

Digital Aspects of the Ukrainian Digitalization

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ABSTRACT

The article highlights the issue of digitization components in Ukraine. The study aims to show the importance, the current state of digitalization, and its main components, which are determined by international competitiveness rankings indicators. The author's analysis methodology, based on a combination of domestic and international methods of the competitive digitalization indicator, is used for the study. The study's relevance is indicated by the globalization processes and general economic trends towards digitalization. The study results show the current digitization state in the Ukrainian economy and also Ukraine's world position on various digitalization parameters. The greatest strengths are the intellectual capital in Ukraine; the weakest sides are the country's technological level and readiness to a volatile market. Also, the digitalization of Ukraine is accompanied by problems, which include the reform of the labor organization in IT companies, cybersecurity problems, and a lack of investment. The study has practical value in its application to developing strategies for digitalization development. Further research will improve the process for developing different aspects of digitalization.

HIGHLIGHTS

- ① The article highlights the issue of digitization components in Ukraine.
- ② The study has practical value in its application to developing strategies for digitalization development.

Keywords: Digitalization, IT, Covid-19, innovation

The new post-industrial era completely redefines the way we perceive the traditional economy's realities, the business processes, resources and human capital value, goods on the market, etc. The social and economic development of the new era is accompanied by a gradual displacement of material resources and the growth of digital technology. Evolutionary changes in the interpretation of digital technology's role in economic development allow us to understand better the modern digitalization processes taking place in the economy and society.

Implementing innovation and new technologies, the need to gain leadership, and the competitiveness of economic sectors in the globalized digital world requires a deliberate, strategically-oriented policy regarding digitalization. Such actions should liberalize the digitalization regulation, adapt the

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regulatory framework, stimulate investments and use scientific theories for economic development concepts.

It is essential to define the digital aspects of digitalization not only as the dynamism of different types of digital technologies. Furthermore, it is essential to study trends in the context of globalization, i.e., taking into account the state's competitiveness in the international digital technology market. Determining our state's position in global digital economy indices is an essential indicator of the digitalization processes within the country in identifying weaknesses and critical areas for improvement in this aspect. Understanding the Ukrainian positions and our state's place in the globalized digital world will allow a more concentrated internal policy of digital changes necessary for sustainable development. To assess Ukrainian digitalization's digital aspects, the author's team developed a methodology based on the world rankings of innovation and digital technology development.

The study aims to show the current digitalization state's importance and its main components, which are determined by indicators of international competitiveness rankings.

The research should solve the following tasks to solve the goal:

- ♦ conduct a critical review of the scientific literature on the topic of the study;
- ♦ evaluate the regulatory documents of the strategic development of digitalization in Ukraine;
- ♦ to determine the leading indicators and aspects of digitalization, compiled by national and international statistical and analytical organizations;
- ♦ determine the debatable sides of digitalization, identifying threats and prospects for the development of digital technology in Ukraine.

Literature Overview

The impact of digital technology on the economy and development of society is a field of increased interest recently among domestic and foreign scholars. Studies are carried out around the world, in particular Chakpitak *et al.* (2017), Chen *et al.*

(2019) conduct studies in the context of different states; they show that digitalization is an essential element of economic development, and this applies not only to developing countries but also to developed countries. The actualization of the issue at the scientific level occurs for a reason. Many countries independently design development programs based on the development of digital processes (Economic Commission for Latin America and the Caribbean, World Bank Group (2016). In Ukraine, there is also a development concept of digital technology and society, which the Cabinet of Ministers (2018) approved. At the same time, such ideas consider the order of actions to develop a digital society, including financial, organizational issues and the sequence of operations.

The problem of assessing the current state of digitalization in Ukraine is quite studied in the scientific literature. Such authors have conducted recent studies as Mosiichuk & Poita (2020), Spivakovskyy *et al.* (2021), Myskovet (2019), Perflieva *et al.* (2022), Sokolovska (2020). They show the dynamics of digitalization processes using different indicators: quantitative, rating, monetary. According to many scientists, in particular, Chepeliuk & Kutsenko (2021), the development of the digitalization level depends on information technology progress. Among many other researchers, the authors emphasize that information technology can become a force for economic growth. Halimon (2021) formed his own methodology for assessing the digitalization level in his study. The author showed the overall digitalization level as of 2020 and described the importance of knowledge and the technological environment in enabling digital processes to grow in the future. The author's research was based on compiled rankings of state competitiveness, depending on different indicators.

World Bank Group (2016) proposes its components of digital technologies:

1. information and telecommunication technologies – provide access to digital technologies (connectivity);
2. human capital – the skills necessary for workers, managers, civil servants to take advantage of digital opportunities (human capital);

3. a favorable business climate, including a transparent regulatory framework that encourages competition and the creation of new businesses, allows firms to use digital technologies for competition and innovation fully;
4. effective management – within the state provides for institutions that use the Internet for administrative purposes.

There are many approaches to evaluating the digitalization aspects of different countries. The main purpose of this article is to assess the current state, threats, and prospects, using domestic and international practices to determine the digitalization of the economy. This assessment is also of practical importance because the developed strategies for state development should be based not only on the internal state policy but also on the dynamics of the global market and the competitive specifics of its formation.

Research Method and Methodology

This article is based on the author's methodology for assessing the digitalization of Ukraine. This methodology considers domestic and foreign approaches to evaluating the level of digitalization. The domestic methodology is based on the method of the State Statistics Service of Ukraine, which assesses the use of information technology for many indicators: in particular, the use of computer technology in enterprises and the level of innovation. In contrast to the State Statistics Service of Ukraine, international organizations assess the impact of digitalization on business and the population. Thus, the global innovation index shows the total picture of innovation and covers about 80 indicators, including indicators relating to the political situation, education, infrastructure, and knowledge creation in each country. The Global Connectivity Index shows the level of use of cloud technology, IT investments, optical fiber coverage, and investments in telecommunications. The overall competitiveness rating is based on the general socio-economic situation assessment in the country according to several indicators. So this study will consider only the criteria of innovation and information technology use. The Cybersecurity Index is based on regular cybersecurity assessments.

It includes national information protection standards development, monitoring of national strategies, regular participation in international events to exchange cybersecurity practices, small business cybersecurity improvement, frequent involvement of interested parties in cybersecurity. Finally, the Global Digital Competitiveness Index forms knowledge, technology, and competitiveness status. Thus, to show the complete picture of the application of digital aspects of digitalization, all the criteria elements used to rank the level of use of digital technology and innovation are used.

General scientific methods of knowledge are used in the processing of information. In particular, the grouping method allows you to collect ratings on various criteria for a certain period. The analysis method will enable us to determine the trend of changes in these criteria. The process of synthesis of information allows, on the contrary, to identify and analyze its components from general data. Finally, induction and deduction methods are used to critically review the received information, which identifies the main threats and prospects of digitalization in Ukraine.

Research Results

Experts perceive digital technologies in Ukraine, economists, and scientists (Podolchak *et al.* 2019; Kostiuk-Pukaliak & Khoma, 2017) as an invisible tool and force that can take the Ukrainian economy to a new level. The economic strategy of Ukraine – 2030, developed by the Ukrainian Institute of the Future, refers to two scenarios for the development of the digital economy in Ukraine, depending on the assessment of the criticality and the need for rapid and profound changes in the traditional economic order – inertial (evolutionary) and targeted (forced). The evolutionary scenario assumes an inertial continuation of past trends, i.e., perception of technologization, economy digitalization, and human capital. In the case of the inertial scenario, the Ukrainian economy remains inefficient, labor migration and the “brain drain” will continue, and Ukrainian products will lose competition on foreign markets. If the state takes standard and formal steps, they will not be enough for substantial growth. The target (forced) scenario assumes the transition of the Ukrainian economy within 5–10 years to

development and appearance in its structure of a significant share of the digital economy (up to 65 % of GDP). According to the Ukrainian Institute of the Future, Ukraine can generate \$1 trillion of gross domestic product, but this requires the introduction of information technology in all sectors of the economy (Hi-Tech Office Ukraine, Ukrainian Institute of Future, 2021).

Figure 1 shows that by 2030 digital products will account for 65 % of the total economy. But for this to happen, already in 2024, it is necessary for the Ukrainian market to produce and consume \$4 billion of information products, and by 2030 the figure should be about \$16 billion. According to the Institute of the Future, to achieve the goal for the next ten years should invest \$70 billion in digital technology (Table 1). Furthermore, the researchers believe that if innovations were introduced in all

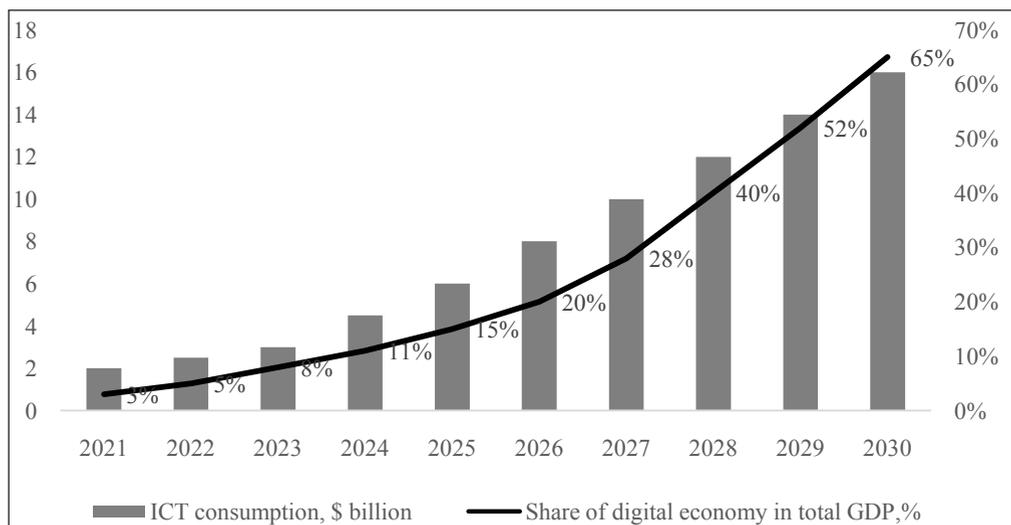
sectors of the economy, the labor market would create an additional 700 thousand jobs. At the same time, it is possible to attract such amounts from both domestic and foreign markets. Thus, we can say that the economy of Ukraine is staking on digitalization as the primary tool to improve its efficiency.

As shown in the literature review, aspects of digitalization are assessed differently by different researchers and organizations. According to state statistics of Ukraine, the main elements of digitalization are innovation, the use of the Internet in industrial and other companies, the use of websites and e-commerce, the provision of interactive services, the use of cloud technology, IT technology, and 3D printing. According to 2020 data, 14.9 % of all organizations in Ukraine used innovations in their production processes. The indicator is not stable; it has both increasing

Table 1: The digitalization effect in the economy of Ukraine

Indicators	2021	2025	2030	Total 2021–2030
Investment in digital infrastructure, \$ billion	0,7	3	6	16
Investments in digitalization of production, business, industry, \$ billion	1,5	5	14	70
Increase in productivity due to digitalization,%	1,1	1	13	
Additional GDP created through digitalization (only the effect of investment and productivity), \$ billion	17	93	280	1 260
Additional GDP,%	11	44	95	
Additional revenues to the Budget, \$ billion	3,2	17	50	240
Number of jobs created (excluding the export IT industry), thousand people	150	300	700	
Share of digital economy in Ukraine (in total GDP),%	3	15	65	

Source: Compiled by the authors based on Ukrainian Institute of the Future, 2021.



Source: Compiled by the authors on the basis of the Ukrainian Institute of the Future, 2021.

Fig. 1: Digital technology implementation and its impact on GDP of Ukraine until 2030

and decreasing tendencies due to the high cost of innovations and the inability of companies to allocate funds for their implementation (Table 2).

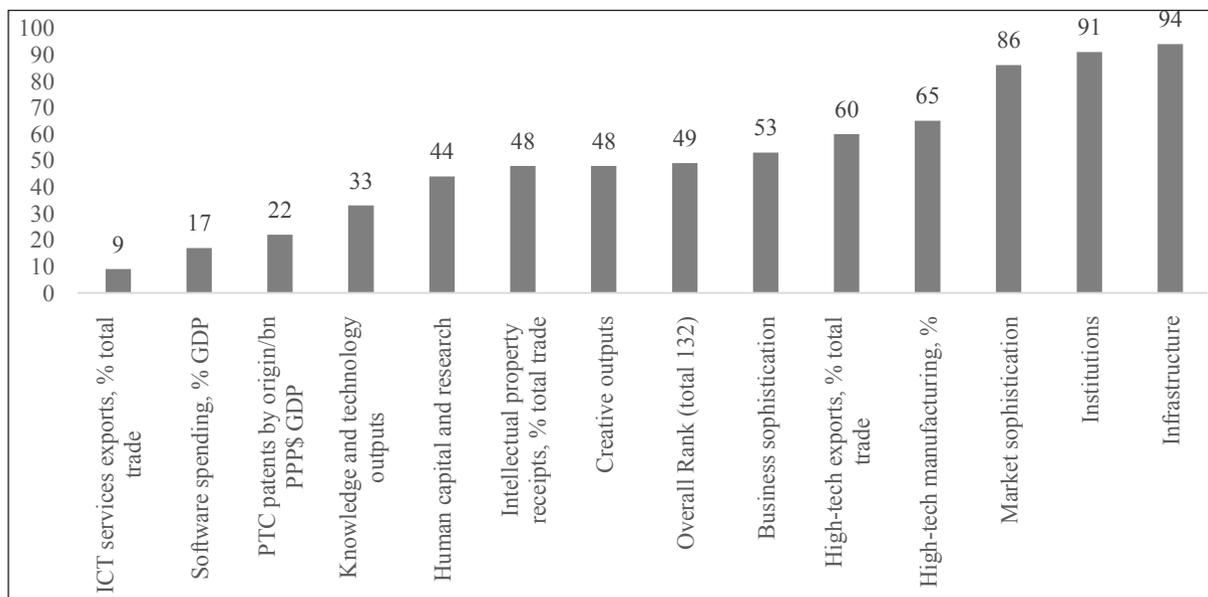
The Internet technology issue is solved for most companies that operate on the market of Ukraine. 86,6 % of all companies use it for business communications, and the figure in 2018 was higher. If we talk about the business presentation on the Internet with the help of the site, the indicator does not change the dynamics of three years. About 35% have a website, and only 10 % provide services online. In 2020, the number of companies with programmers on staff was 21.7 %. The figure is up from 2019 but down from 2018. 3D technology has only been implemented by 2.3 % of companies so far. We can conclude that the introduction of interactive technologies is the most progressive

digitalization method among Ukrainian businesses. When it comes to international rating agencies and organizations, they use other technologies to assess the level of digitalization. Quite important are indicators: the export of digital technology, the cost of purchasing software, the formation of patents for new technologies, the use of knowledge, human capital, the issue of protection of intellectual property, creativity, business experience, market experience, regulatory institutions, infrastructure development. In total, in the global innovation index ranking, which was attended by 132 countries, Ukraine took 49th place, which means that Ukraine forms the top 50 countries list for innovation (Fig. 2). Speaking about cybersecurity, it is safe to say that Ukraine does not pay enough attention to the problem. Today, according to ITUPublications

Table 2: Share of Ukrainian companies that use different types of digital technologies

Digital technologies	2018	2019	2020	Annual Growth, %
Use innovation	15,6	13,8	14,9	8,0
Use the Internet	88	86,4	86,6	0,2
Use a website	35,6	35,2	35,3	0,3
Provide interactive services	10,3	10,2	10,4	2,0
Use cloud technology	9,8	10,3	10,2	-1,0
IT staff	22,30	21,60	21,70	0,5
3D printing	2	2,3	2,3	0,0

Source: Collected by the authors on the basis of State Statistics Service of Ukraine (2021).



Source: Compiled by the authors based on Dutta et al. (2021).

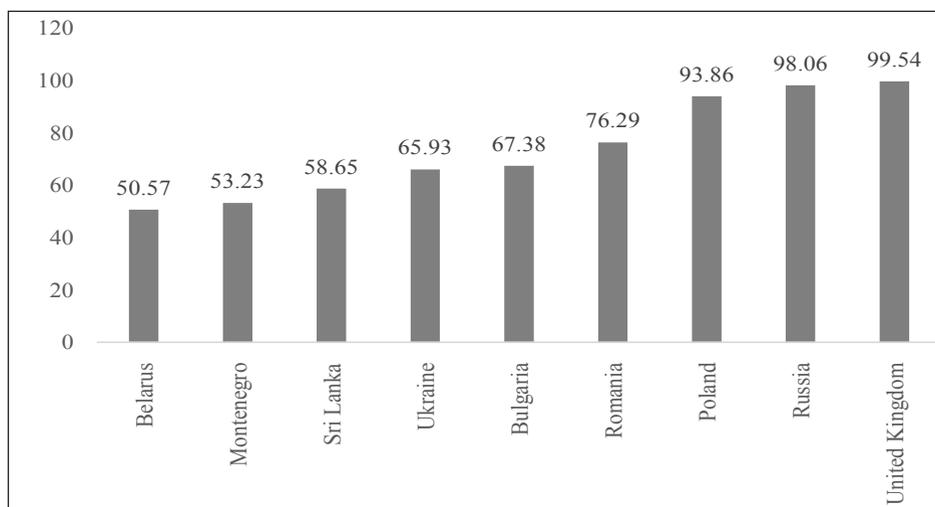
Fig. 2: Ukrainian global innovation index components

(2020), which annually forms the cybersecurity rating of countries, Ukraine received 65 points out of 100. This index is lower than the level of Moldova and Bulgaria. Having a significant potential of information technology development, this issue should be addressed radically because it can form threats not only to the development of the information sector but also to the socio-economic security of the population (Fig. 3).

According to ITUPublications (2020), most problems are associated with the interaction of national systems with global technical problems and implementation capabilities. However, the level of formal regulation of the issue is relatively high (Fig. 4).

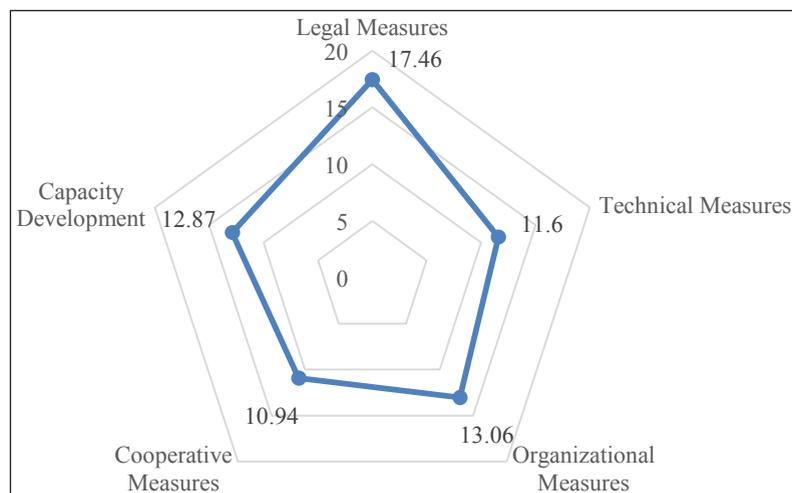
It can be concluded that the administration, authorities, and the main players of the information market feel the lack of personnel, funds and technical capability to deal with cyber security issues. Today, all efforts are directed towards the organization of information technology experts in the rapid development of demand for the domestic labor market.

According to the Center for Global Competitiveness, the main aspects of digitalization are knowledge, technology, and readiness for market changes. If we assess the situation in Ukraine, we can state that quite a strong point of the domestic aspects of digitalization is the intellectual power of the country, i.e., knowledge. The indicator in 2021



Source: Compiled by the author based on ITUPublications, (2020).

Fig. 3: Cybersecurity index of Ukraine and other countries in 2021



Source: Compiled by the author on the basis of ITUPublications (2020).

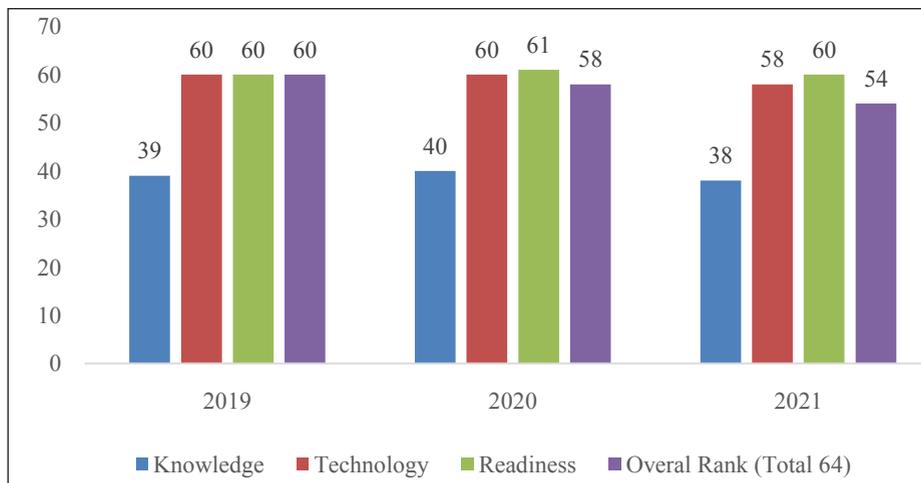
Fig. 4: Ukrainian cybersecurity index components in 2021

improved Ukraine’s international position in the ranking, as it was 38 out of 64 countries, which allowed Ukraine to rise in the overall indicator of digital competitiveness by 4 points last year and by 6 points compared to 2019. On the other hand, readiness for market changes is a weak factor for Ukraine. The country’s technological capability is relatively weak, but it tends to improve, as shown in Fig. 5.

General improvement of the digitalization indicator is also observed in the Global Connectivity Index (2020), according to which Ukraine has moved up by three positions in 3 years.

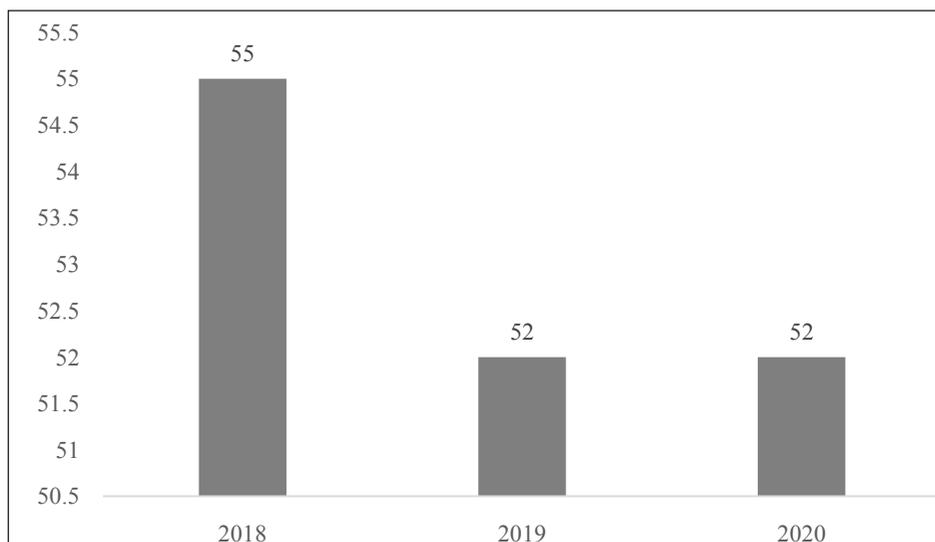
The World Economic Forum shows that Ukraine’s innovativeness is an unstable indicator. Unfortunately, the rating data of Ukraine are collected for 2019, so the information is somewhat outdated. Still, in general, we can determine that in 2019 Ukraine ranked 60th out of 141 countries on the level of innovative ability, 78th on the level of adoption of computer technology, and 67th on the level of investment in development and research (Table 3).

Although the domestic rate of information technology development is considered relatively high, compared to the development of other



Source: Compiled by the authors on the basis of IMD World Competitiveness center (2021)

Fig. 5: Global Digital Competitiveness Index Structure



Source: Compiled by the authors based on Huawei (2020).

Fig. 6: Structure of the Global Connectivity Index

Table 3: Ukraine's place in the competitiveness ranking in terms of the use of information technology

Indicator	2019	2018	2017
	Rank (141 total)	Rank (140 total)	Rank (137 total)
Internet users, % adult population	84	83	81
Mobile-cellular telephone subscriptions per 100 pop	60	33	23
R&D Expenditures, % GDP	67	56	76
ICT adoption	78	77	NA
Innovation capability	60	58	61

Source: Compiled by the authors based on Schwab (2019).

countries, this trend is not enough to increase the country's overall competitiveness.

To significantly increase the level of digitalization, certain circumstances are necessary to increase the need for the development of such technologies. According to a study by the BCG group in the COVID-19 survey, it is shown that such an accelerating factor was the pandemic, in which most companies were forced to switch to innovative and digital technologies (Columbus, 2020).

DISCUSSION

Today, many experts (Hi-Tech Office Ukraine, Ukrainian Institute of Future, 2021; European Commission, 2015) and scientists believe (Polozova & Sheiko, 2021; Saiko & Luchko, 2021; Hlazova, 2021) that digitalization is a tool for economic development not only in Ukraine but also in other European countries. Among the main objectives of the national program to create a digital economy in the emerging global digital space should be the digitalization of material production, services, and in general the entire socio-economic and public life of society, as well as ensuring the effective participation of the country in all processes of the global digital ecosystem. There is a unique opportunity for the economy and the global digital space to make a "digital leap" in different sectors (Dovgal *et al.* 2021; Dubyna & Kozlianchemko, 2019; Novikova *et al.* 2020).

Saiko & Luchko (2021) consider medicine, marketing, education, public services, and culture the main digitalization areas. Zhosan (2020) added such sectors as business, financial market, production processes to the number of the promising regions in Ukraine.

The digital infrastructure development will guarantee new jobs, which will reduce unemployment. But it is

essential to transform the economy promptly when the market and external circumstances contribute to this development (Dovgal *et al.* 2021).

According to the authors, the current government's strategic goal to generate \$1 trillion for the Ukrainian economy is quite ambitious. To solve it, it is necessary to create a favorable climate for the development of the information sector. Modernization, transformation, and innovation in Ukraine's digital development administration are under threat today. Today there are several obstacles to the development of information technology, which can stop the processes of the IT market growth.

First and foremost is the issue of taxation of hired employees. The current practice of interaction with FOP is under question because the state plans to make adjustments in the information sector market, forcing companies to hire employees, and accordingly increase the tax rate from 5 % to 45% (22 % – social tax deduction, 18 % – a tax on income of the employee). This taxation system is unfair and inappropriate for the digital sector because 5 % of the actual income received (which on average is 50,000 UAH) is the threshold amount that entrepreneurs are willing to pay while staying in Ukraine (NVBusiness, 2021). The second problem is cybersecurity, which is currently relatively low. Given the constant increase in digital technology in public administration and the lack of essential digital competencies, many people have become victims of financial fraud.

The third problem is the issue of investing in the development of information technology. Today, finding investors for IT products is not problematic. It is problematic to standardize international cooperation and make it consistent with international requirements. Also, in the market,

quite a few domestic investors are willing to invest in the development of new technologies, which is also associated with high risks and instability in the state (Speka Media, 2021)

But under the current economic strategy, the possibility of implementing the goal remains open because of the lack of specialists. Higher educational institutions are strenuously graduating specialists in information technology, but they can become highly qualified specialists only after 5–7 years of experience. Thus, shortly the labor market in information technology will feel an acute shortage of personnel, which will also halt the rapid development of the industry (Forbes, 2021).

In turn, in addition to obstacles, there are also forces contributing to the development of the market. Ianenkova (2021) and other international experts (Nachit & Belhcen, 2020) emphasize the benefits of covid-19 for the development of the digital economy. The author shows that under quarantined constraints, IT companies have already set up remote production processes that are more cost-effective and also able to meet the needs of developed countries for intellectual capital quickly. The problems that prosperous states face in quarantine restrictions can become an engine of progress for the Ukrainian economy. Of course, such economic development processes will be indirect – increasing the level of employment of the population and the inflow of foreign capital into the country in the form of wages.

CONCLUSION

According to the study results, we can conclude that digitalization is an important and decisive component of the future development of the economy not only in Ukraine but also in other countries. With the spread of COVID-19, digitalization of the economy has become the only way to renew it, and with the right organizational approach, it becomes an essential element of its development.

The main aspects of digitalization are related to the application of digital technologies in industry and the country's population. Today digitalization in Ukraine is at its early stages of development in terms of industrial production – about 30 % have their own websites. Still, only 10% implemented automation processes in the production, 15 % used innovative technologies. If we talk about the level

of cyberization in general, the Internet technologies in the country are underdeveloped compared to other countries, which is associated with the slow development of digital technology. In the list of developing and developed countries, Ukraine ranks almost last in terms of technological capabilities and the willingness to develop. If we talk about the vital components of digitalization, they are the labor market, which is characterized by a sufficient number of specialists who are ready to meet the needs of the domestic and foreign markets. Ukraine is developing its digital potential according to its economic development strategy, which provides for digital aspects of economic development. But the implementation of strategic directions and plans is possible only with the state support of the information technology sector and the formation of a business climate in which domestic and foreign investors in the field of information technology would appear on the market. If Ukraine does not create conditions for the favorable development of digitalization, the economy will not get a chance of rapid growth, and all the accidentally formed good preconditions for the development of the information sector, unfortunately, will be lost.

The study's practical value lies in the possibility of its application to the development of strategies for digitalization development. The subject of further research will be the improvement of strategies to develop various aspects of digitalization.

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