primary purpose of this approach is to identify functional relationships between two sets of variables. In other words, the canonical analysis allows us to identify the maximum correlations between the groups of the investigated indicators. In this study, three canonical models will be built to analyse the connection between digitisation and the education sector, digitalisation with the healthcare sector and digitalisation with the social protection sector. Thus, three normalised linear models will be built as a result of the canonical analysis (1):

$$У = f\ (x, z, w) \quad (1)$$

where У − A set of canonical variables characterising the level of digitisation; x − A set of canonical variables characterising the education sector; z − A set of canonical variables characterising the healthcare sector; w − A set of canonical variables characterising the social protection sector.

$$X = a_0 + a_1x_1 + a_2x_2 + a_3x_3 \quad (1a)$$

where x_1 − Participation in early childhood education by sex (edu1); x_2 − At least upper secondary educational attainment, age group 20-24 by sex (edu2); x_3 − Employment rates of recent graduates (edu3). a – Parameters of the canonical model.

$$Z = c_0 + c_1z_1 + c_2z_2 + c_3z_3 \quad (1b)$$

where z_1 − Total health care expenditure (health1); z_2 − Hospital beds (health2); z_3 − Healthy life years at age 65 by sex (health3); c – Parameters of the canonical model.

$$W = d_0 + d_1w_1 + d_2w_2 + d_3w_3 \quad (1c)$$

where w_1 − Expenditure on social protection (soc1); w_2 − Social benefits by function (soc2); w_3 − Social protection receipts (soc3); d – Parameters of the canonical model.

$$У = b_0 + b_1y_1 + b_2y_2 + b_3y_3 \quad (1d)$$

where y_1 – Percentage of the ICT sector on GDP (dig1); y_2 – Percentage of the ICT personnel in total employment (dig2); y_3 – Percentage change of value added by the ICT sector at current prices (dig3); b – Parameters of the canonical model.

In the third step, selecting statistically significant indicators from the indicators of education, health care and social protection using the principal components method is necessary. The basis of this method is the orthogonal transformation of the input set of observations in combination with a bunch of potentially related variables into a variety of new variables with no linear correlation. The resulting groups of variables are called principal components. The method of main components allows you to identify the components of *G* and determine the level of each component within specific units of the data set. The relationship between the initial variables and selected components has the following form (2):

$$z_i = \sum_1^m a_{ij} G_j \quad (2)$$

where z_i– Standardised values of the *i*th characteristic with unit variances; *m* – The total number of studied features; a_{ij}– Factor loading of the *j*th component on the *i*th feature.

The factor loading represents the closeness of the connection between the *j*-th component and the *i*-th feature and can take on values from -1 to 1 inclusive. The square of the factor loading describes the contribution of the *j*th component to the variation of the ith characteristic. If we find the sum of the squares of the factor loadings for all the selected components, we will get the total variance of the total number of investigated features *m* (3).

$$\lambda_j = \sum_1^m a^2{}_{ij} \quad (3)$$

where λ_i – The total variance of the total number of features *m*; *m* – The total number of investigated features; a_{ij}– the factor loading of the *j*th component on the *i*th feature.

In the fourth step, the formalisation of the functional dependencies between the digitalisation indicators and the indicators of education, health care and social protection determined using the principal components method will be carried out using a three-factor linear regression model. Thus, three regression models will be built, where digitalisation variables perform the role of dependent variables (4-6).

$$dig1 = e_0 + e_1 edu_n + e_2 health_n + e_3 soc_n \quad (4)$$
$$dig2 = e_0 + e_1 edu_n + e_2 health_n + e_3 soc_n \quad (5)$$
$$dig3 = e_0 + e_1 edu_n + e_2 health_n + e_3 soc_n \quad (6)$$

where $dig_{1,2,3}$– dependent variables of digitisation; *e* – parameter of the regression equation; edu_n, $health_n$, and soc_n – dependent variables are obtained using the principal components method.

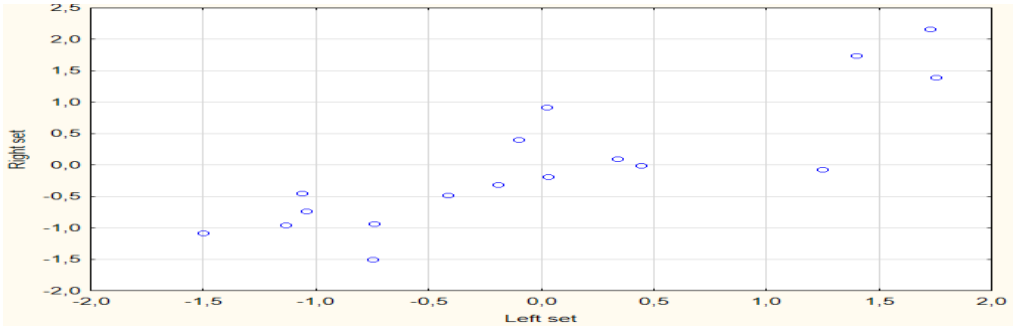
Results. The appropriate module in the STATISTICA 12 software complex was used for canonical modelling. Given the results presented in Table 3, all three built canonical models are of high quality since the canonical correlation coefficient for all models is more significant than 0.7. In addition, the canonical models' high quality is confirmed by The Chi-Square indicators and $p < 0.05$, which ensures the statistical significance of the canonical correlation coefficients. It is worth noting that all groups of indicators participating in the simulation are 100% included in the analysis (Variance extracted equals 100%). The Total redundancy analysis confirms the following trends: more than 50% of the variation in the studied indicators of education (65%), health care (53.98%) and social protection (52.4%) is explained by the change in the studied indicators of digitalisation.

Table 3. Canonical Analysis Summary

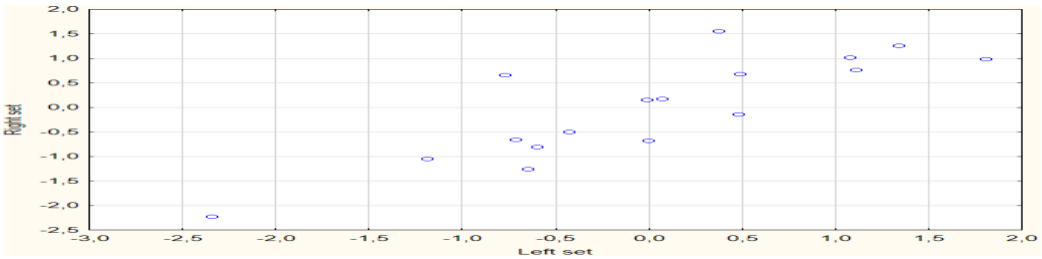
	Dig_Set	Edu_Set	Health_Set	Soc_Set
Number of variables	3	3	3	3
Variance extracted	100%	100%	100%	100%
Total redundancy	41,3%	65,0%	53,98%	52,4%
Chi-Square		18,2	17,8	16,7
p				
R^2		0,03	0,03	0,04

Sources: developed by the authors.

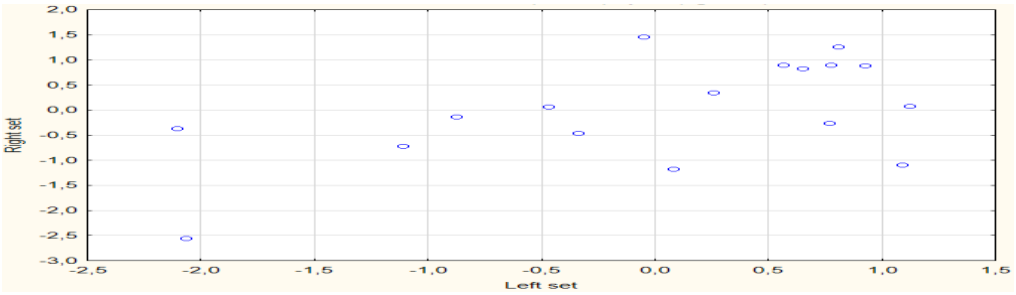
The density and direction of the relationship between the studied indicators are graphically presented on Scatterplots of canonical correlations (Figure 1).



a) the close connection between the indicators of digitalisation and education



b) the close connection between the indicators of digitisation and healthcare



c) the close connection between the indicators of digitalisation and social protection

Figure 1. Scatterplots of canonical correlations between the Left set (variables of digitalisation) and the Right set (a – variables of education, b – variables of healthcare, c – variables of social protection)

Sources: developed by the authors.

Since all sets of canonical variables consist of three indicators, the maximum number of canonical roots for each sample is three. To build canonical models, it is necessary to determine which canonical root is optimal. It can be determined using the table of results (Table 4) with The Chi-Square indicators, Canonical R^2 and p-values.

Table 4. Chi-Square Tests with Successive Roots Removed

Indicator	Root Removed	Canonical R	Canonical R^2	Chi-Square	df	p	Lambda Prime
edu	1	0,84	0,70	17,78	9	0,04	0,24
	2	0,37	0,14	2,84	4	0,59	0,80
	3	0,27	0,08	0,98	1	0,32	0,92
health	1	0,86	0,73	18,18	9	0,03	0,23
	2	0,31	0,09	1,59	4	0,81	0,88
	3	0,17	0,03	0,37	1	0,55	0,97
soc	1	0,75	0,80	16,73	9	0,01	0,58
	2	0,34	0,12	2,29	4	0,68	0,83
	3	0,24	0,06	0,73	1	0,39	0,94

Sources: developed by the authors.

Considering the results in Table 4, The Chi-Square indicators, Canonical R2, and p-values for indicators of education, health care and social protection characterise Root 1 for further interpretation of the results of canonical modelling.

At the next stage of the canonical analysis, it is necessary to analyse the correlation coefficients between the studied groups of indicators (Table 5). The closest connection (more than 0.5) is observed between the following indicators: Percentage change of value added by the ICT sector at current prices (dig1) and Participation in early childhood education (edu1) – -0,55; Percentage change of value added by ICT sector at current prices (dig1) and Employment rates of recent graduates (edu3) – -0,66; Percentage of the ICT personnel in total employment (dig2) and At least upper secondary educational attainment, age group 20-24 (edu2) – -0,61.

Table 5. Correlations between variables of digitalisation and education, health care, social protection

	edu1	**edu2**	**edu3**
dig1	-0,11	-0,12	-0,08
dig2	0,29	-0,23	0,16
dig3	-0,55	0,29	-0,66
	health1	**health2**	**health3**
dig1	-0,17	-0,27	0,23
dig2	-0,13	-0,61	0,24
dig3	-0,30	-0,30	-0,14
	soc1	**soc2**	**soc3**
dig1	-0,28	0,03	0,19
dig2	-0,12	-0,18	0,31
dig3	-0,28	-0,04	-0,12

Sources: developed by the authors.

Since Root1 for each group of investigated indicators most explains the areas involved in this analysis, canonical weights from Root1 will be used to build canonical models (Table 6).

Table 6. Canonical weights for variables of education, healthcare, and social protection

Variable	**Root 1**	**Root 2**	**Root 3**
dig1	0,40	-1,36	0,64
dig2	-0,84	1,17	0,39
dig3	0,87	0,64	0,09
edu1	-0,57	1,09	0,02
edu2	0,17	0,25	-1,01
edu3	-0,48	-0,99	-0,57
health1	0,55	-0,69	0,99
health2	-1,34	0,14	-0,19
health3	-0,82	1,16	0,08
soc1	1,04	-0,62	-0,31
soc2	0,48	0,51	-0,80
soc3	-1,03	-0,17	-0,57

Sources: developed by the authors.

Canonical models built based on Canonical weights of Root1 have the following form (7-10)

$$X = -0{,}57x_1 + 0{,}17x_2 - 0{,}48x_3 \quad (7)$$

$$Z = 0{,}55z_1 - 1{,}34z_2 - 0{,}82z_3\,; \quad (8)$$

$$W = 1{,}04w_1 + 0{,}48w_2 - 1{,}03w_3 \quad (9)$$

$$Y = 0{,}4y_1 - 0{,}84y_2 + 0{,}87y_3 \quad (10)$$

At the next stage of the research, among the studied indicators of education, health care and social protection, it is necessary to select those indicators that have the most tremendous significance in the research process. For this, you need to use Principal Component Analysis. In particular, it is necessary to analyse the factor loadings obtained as a result of this analysis (Table 7).

Table 7. Factor Loadings

	Comp1	Comp2	Comp3	Comp4	Comp5	Comp6	Comp7	Comp8	Comp9
edu1	0,68	0,43	0,13	-0,01	0,34	-0,43	0,07	-0,12	-0,06
edu2	-0,59	0,12	0,18	-0,70	0,20	-0,03	-0,25	-0,06	0,08
edu3	0,22	0,75	-0,33	0,22	0,37	0,27	-0,09	0,11	0,09
health1	0,67	-0,26	-0,59	-0,12	-0,19	-0,22	-0,03	0,09	0,19
health2	-0,37	-0,38	-0,72	0,20	0,22	-0,03	-0,22	-0,22	-0,08
health3	0,62	0,38	0,11	-0,02	-0,41	0,15	-0,22	-0,28	0,00
soc1	0,84	-0,29	0,05	-0,17	0,09	0,06	-0,28	0,25	-0,15
soc2	-0,26	0,52	-0,62	-0,39	-0,25	-0,02	0,16	0,08	-0,14
soc3	0,68	-0,36	-0,11	-0,36	0,25	0,28	0,30	-0,15	0,00

Sources: developed by the authors.

The most significant values of factor loads correspond to the following indicators:

- Employment rates of recent graduates (edu3) – 0,75;
- Hospital beds (health2) – -0,72;
- Expenditure on social protection (soc1) – 0,84.

Thus, precisely these three indicators will participate in constructing three-factor regression models. They will act as independent variables. The researched digitalisation indicators (dig1-3) will act as dependent variables. The results of constructed regression equations are presented in Tables 8-10.

Table 8. Results of the first regression model (the dependent variable – dig1)

Variables	Reg. coef.	t-stat	p-level
_cons	3,97	1,08	0,29
edu3	0,26	1,29	0,21
health2	-0,20	-0,93	0,36
soc1	-0,50	-2,37	0,03
R^2=0,51		F=2,24 at p=0,117	

Sources: developed by the authors.

Table 9. Results of the second regression model (the dependent variable – dig2)

Variables	Reg. coef.	t-stat	p-level
_cons	0,59	0,30	0,76
edu3	0,48	2,76	0,01
health2	-0,40	-2,19	0,04
soc1	-0,43	-2,33	0,03
R^2=0,66		F=4,99 at p=0,01	

Sources: developed by the authors.

Table 10. Results of the third regression model (the dependent variable – dig3)

Variables	Reg. coef.	t-stat	p-level
_cons	111,25	6,52	0,00
edu3	-0,80	-5,76	0,00
health2	-0,40	-2,74	0,01
soc1	0,02	0,14	0,89
R^2=0,83		F=12,76 at p=0,000	

Sources: developed by the authors.

The obtained regression equations have the following form (11-13).

$$dig_1 = 3{,}97 + 0{,}26edu_3 - 0{,}2health_2 - 0{,}5soc_1 \quad (11)$$
$$dig_2 = 0{,}59 + 0{,}48edu_3 - 0{,}4health_2 - 0{,}43soc_1 \quad (12)$$
$$dig_3 = 111{,}25 - 0{,}8edu_3 - 0{,}4health_2 + 0{,}02soc_1 \quad (13)$$

The values of the criteria *F*, p-value and coefficients of determination R^2 for the built models prove that the first model (dependent variable dig1) is not statistically significant because the p-value is greater than 0.05, and the coefficient of determination is at an average level and is equal to 0.51. In addition, no parameter

of the regression equation is statistically significant. The second and third models show much better results. The models are statistically significant (the p-value for the *F* test is less than 0.05), and the coefficient of determination R^2 for both models is higher than 0.5 and is equal to 0.66 for the second model and 0.83 for the third model. In addition, the obtained parameters of the regression equations are statistically significant:

- Percentage of the ICT personnel in total employment (dig2), the Percentage change of value added by ICT sector at current prices (dig3) and Employment rates of recent graduates (edu3) – with an increase in edu3 per unit, dig2 will increase by 0,48 %, and dig3 will decrease by 0,8 %;
- Percentage of the ICT personnel in total employment (dig2), Percentage change of value added by ICT sector at current prices (dig3) and Hospital beds (health2) – with an increase in health2 by one unit, dig2 and dig3 will decrease by 0,4 %;
- Percentage of the ICT personnel in total employment (dig2) and Expenditure on social protection (soc1) – with an increase in soc1 by one unit, dig2 will decrease by 0,43 %.

Conclusions. Conducting complex studies of digitalisation in the social sector is accompanied by a whole range of obstacles: the complexity of interactions between state institutions, non-profit organisations, public groups and individuals; lack of standardisation of technologies; limited data availability; ethical and privacy issues; rapid technological progress that requires the adaptation of the social sector to such transformations To address these challenges, researchers need to collaborate with stakeholders in the social sector, use a variety of research methodologies, and actively engage in ongoing dialogue to understand the complexity of digitalisation in this context.

Therefore, it is not easy to find among the existing scientific works the authors who conducted a comprehensive assessment of the interaction of digitalisation and all segments of the social services sphere. In the work of Cheng et al. (2022), research on the impact of digitalisation on the work of social service professionals is conducted precisely through the prism of the healthcare sector. The primary purpose of this study was to investigate the knowledge of mobile health programs among Taiwanese college students of social services. The work carried out by the scientists gives a significant result for the country as a whole; however, unlike our research, it does not take into account the nature of the connection with other sectors of the social sphere (educational and social protection) and is not of an international character. The purpose of the following study of the group of authors led by Mitchuk et al. (2021) is the improvement of social work tools as an element of social communication under the influence of digitalisation. For this, the authors conducted a study of the features and tools of social work, analysed social communication through the prism of social work and proposed ways to improve social work; however, unlike our research, this article lacks any scientific and methodological approaches that can be used in the future with the inclusion new social sectors.

To achieve the goal of the article (development of a scientific-methodical approach that will allow formalising the functional connections between digitalisation and the spheres of education, health care and social protection), the research developed a three-step scientific-methodical approach. This approach comprises Canonical Correlation Analysis, Principal Component Analysis and Multiple Regression Modeling. The input variables were twelve key indicators of digitisation, the education sector, health care and social protection. The study was conducted for thirty-five European countries from 2020-2022. As a result of the canonical analysis, it was found that more than half of the variation in the studied indicators of education (65%), health care (53.98%) and social protection (52.4%) is explained by the change in the studied indicators of digitalisation. It confirms the significant impact of digitisation processes on the studied social services sectors. In the second step of the research, three indicators from the field of social services were selected using Principal Component Analysis: Employment rates of recent graduates, Hospital beds and Expenditure on social protection. In the third step, three three-factor regression models were built, where digitalisation indicators are the dependent variables, and indicators selected using Principal Component Analysis are the independent variables. As a result of regression modelling, it was found that the Percentage of the ICT personnel in total employment and the Percentage change of value added by the ICT sector at current prices are positively influenced by the Employment rates of recent graduates and negatively by Hospital beds and Expenditure on social protection. The implementation of digitalisation processes in the social services field is accompanied by several problems that must be solved. In particular, the digital divide can hinder equal access to digital social services, especially for marginalised communities and individuals with limited access to technology or digital literacy. Ensuring equitable access is critical to preventing further exclusion and inequality. Data privacy and security (protecting sensitive information and ensuring compliance with data protection regulations) are essential to maintaining trust in digital platforms. Also, many people, especially older people or those from disadvantaged backgrounds, may need more digital literacy skills to navigate and

use digital social services effectively. Providing training and support to improve digital skills is critical to ensuring inclusion. Addressing these challenges requires collaboration between government agencies, service providers and community organisations to ensure that the benefits of digitisation are accessible to all and aligned with social and ethical values.

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Управління процесами цифровізації у сфері соціальних послуг

Завдяки цифровим технологіям соціальні сфери стають все більш мобільними та стійкими до трансформаційних процесів. Сучасне суспільство потребує отримання якісних соціальних послуг у цілодобовому форматі. Важливо розуміти, що цифровізація має бути більш соціально нейтральною. З одного боку, цифрові технології надають суспільству нові перспективи, можливості та рішення, а з іншого – можуть спричинити виникнення різноманітних ризиків. Управління процесами цифровізації соціальних послуг передбачає не лише впровадження цифрових інновацій, а й оцінку наслідків для суспільства та держави. Таким чином, дана стаття має на меті проаналізувати сучасні тенденції цифровізації у сфері соціальних послуг та розробити науково-методичний підхід, який дозволить формалізувати функціональні зв'язки цифровізації зі сферами освіти, охорони здоров'я та соціального захисту. У статті ці твердження підтверджуються бібліометричним аналізом співпоширеності ключових слів. Це дало змогу виділити ключові вектори серед досліджень цифровізації у сфері соціальних послуг: освіта, охорона здоров'я та соціальний захист, які передбачають зміну самої суті цифровізації через призму різних наукових підходів. У зв'язку з цим дана стаття присвячена вивченню взаємозв'язку цифровізації та критичних показників освіти, охорони здоров'я та соціального захисту за допомогою методу головних компонент, канонічного кореляційного аналізу та множинного регресійного моделювання. Дослідження здійснювалось на основі вибірки з 35 європейських країн у 2020-2022 роках. Було побудовано три канонічні моделі, кожна з яких тестувала функціональний зв'язок між показниками цифровізації досліджуваних країн (відсоток сектору ІКТ у ВВП, відсоток персоналу ІКТ у загальній зайнятості, відсоток зміни доданої вартості на сектор ІКТ у поточних цінах) та обрані показники освіти, охорони здоров'я та соціального захисту. У результаті було виявлено, що в цілому розвиток цифрових технологій позитивно впливає на соціальні послуги. Та все ж найсуттєвіший зв'язок спостерігається між показниками цифровізації та сферою освіти та охорони здоров'я.

Ключові слова: цифровізація, інновації, соціальні послуги, освіта, охорона здоров'я, соціальний захист, канонічний кореляційний аналіз.