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IMPACT OF DIGITALIZATION OF THE ECONOMY ON TRANSFORMATION OF THE LABOR MARKET: OPPORTUNITIES AND THREATS

ABSTRACT

The article discusses the current problems of digitalisation of the economy in the context of the transformation of the labour market and employment. The study notes that in the current economic conditions, the digitalisation of the economy is becoming a lever that significantly affects the labour market and changes its situation. The changes in the structure of vacancies, in the context of work, and in the professional competencies of the workforce are determined. The authors conclude that the digitalisation of the economy is a complex process that creates both additional opportunities and threats, especially in terms of employment. These trends and features draw the attention of many scholars to this topic and make it very relevant.

The purpose of the article is to further develop theoretical provisions and practical recommendations on the impact of digitalisation of the economy on the transformation of the labour market and employment. The object of research is the process of labour market transformation, which is influenced by the digitalisation of the economy. The subject of the study is the theoretical and practical aspects of the impact of economic digitalisation on the transformational changes taking place in the labour market.

The main results of the study: the evolution of the concept of 'digital economy' is investigated, the approaches of different authors to its essence are presented; the indicators of the labour market and employment in Ukraine are assessed, its features and development trends are determined; the essence of the concept of 'digitalisation of the economy' is clarified and specified; a conceptual scheme of digitalisation of the economy is proposed and substantiated; the opportunities and threats of the impact of the digitalisation of the economy on the labour market are summarised, as well as the expected results and possible consequences for employment are considered; measures of state regulation of employment are proposed in terms of opportunities and threats of the digitalisation of the economy to the labour market.

Keywords: digital economy, digitalization, labor market, employment, unemployment, transformation

JEL Classification: E24, O11, O15, O30

INTRODUCTION

The digital transformation of the economy has a significant impact on the life of society, altering many aspects of work. Business conditions are becoming more complex, increasing competition and changing consumer preferences.

According to (Digital, 2023), in 2023, 68% of the population used mobile devices, which is 5.44 billion people. It should be noted that today in the whole world 5.16 billion people, 64.4% of the total population use the Internet in their personal life and communication. At the same time, the number of people using social networks is constantly growing (4.76 billion or 60% of the population).

It is worth noting that under the influence of digitalization of the economy, there is an active transformation of the labour market and employment of the population. On the one hand, these processes create new solutions and types of employment in the digital environment. On the other hand, this leads to a significant movement of workers from

traditional sectors of the economy to high-tech industries that require employees to have digital competencies and skills, and the ability to continuously learn. In such transformational conditions, there is not only changing the role of the human factor in the digital economy but also a modification of the employment structure due to the activation of remote work, freelance work and other flexible forms of employment. Studies by many scientists predict a massive loss of existing jobs and labour activities. This, in turn, requires state and international regulators to develop new approaches to the social protection of employees, tax regulation and legal support of social and labour relations.

The process of digitalization of the economy also leads to certain difficulties associated with the education system. It necessitates the adaptation of training programs to new requirements, as well as the development of digital literacy of the population.

LITERATURE REVIEW

The direction of development of the digital economy, as well as the transformations that occur in society under the influence of digitalization, are discussed in the works of many foreign researchers and scientists. And, despite the fact that the concept of "digital economy" has existed for more than 20 years, there is still no established widely accepted definition in the scientific literature.

The appearance of the first computers in the late 1940s of the 20th century, which were capable of processing large amounts of information, launched the widespread development of computerization. Already in the 1960s, the first automated control systems were created and implemented in production management. Over the next decades, the scientific community has made a significant contribution to the development of the basis of the digital economy as a system based on digital technologies. At the end of the 1990s, the modern concept of "digital economy" appeared in the specialized literature. The scientific community has made significant contributions to the formation of the basis of the digital economy since the 1990s when the understanding of the digital economy as an economic system based on digital technologies was laid. This period was marked by the beginning of the transformation of economic processes under the influence of information technology.

The modern concept of "digital economy" appeared in the specialized literature in the late 90s of the XX century, after the publication of D. Tapscott (1997). When describing the digital economy ("data economy"), the scientist focused on the use of various Internet technologies in the implementation of economic activities. During the same period of time, a slightly different concept of the digital economy was presented by N. Negroponte (1995), according to whom the digital economy is the conduct of economic activities of enterprises and organizations using newly introduced information technologies and the management of these technologies.

It should be noted that if in the 1990s the key feature of the digital economy was determined by Internet technologies, then since the 2000s it has been mobile and wireless networks, cloud computing, and Big Data technologies. The evolution of the digital economy has seen a transition from the dominance of Internet technologies in the 1990s to a significant expansion of the technological arsenal in the 2000s, including mobile and wireless networks, cloud computing and Big Data technologies.

In 2001, Thomas Mesenbourg (2001) for the first time clearly identified the main components of the digital economy: e-business infrastructure – equipment, software, telecommunications, networks, human capital; electronic commerce (e-commerce); increase in the value of traditional industries through the use of digital technologies (firm and industry structure); the difference in the value of the workforce of the digital economy compared to the traditional one (demographic and worker characteristics); changes in the added value of products and services of the digital economy (Price behaviour).

Proponents of a similar approach are American economists R. Bukh and R. Heeks (2018), who consider the digital economy in the context of the processes of transformation of all sectors of the economy under the influence of information technology and determine the structure of the digital economy, including information computer technologies, as well as any activity directly related to the use of digital technologies.

R. Bukh and R. Heeks (2018) identify four approaches to the formation of the concept of a "digital economy": resource-oriented, focusing on technology, as well as information and human resources; procedural, within which the use of technology to carry out business transactions is primarily analyzed; structural, affecting structural transformations of the economy; a business-oriented approach that considers the digital economy through the prism of new business models: e-commerce, online business, digital platforms.

The British economist M. Skilton (2015) in turn considers the digital economy to be part of a new, digital ecosystem and defines it as a set of virtual resources and digital transactions carried out in markets, as well as companies, resources and services that increase GDP and the size of net assets. At the same time, the digital ecosystem refers to the combined interaction of technologies in market and business activities, contributing to the emergence of a new type of consumer, business, market environment and interaction experience.

According to analysts OECD (2016), the modern digital economy enables and enables trade in goods and services through electronic commerce on the Internet.

The definition proposed by the participants of the G20 Initiative for the Development of the Digital Economy (2016) is quite meaningful and justified, they characterized the digital economy as a wide range of economic activities, including the use of digitized information and knowledge as a key factor of production, modern information networks as an important space of activity, and also the effective use of information and communication technologies (ICT) as an important factor in productivity growth and structural optimization of the economy. Digital, networked and smart ICTs enable modern economic activity to be more flexible, dynamic and smart.

M. Knickrehm, B. Berthon, and P. Daugherty (2016), in their work, focus on the fact that the digital economy represents a part of the total production volume created by various "digital" resources. These resources include digital skills, digital equipment (parts, software and communications) and intermediate digital goods and services used in production.

Having presented an overview of the approaches of different authors, we can highlight several elements inherent in the process of the digital economy: the use of digital technologies in economic activity; the presence of a platform on which economic activity is carried out (platform companies: Google, Facebook, Amazon, eBay and Alibaba; the basis for the existence of business models of companies is digital products and services.

Thus, summarizing the considered conditions, features, risks and expected results, we can conclude that the digitalization of the economy is a process of continuous transformation of social, economic, labour and technological relations emerging and developing in the global information space through the widespread use of digital technologies.

AIMS AND OBJECTIVES

The research is aimed at developing theoretical principles and practical recommendations for the infusion of digitalization of the economy into the transformation of the labour market and employment of the population. To achieve the goal, the authors of the study singled out the following tasks:

- to delineate the theoretical and methodological ambushes of the concept of "digital economy" and "digitalization of the economy, to clarify and concretize the concept of "digitalization of the economy";
- to monitor the influx of the digital economy into the retail market and to explore the government's approaches to the market in the context of digitalization of the economy;
- to assess the potential and threat of the influx of digitalization on the market, as well as the results and possible inheritances;
- to assess the significant influx of digitalization of the economy into the market, and also change the number of vacancies in the market by changing the number of enterprises, what kind of information and communication technologies and enterprises that operate in the field of information and communication (with the help of stimulated regression).

METHODS

The theoretical and methodological basis of this study is the work of foreign and domestic scientists on the study of the impact of the digital economy on the transformation of the labour market, employment and unemployment, and statistical materials.

In the process of writing the work, a system of behind-the-scenes and special methods was developed:

- retrospective analysis – for the implementation of the evolution and development of the concept of "digital economy";
- theoretical delineation – to delineate the theoretical and methodological ambushes of the concept of "digital economy" and "digitalization of the economy;

- ▪ systemic analysis and scientific abstraction – to clarify and concretize the concept of "digitalization of the economy"; to monitor the influx of the digital economy into the retail market; to explore the government's approaches to the market in the context of digitalization of the economy;

- ▪ analysis and synthesis, induction and deduction – to set research goals; to assess the potential and threat of the influx of digitalization on the market, as well as the results and possible inheritances;

- ▪ correlation-regression analysis – to define the statistical substantial of the influence of digitalisation of the economy on the labour market using the regression equation.

The regression equation will allow us to determine how the number of vacancies changes in response to changes in the number of enterprises using information and communication technologies and enterprises operating in the field of information and communications. For regression evaluation will be used some metrics such as multiple regression coefficient (R), coefficient of determination (R^2), adjusted coefficient of determination (R^2), Fisher's criterion (F), standard confidence interval (P-Value), analysis of variance and residuals. Each metric provides a unique perspective on how well the model is doing, and together they provide a comprehensive overview of the model's performance. For the evaluation of predictors in the regression equation, a p-value indicator will be used, which shows how changes in the predictor are associated with changes in the response.

statistical analysis and graphical-analytical interpretation – for illustrative purposes, along with additional drawings and a table of key problems in the market, indicators of employment and unemployment in Ukraine; opportunities and threats to the market in the context of digitalization of the economy.

RESULTS

An age of global change started in the latter half of the 20th century, marked by the transition to an information society and the spread of information technology Currently, there is a significant transformation in the labor market. The influence of digital technologies is felt in the changing structure of employment, and the generation of new forms and types of work activity. In particular, the development of the platform economy has contributed to the emergence of innovative models of labour organization, which involves a revision of traditional approaches to employment and unemployment and requires adaptation from both the market and regulatory mechanisms.

The structure of the digital economy contains the following elements: purely digital services and products, goods and services, the production of which depends on information technology, as well as the information technology industry itself; artificial intelligence and neural networks capable of learning and making decisions; production process automation technologies; blockchain technologies; quantum technologies; virtual reality technologies; robotics components and others. Often in publications you can find an approach in which the terms "digital economy" and "digitalization of the economy" are used interchangeably, but there are still differences between them in meaning and context of application.

Having studied the approaches of different authors to the content of the process of digitalization of the economy, we can highlight its most important features (Figure 1).

Digitalization of the economy is a natural evolutionary stage in the development of the economic system. Digitalization of the economy involves the widespread introduction of modern information technologies into socio-economic processes and phenomena.

Digital technologies have become an everyday part of the economic, political, and cultural life of the population and economic entities; a large number of documents and knowledge have been transferred to electronic form; interaction between citizens and the state, economic entities and the state takes place on digital platforms. Digitalization of the economy characterizes the process of transformation and integration of digital technologies into all aspects and types of economic activity.

The digitalization of the economy is radically changing the social structures and way of life familiar to the population. This process not only provides access to extensive knowledge and unique skills but also contributes to the emergence of new professions, offering everyone a path for professional and personal growth. The emergence of new social elevators is becoming a fundamental element for enhancing economic development and social activity, contributing to the formation of a dynamic and innovative society. Moreover, it is thanks to the digitalization of the economy that states have the opportunity to secure their status as leaders in this area, ensuring sustainable development and the well-being of their citizens.
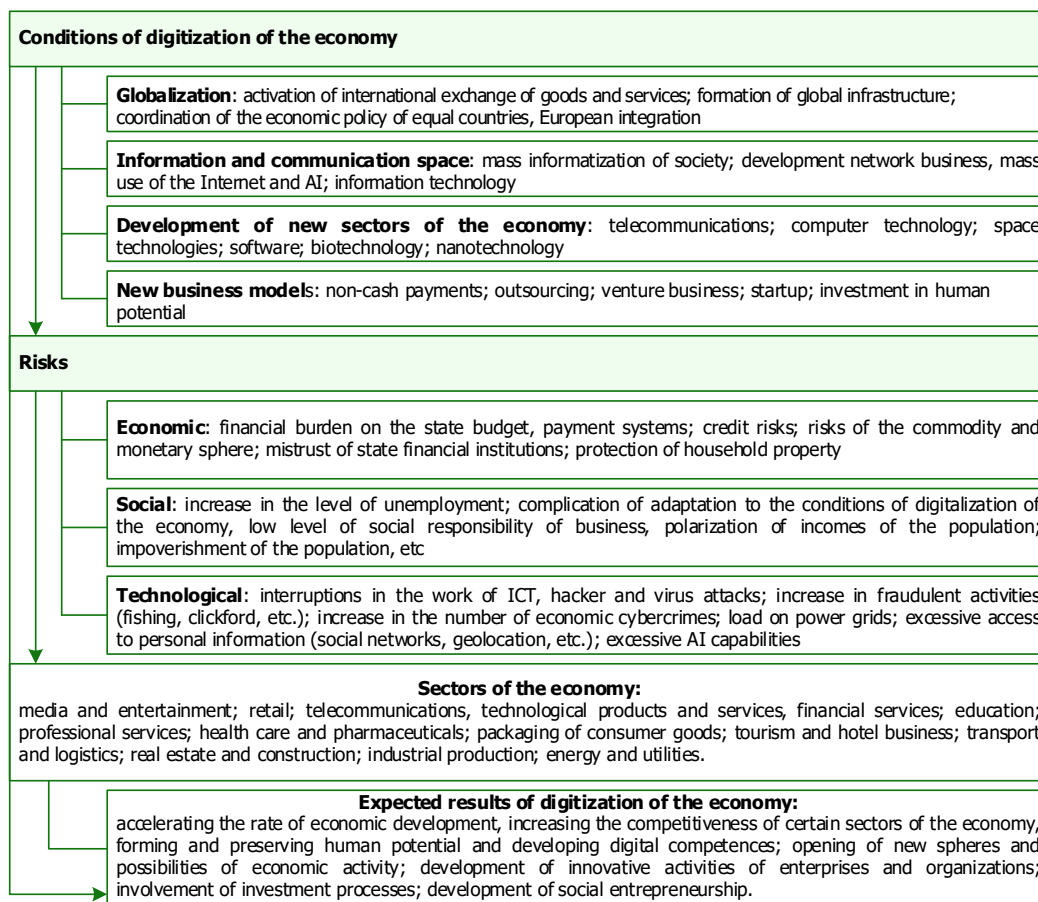
Conditions of digitization of the economy

Globalization: activation of international exchange of goods and services; formation of global infrastructure; coordination of the economic policy of equal countries, European integration

Information and communication space: mass informatization of society; development network business, mass use of the Internet and AI; information technology

Development of new sectors of the economy: telecommunications; computer technology; space technologies; software; biotechnology; nanotechnology

New business models: non-cash payments; outsourcing; venture business; startup; investment in human potential

Risks

Economic: financial burden on the state budget, payment systems; credit risks; risks of the commodity and monetary sphere; mistrust of state financial institutions; protection of household property

Social: increase in the level of unemployment; complication of adaptation to the conditions of digitalization of the economy, low level of social responsibility of business, polarization of incomes of the population; impoverishment of the population, etc

Technological: interruptions in the work of ICT, hacker and virus attacks; increase in fraudulent activities (fishing, clickford, etc.); increase in the number of economic cybercrimes; load on power grids; excessive access to personal information (social networks, geolocation, etc.); excessive AI capabilities

Sectors of the economy:
media and entertainment; retail; telecommunications, technological products and services, financial services; education; professional services; health care and pharmaceuticals; packaging of consumer goods; tourism and hotel business; transport and logistics; real estate and construction; industrial production; energy and utilities.

Expected results of digitization of the economy:
accelerating the rate of economic development, increasing the competitiveness of certain sectors of the economy, forming and preserving human potential and developing digital competences; opening of new spheres and possibilities of economic activity; development of innovative activities of enterprises and organizations; involvement of investment processes; development of social entrepreneurship.

Figure 1. Conceptual diagram of digitalization of the economy and measurement of results.

At the same time, existing studies do not adequately present the issues of the impact of the processes of digitalization of the economy on the transformation of the labour market of Ukraine, do not study the opportunities and threats of different levels that arise in this case, do not substantiate the strategic prospects and measures of state regulation and support of the labour and employment market from the perspective of strengthening the country's competitiveness.

The prospects for digitalization and its impact on the labour market can be presented using the following statistics.

Between 2009 and 2011, digitalization created 17 million jobs in countries with economies in transition (Williams, L.D., 2021).

According to Eurostat data (2021), the share of households with access to the Internet in the EU-27 has grown to 90%, which is approximately 26% higher than in 2009 (64%). The share of people from 16 to 74 years in the EU-27, who bought or bought products and services online for a private blog, reached 60%, which is 14% higher than in 2014 (46%).

At least 30% of functions within professions can be automated in line with ongoing technology development (McKinsey, Global Institute, 2017).

The world's GDP could be driven by the automation of workers and the use of additional technology by USD 9 trillion already in 2030 (McKinsey, Quarterly 2018).

It should be noted that Ukraine has approved the law "On stimulating the development of the digital economy in Ukraine" (2023), which creates a special legal space for the IT industry and directs to stimulate the development of the digital economy in Ukraine, involvement of talented minds for running innovative business, earning investments, development of digital infrastructure and recruitment of talented professionals.

It should be noted that the digital revolution has little impact on the domestic industry, which, unfortunately, is faced with an accelerated decline in the pace of development. One of the key problems for the country is the technological gap, which not only persists but is also deepening due to a lack of innovation and investment in digitalization. Such problems lead to increased conflict in the social and labour sphere and social tension in society (Nazarov, N. et al., 2022).

Despite this, Ukraine is undergoing a process of structural change, shifting its focus from traditional industries such as agriculture and heavy industry to services, information technology and high-value-added manufacturing.

At the same time, to understand the impact of digitalization of the economy on the labour market and employment in Ukraine, it is necessary to analyze its key features determined by the historical development of the country, economic changes, political situation and social factors.

The Ukrainian labour market has always been distinguished by its dynamism and ability to adapt in the face of challenges. However, the russian invasion in February 2022 introduced new unprecedented challenges. Crisis phenomena such as mass emigration, internal displacement, destruction and reorientation of businesses, and a decrease in the number of available jobs have become a new reality for many. Today, the Ukrainian labour market continues to adapt to changes and finds new forms of employment.

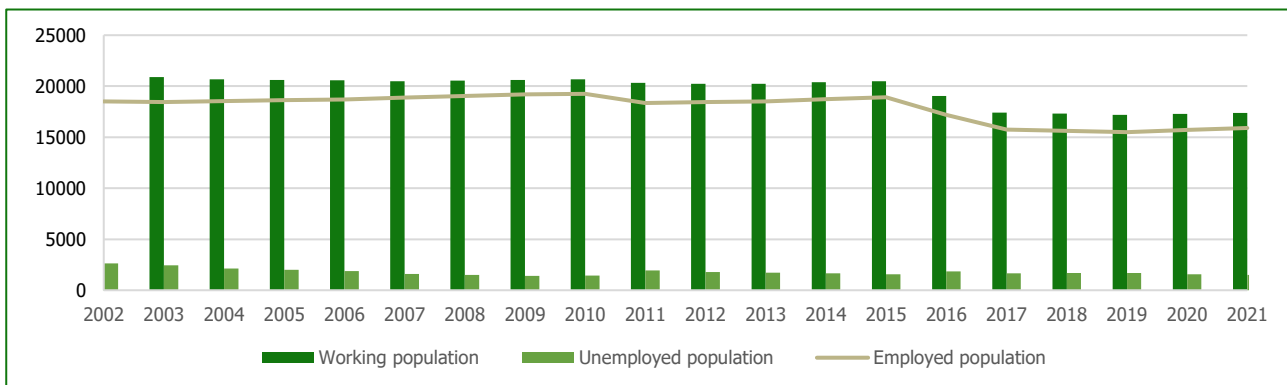Figure 2 shows the dynamics of the working-age, employed and unemployed population in Ukraine from 2002 to 2021.

Figure 2. Dynamics of the working age, employed and unemployed population in Ukraine, million people. *(Source: built by the authors based on the data SSSU (State Statistics Service of Ukraine, 2023)*

Based on the analysis of the data presented in the figure, the following key trends can be identified: there is a steady decline in the working-age population from 21,150.7 thousand people in 2002 to 17,381.8 thousand people in 2021. The reduction in the working-age population is due to both natural population decline and migration processes. After continuous growth in the number of people employed until 2010, a period of recession followed and a gradual recovery did not reach the level of previous years. A general decrease in the number of unemployed in the context of a reduction in the working-age population may indicate the adaptation of the labour market to changing conditions, including the growth of informal employment, self-employment and the development of the digital economy. Internal migration contributes to the redistribution of labour to quieter regions.

It is important to assess the situation in the Ukrainian market by analyzing unemployment. Relying on the availability of official statistical information due to the level of unemployment (according to the ILO methodology), starting from the year 2022, it is necessary to rely heavily on expert estimates and the results of sociological research. Based on estimates from the National Bank of Ukraine, the unemployment rate (according to the ILO methodology) in 2022 will likely exceed 30% (Figure 3).
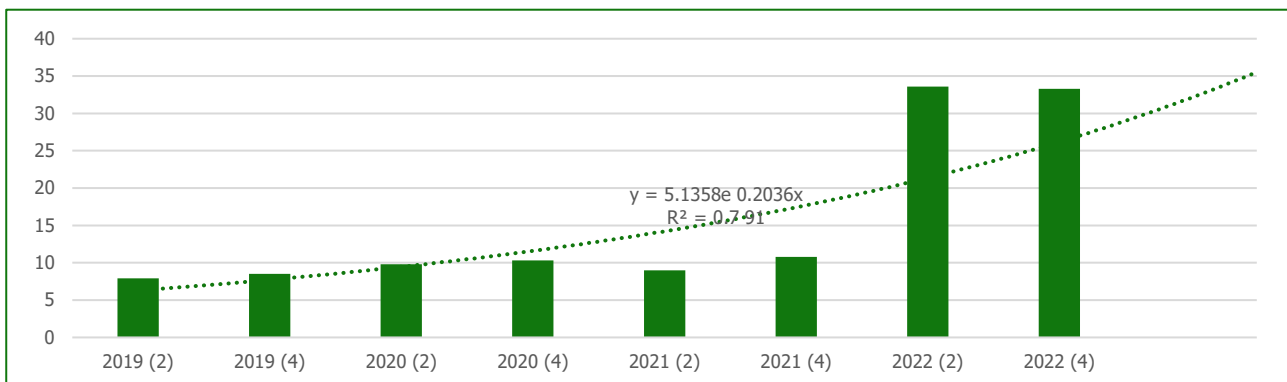

Figure 3. Dynamics of changes in the unemployment rate in Ukraine (data for the 2nd and 4th quarters of each year) according to the ILO methodology (2022 year − NBU regulations), %. *(Source: built by the authors based on the data NBU, 2023)*

Throughout 2019 and 2020, the unemployment rate remained relatively stable, with little fluctuation between quarters. In 2020, starting from the second quarter, the unemployment rate has been increasing, which is associated with the COVID-19 pandemic and its impact on economic activity. The unemployment rate is falling in 2021, which may indicate the beginning of a recovery in the economy and labour market after the initial hit of the pandemic. The sharpest increase in the unemployment rate occurred in the second and fourth quarters of 2022, which is associated with the outbreak of war and its devastating consequences for the economy and labour market of Ukraine. In Ukraine, through the war and occupation, a lot of people were lost to work. Using a forecast exponential trend line, it is possible to replace the steady increase in unemployment in the near future due to objective and subjective factors.

Not to be surprised by the negative consequences of the war, throughout 2023, employers informed employment centres about the availability of 329 thousand vacancies, although the number of vacancies is significantly smaller. It is predicted to become even lower for the foreseeable future (Figure 4).
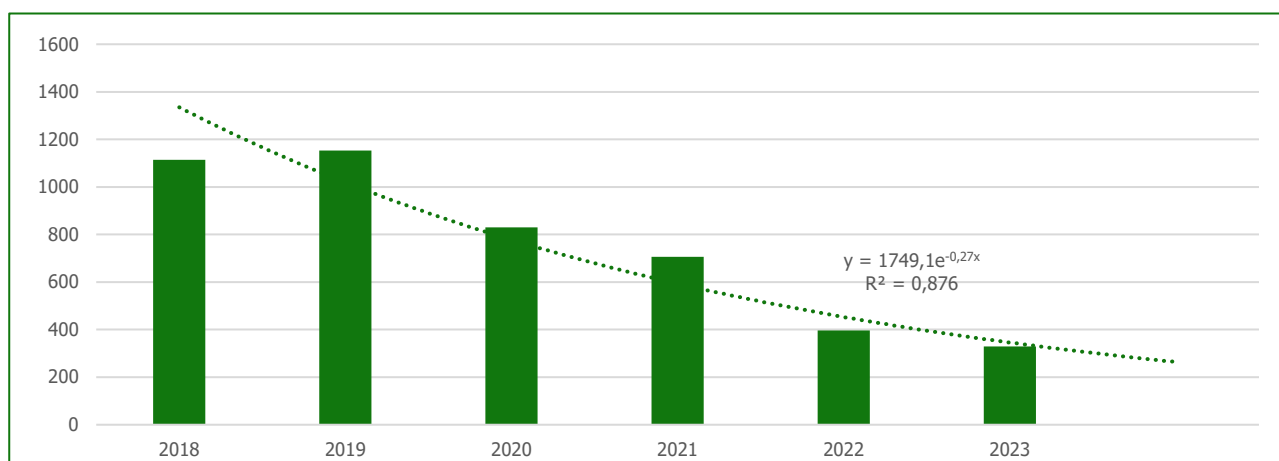

Figure 4. Number of vacancies in Ukraine in 2018-2023, thousand units. *(Source: built by the authors based on the data from State Statistics Service of Ukraine, 2023)*

According to data from the State Statistics Service of Ukraine (2023), the structure of vacancies by type of economic activity remained unchanged: 18% of vacancies were found in processing industries; 16% – in wholesale and retail trade; 13% – in the sphere of education; 9% – in agriculture; 8% – in the sphere of health protection; 8% – in state-administered defence; 7% – in the transport sector.

In the professional sector, the greatest number of vacancies were for work: maintenance workers, installation and machine operation (18%); workers in the trade and service sector (17%); representatives of the simplest professions (15%); skilled workers with tools (14%); professionals (11%); specialists (11%); service workers (6%).

The increase in vacancies and jobs in various areas of economic activity is important for the national economy.

To study the impact of economic digitalisation on the labour market, it is reasonable to apply economic and mathematical methods. In particular, the construction of a regression equation will help determine the statistical essence of the impact of economic digitalisation on the labour market. The regression equation helps to identify the existence and strength of the relationship between the factor indicators and the outcome indicators by calculating the following relationship indicators: multiple regression coefficients, coefficients of determination, Fisher's criterion, standard confidence interval, etc. It is proposed to use the indicator of the number of vacancies in the labour market as an effective indicator, and the number of enterprises with access to the Internet, the number of enterprises engaged in e-commerce, the number of active enterprises and individual entrepreneurs working in the field of "Information and telecommunications" as factor variables. These indicators were selected by the analysis of the available database of the State Statistics Service of Ukraine for the analysed period. Thus, by building a regression equation, we will check how the number of vacancies changes in response to changes in the number of enterprises using information and communication technologies and enterprises operating in the field of information and communications. Let's establish the form of the relationship between the number of vacancies (y) and the independent variables (number of enterprises with access to the Internet (x_1), number of enterprises engaged in e-commerce (x_2), number of active enterprises and individual entrepreneurs working in the field of "Information and telecommunications" (x_3)). We built a correlation-regression model in the form of a regression equation by the Multiple Regression procedure in STATISTICA 12.0. The initial data for the model given in Table 1 is based on State Statistics Service of Ukraine data.

Table 1. Initial data for building a correlation-regression model. *(Source: data by State Statistics Service of Ukraine, 2017-2022)*

Year	Vacancies (y), thousand	Number of enterprises with access to the Internet (x1), thousand	Number of enterprises engaged in e-commerce (x2), thousand	Number of active enterprises and individual entrepreneurs working in the field of "Information and telecommunications" (x3), thousand
2017	903.7	39.58	2.35	115459
2018	1114	43.3	2.476	137479
2019	1153.3	43.79	2.44	166556
2020	829.7	44	2.494	208596
2021	705.8	44.51	2.513	243210
2022	396.3	42.79	2.48	261616

The results of the performed Multiple Regression procedure are presented in Table 2.

Table 2. Regression Summary. *(Source: built by the authors by the Multiple Regression procedure in STATISTICA 12.0)*

N=6	Regression Summary for Depend Variable: Y R= ,99834925 R?= ,99670123 Adjusted R?= ,99175307 F(3,2)=201,43 p< ,00494 Std. Error of estimate: 25,415					
	b*	Std. Err. of b*	b	Std. Err. Of b	t(2)	p-value
Intercept			3246.59	1507.528	2.1536	0.164116
X1	0.795130	0.054296	125.44	8.566	14.6443	0.004631
X2	-0.983116	0.075029	-0.00	0.000	-13.1031	0.005774
X3	-0.338802	0.081051	-27.88	673.030	-4.1431	0.043615

Table 2 shows the standardised coefficient of the regression equation (*Intercept b),* coefficients of the regression equation and indicators for regression evaluation. In particular, indicators for regression evaluation:

- multiple regression coefficient R = 0.998, which indicates a very strong relationship between the effective indicator and factor values;

- coefficient of determination R^2 = 0.997, which confirms that the validity of the effective indicator is 99.6% determined by the selected factor values. The decision is 0.04% due to other factors that influence the values of the effective indicator but are not included in the regression model. This indicator characterizes part of the dispersion of the resultant sign y, which is explained by regression, in the outer dispersion of the resultant sign;

- adjusted coefficient of determination Adjusted R^2 = 0.992, which indicates the high intensity of the description of the origin;

- Fisher's criterion $F_{(3,2)}$ = 201.43, which outweighs the table value (9.55) and indicates the significance of the link;

- standard confidence interval P-Value = 0.005, which indicates that there is less than 0.5% probability of the occurrence between the variables and the random feature of the sample.

The values of indicators for regression evaluation indicate a sufficient level of reliability of the regression results, apparently, the validity has been rejected and is quite natural. The coefficients of the regression equation with the exception of the standardised coefficient of the regression equation *Intercept b* have high reliability. Standard confidence interval P-Value <0.05 confirms their significance.

The analysis of variance and correlation coefficients also can be useful for regression evaluation. The results of performed analysis of variance and correlation coefficients are presented in Table 3 and Table 4.

Table 3. The results of analysis of variance. *(Source: built by the authors by the Multiple Regression procedure in STATISTICA 12.0)*

Effect	Analysis of Variance; DV: Y				
	Sums of Squares	df	Mean Squares	F	p-value
Regress.	391574.7	3	130524.9	5939.583	0.000168
Residual	44.0	2	22.0		
Total	391618.7				

Table 4. The results of analysis of correlation coefficients. *(Source: built by the authors by the Multiple Regression procedure in STATISTICA 12.0)*

Variable	Correlations			
	X1	X2	X3	Y
X1	1.000000	0.915379	0.586012	-0.003061
X2	0.915379	1.000000	0.741331	-0.307248
X3	0.586012	0.741331	1.000000	-0.799182
Y	-0.003061	-0.307248	-0.799182	1.000000

The analysis of variance in Table 3 shows how much of the variance is in the regression equation (Regress) and how much is in the residuals (Residual). So, the small proportion of residuals to total variance indicates the high quality of the regression equation.

Table 4 confirms the relationship between the factor indicators (x_1, x_2, x_3) and the outcome indicator (y) whereas the number of active enterprises and individual entrepreneurs working in the field of "Information and telecommunications" (x_3) has the biggest impact on the number of vacancies (y).

In addition to previous methods of regression evaluation, the analysis of residuals was made (Figure 5).
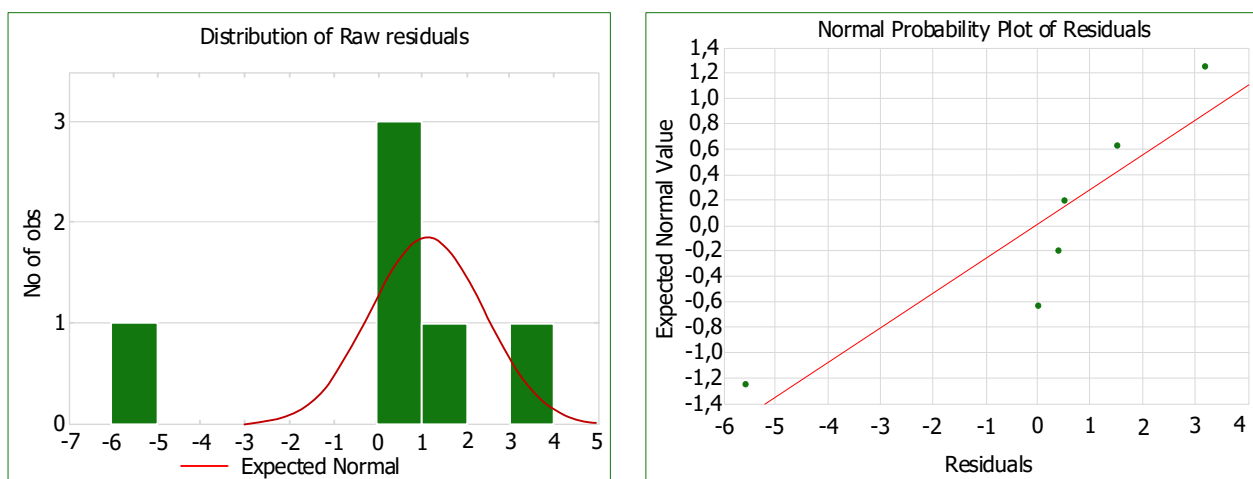

Figure 5. The result of the analysis of residuals. *(Source: built by the authors by the Multiple Regression procedure in STATISTICA 12.0)*

Figure 5 confirms the regression equation adequacy because the normal law describes the distribution of residuals.

Thus, the regression equation without a standardised coefficient of the regression equation *Intercept b* (1) is:

$$y = 0.795 \cdot x_1 - 0.983 \cdot x_2 - 0.339 \cdot x_3 \tag{1}$$

where: y – the number of vacancies (work positions), thousand; x_1 – the number of enterprises with access to the Internet, thousand; x_2 – the number of enterprises engaged in e-commerce, thousand; x_3 – the number of active enterprises and individual entrepreneurs working in the field of "Information and telecommunications", thousand.

This regression equation suggests that:

- if the number of enterprises with access to the Internet increases by 1 thousand, the number of vacancies will be reduced by 0.795 thousand;

- if the number of enterprises engaged in e-commerce increases by 1 thousand, the number of vacancies will be reduced by 0.983 thousand;

- if the number of active enterprises and individual entrepreneurs working in the field of "Information and telecommunications" increases by 1 thousand, the number of vacancies will be reduced by 0.339 thousand.

- Thus, the developed regression equation confirms:

- direct linear connection between the resulting indicator y (the number of vacancies) and the indicator x_1 (the number of enterprises that provide access to the Internet to personnel);

- return between the resulting indicator (number of vacancies) and factor values x_2 and x_3 (number of enterprises involved in e-commerce and number of active enterprises and fi significant individuals who work in the field of "Information and telecommunications").

Optimistic is the fact that, consistent with the established model, the number of vacancies (y) is positively affected by the number of businesses that provide access to the Internet (x_1). This creates the opportunity to transform the labour market.

However, the established form of connection shows that in Ukraine, the growth in the number of enterprises using information and communication technologies and enterprises operating in the field of information and communications does not lead to an increase in the number of vacancies (jobs), but rather to a decrease. Accordingly, the larger the number of enterprises engaged in e-commerce and the number of active enterprises and individual entrepreneurs working in the fields of information and telecommunications, the fewer jobs are available. This indicates certain threats to the labour market due to the digitalisation of the economy.

The practical significance of the obtained results is in the application of regression analysis as a powerful and flexible tool for assessing the existing impact of digitalisation of the economy on the labour market, namely, the dynamics of the number of available jobs due to changes in the number of enterprises using information and communication technologies and enterprises operating in the field of information and communications using the built regression equation.

The modelling allows us to draw the following conclusions:

- the relationship between the number of vacancies and the number of enterprises with access to the Internet has been confirmed. This trend creates certain opportunities in the labour market;

- however, with the growth in the number of e-commerce and information and telecommunications companies, the number of vacancies decreases; this trend is threatening in terms of reducing the number of jobs in the labour market.

Despite the difficult trials of recent years, Ukraine has successfully demonstrated its ability to digitalize certain sectors of the economy, solve high-tech problems, and provide high-quality IT services, which makes it a preferred partner for many of the world's leading companies. This position strengthens the country's reputation as a centre of innovation and technological development, highlighting the importance of Ukrainian specialists and companies.

Thus, the study found that there are mixed trends in the impact of digitalisation on the Ukrainian labour market. This necessitates a detailed analysis of the impact of the digitalisation of the economy on the labour market and employment. Table 5 presents the opportunities and threats of the impact of digitalization on the labour market, as well as their expected results and possible consequences.

The data presented in Table 5 demonstrates how digitalization can simultaneously provide new opportunities and create threats in the labour market and in the field of employment, which requires the development of measures of state regulation of legislation, the labour market, and employment processes.

Measures of state support for the labour market in the context of using the opportunities of digitalization of the economy should be multifaceted and include the development and implementation of a labour market monitoring system for timely identification of trends and forecasting changes in the structure of employment; supporting innovative start-ups to create new jobs; legal regulation of flexible forms of employment, including remote work, their adaptation; digital transformation of the protection system for transparency of labour relations; updating the educational system with a focus on digital skills.

Table 5. Matrix of the impact of digitalization of the economy on the labour market.

Possibilities	Expected results	Threats	Possible consequences
1. Research on the labour market, employment and unemployment	The use of big data technologies (Big Data), artificial intelligence and machine learning makes it possible to more accurately predict trends in the labour market, identify in-demand skills and professions, adapt educational programs to the needs of the economy, monitor the dynamics of employment and unemployment, effectively plan educational programs and retraining programs	1. Monopolization of the market by large technology companies	The dominance of a few large technology companies can limit the emergence of new competitors and innovation, and increase economic inequality. dominance in the Internet, e-commerce, social networks, mobile operating systems and software; economic and social imbalances are possible in matters of employment, income distribution, access to innovative products and services, and information
2. Creation of new types of jobs	The emergence of new professions related to the development, support and implementation of digital technologies; a general increase in vacancies in the technology sector; growing demand for highly qualified specialists	2. Replacement of jobs and displacement of people due to automation	Potential reduction in the number of human jobs, especially in sectors with high levels of routine and repetitive tasks; displacement of workers from traditional areas of employment, changes in the structure of employment; increase in unemployment in sectors with a high degree of automation, decrease in demand for low-skilled labour
3. Increased labor productivity	GDP growth, improved trade balance, increased competitiveness; increased the efficiency of labour processes, reducing the time required to perform labour operations. Intelligent systems and artificial intelligence can process large volumes of data quickly, accurately and efficiently	3. Increasing income polarization and economic inequality	The digital divide effect – i.e., disparities in access to digital resources, knowledge and skills, exacerbating inequalities of opportunity; highly qualified specialists in information technology and related sectors receive significant benefits, including increased income and expanded career prospects; workers in low-digital sectors or with limited digital skills face the risk of job losses and reduced incomes
4. Increased labor automation	Implementation and integration of automated systems and robotic solutions into production and operational processes to replace or complement human labour. Increasing efficiency and productivity, reducing transaction costs, minimizing the likelihood of errors, improving quality	4. The problem of protecting personal data, privacy and private life.	Strengthening the issue of ensuring confidentiality and protection of personal data; the collection, analysis and storage of large volumes of data by users of digital services and platforms increases the risks of misuse of personal information, including its leaks, sale to third parties and use to manipulate consumer behaviour
5. Flexibility of forms of employment and employment; inclusiveness and accessibility of the labour market	A variety of employment contracts and employment conditions, including part-time work, remote work, freelancing, seasonal, temporary, and project work. Flexible forms of employment help increase employment and reduce unemployment, providing opportunities for integration into the labour market and adaptation of various social groups (youth, people with disabilities, and older people). Flexible work hours, improved work-life balance	5. Digital dependence of economic and social systems	Driven by the need for continuous access to information and communications technologies and cyber-infrastructure, which increases vulnerability to failures in the operation of these systems. Increasing reliance on digital technologies in critical sectors of the economy (energy, healthcare, financial services and transport) could lead to systemic risks that could cause disruption to these sectors and social discontent
6. Increasing transparency and fairness of social and labour relations	Equal access to information about labour conditions, development of effective mechanisms for monitoring and control over compliance with labour legislation; development of social dialogue between employers, employees and the state; improving working conditions and increasing productivity; combating informal employment through electronic labour contracts, tax and insurance contributions.	6. Ambivalence and institutional uncertainty in the sphere of regulation of labour relations	The increase in the number of workers with non-traditional forms of employment and freelancers leads to a decrease in job stability and the absence of usual social guarantees for a significant part of the workforce; Rapid development of new technologies can outpace the ability of governments and legislatures to adopt legislation, creating legal and ethical problems
7. Education and vocational training; advanced training and retraining	Improving access to educational resources and online learning platforms; individualization of training, acquisition of relevant knowledge, development of skills, opportunities for continuous learning and skill development; online courses, webinars and other forms of training allow employees to improve their skills or learn new professions without the need for a long-term break from production.	7. Deficiency or mismatch of professional skills and competencies	The general level of education and training of specialists, which does not meet the current needs of the labour market; the gap between staff skills and labour market requirements (skills gap); lack or absence of professional knowledge and skills among employees to perform certain types of professional activities; increased unemployment
8. Optimization of personnel selection and hiring processes, improving access to information about vacancies	Increasing efficiency, speeding up, reducing the cost and reducing the time for recruiting through the introduction of automated personnel recruitment and selection systems, the use of artificial intelligence algorithms for analyzing resumes and candidate profiles, and the development of integrated open platforms for centralizing information about vacancies. Ensuring wide access to information about vacancies for job seekers, increasing the transparency of vacancies; effective interaction between employers and applicants	8. Psychological and social problems of personnel	Personnel are faced with a complex of psychological and social challenges, including technological stress, social isolation, blurring of boundaries between work and personal time, information overload, and professional uncertainty. These phenomena contribute to anxiety, deterioration of psychological state and decrease in the level of involvement in the work process.

Despite the significant impact of economic digitalization on the transformation of the Ukrainian labour market and the creation of new opportunities for its development, a number of problems and threats arise that require attention and solutions from the state. Therefore, the development of measures of state regulation of the labour market and employment requires

an integrated approach, which should include specific programs and measures to reduce risks and negative consequences that arise or may arise in the context of the digitalization of the economy. Let's take a closer look at them.

Countering market monopolization involves: supporting medium and small businesses through tax incentives, grants and access to financing; regulating antitrust laws to curb the dominance of big technology companies; promoting open access to technology and innovation for all market participants.

Job displacement due to automation involves: retraining and upskilling the workforce towards in-demand digital and technical skills; stimulating the creation of new jobs in areas related to the digital economy; developing support programs for workers whose jobs are at risk of automation.

Reducing income polarization and economic inequality could mean: introducing tax fairness measures to reduce income gaps; increasing access to quality education and training opportunities; raising the minimum wage and social protection of the population.

Protection of personal data involves: strengthening legislation on data protection and privacy; increasing public awareness of the risks and measures to protect personal information; introduction of strict requirements for companies to ensure the security of user data.

Softening the digital dependence of economic and social systems can be implemented through: developing programs to ensure the sustainability and independence of key sectors of the economy; support for research and development in the field of alternative technologies.

Eliminating ambivalence in the regulation of labour relations involves: reforming labour legislation to reflect the realities of the digital economy; introduction of flexible forms of employment into the legal field while simultaneously ensuring social protection for workers.

Addressing the skills gap means: developing a national education and training strategy; an emphasis on STEM education and digital literacy at all levels of education; collaborating with businesses to develop training and internship programs.

Addressing the psychological and social problems of staff involves: programs to support mental health and well-being in the workplace encouraging work-life balance, including flexible work schedules and remote work options.

The implementation of these government regulation measures requires active interaction between the state and business, educational institutions, public organizations and international partners. The basis for success is adaptability and readiness for continuous learning and development in a rapidly changing digital world.

DISCUSSION

The study confirmed that digitalization has a dual nature in the labour market. On the one hand, it stimulates the creation of new jobs, increases productivity, opens up new economic opportunities and promotes inclusive growth. On the other hand, it generates risks associated with the automation of jobs, increases structural unemployment in some traditional industries, and increases requirements for the qualifications of the workforce. The results of the study are consistent with the findings of other studies that emphasize both positive and negative consequences of digitization for the labour market (M. Knickrehm, B. Berthon, P. Daugherty (2016)). Some studies emphasize the benefits of digitalization, predicting a significant increase in new jobs (McKinsey Global Institute (2017)). Other studies are more cautious and warn of the risks of mass unemployment associated with automation (Simon Kemp, Digital (2023)).

The presented study, unlike existing ones, contains a comprehensive (two-component) approach to the problem under consideration. The article focuses on the trends and changes in the labour market and employment that are caused by the inevitable process of digitalization of the economy.

In the process of research, the essence of the concept of "digitalization of the economy" was clarified and specified, which is based on a clear understanding of the inevitability of the transformation of social, economic and labour relations in the global information space.

An important distinction and achievement of the article is the substantiation of a set of measures of state regulation of legislation, the labour market, and employment processes, as well as the development of a conceptual scheme of digitalization of the economy and measurement of results.

The article focuses on general trends in the labour market, without taking into account the specifics of individual industries and professions. A limitation of the study is that it does not consider the impact of factors other than digitalization on the labour market.

CONCLUSIONS

Thus, the possibilities of digitalization of the economy open up new directions for the development of modern society: flexibility in forms of employment, access to knowledge bases and educational resources, the development of freelancing and remote work, growing demand for analytical and technological skills, the emergence of new and changes in existing professions, automation of many routine processes.

At the same time, it is necessary to clearly and responsibly perceive the threats posed by the digitalization of the economy: the dominance of technology companies, the uncompetitiveness of part of the workforce, the polarization of incomes of the population, the growth of unemployment in certain segments of the labour market, the problem of protecting personal data, and socio-psychological tension.

The identified opportunities and threats make it possible to characterize the possible consequences for the labour market and employment: digitalization can increase inequality among different groups of the population; digitalization can reduce the number of permanent jobs and increase the number of seasonal, temporary, contract jobs, causing income and employment instability; digitalization can change the standards and working conditions of some professions, increasing productivity requirements.

Thus, the digitalization of the economy requires a balanced approach in the development of government measures aimed at mitigating threats to the development of the labour market and employment.

As for future prospects, the research conducted by the authors showed that it makes sense to focus on a more detailed and in-depth study of how digitalization affects individual industries, types of economic activities, specific professions, and manual and automated labour.

ADDITIONAL INFORMATION

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CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest.

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ВПЛИВ ЦИФРОВІЗАЦІЇ ЕКОНОМІКИ НА ТРАНСФОРМАЦІЮ РИНКУ ПРАЦІ: МОЖЛИВОСТІ ТА ЗАГРОЗИ

У статті розглянуто актуальні проблеми цифровізації економіки в контексті трансформації ринку праці та зайнятості населення. У дослідженні зазначається, що в сучасних умовах господарювання цифровізація економіки стає тим важелем, який суттєво впливає на ринок праці та змінює його кон'юнктуру. Визначено, які зміни відбуваються в структурі вакансій, у змісті праці, у професійних компетенціях робочої сили. Автори дійшли висновку, що цифрові-зація економіки – це складний процес, який і створює додаткові можливості, і несе певні загрози, особливо щодо зайнятості населення. Зазначені тенденції та особливості привертають увагу багатьох науковців до цієї теми та роблять її дуже актуальною.

Метою дослідження є подальший розвиток теоретичних положень і практичних рекомендацій щодо впливу цифро-візації економіки на трансформацію ринку праці та зайнятості населення. Як об'єкт дослідження розглянуто процес

трансформації ринку праці, який перебуває під впливом цифровізації економіки. Предмет дослідження – це теоретичні та практичні аспекти впливу цифровізації економіки на трансформаційні зміни, які відбуваються на ринку праці.

Основні результати дослідження: досліджено еволюцію поняття «цифрова економіка», наведено підходи різних авторів щодо її сутності; проведено оцінку показників ринку праці та зайнятості населення в Україні, визначено його особливості й тенденції розвитку; уточнено та конкретизовано сутність поняття «цифровізація економіки»; запропоновано та обґрунтовано концептуальну схему цифровізації економіки; узагальнено можливості та загрози впливу цифровізації економіки на ринок праці, а також розглянуто очікувані її результати та можливі наслідки для зайнятості населення; запропоновано заходи державного регулювання зайнятості з точки зору можливостей і загроз цифровізації економіки для ринку праці.

Ключові слова: цифрова економіка, цифровізація, ринок праці, зайнятість, безробіття, трансформація

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