

UDC 004.8:004.738.5

DOI: 10.57111/econ/2.2024.69

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Digital transformation as an imperative for innovative development of business processes under martial law (Ukrainian experience)

■ **Abstract.** Digital transformation in business is becoming a key factor that determines the competitive advantage and viability of modern enterprises in the economic environment. The relevance of the study is of particular importance in light of the importance of ensuring the continuity of business processes in an unstable environment. The purpose of the study was to establish the theoretical, conceptual, and practical foundations of Ukraine's digital transformation example under martial law and to develop recommendations for improving the development of digital transformation processes.

Article's History: Received: 19.12.2023; Revised: 26.03.2024; Accepted: 27.06.2024

Suggested Citation:

Shveda, N., Garmatiuk, O., Kuzhda, T., Mashliy, H., & Yuryk, N. (2024). Digital transformation as an imperative for innovative development of business processes under martial law (Ukrainian experience). *Economics of Development*, 23(2), 69-79. doi: 110.57111/econ/2.2024.69.

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The study employed a mixed-methods approach. The economic and statistical analysis, utilising techniques like data processing and comparative analysis, revealed Ukraine's inconsistent performance in global digital competitiveness rankings, with areas for improvement identified in future readiness and technological integration. Qualitative methods such as analysis, synthesis, comparison, systematisation, grouping, induction, deduction, and generalisation facilitated a comprehensive understanding of the advantages, disadvantages, and challenges associated with digital transformation in Ukraine, including cybersecurity vulnerabilities and the digital divide. Specifically, the systematisation method allowed careful consideration of the main disadvantages and advantages of digital transformation. The grouping method enabled compiling international rankings based on different criteria over time to identify trends impacting competitiveness. It has been determined that resolving cybersecurity flaws needs to be a primary concern, particularly given the increased threats brought on by the ongoing armed war. Legislative changes, in particular, are thought to be crucial in fostering an atmosphere that is supportive of digital business transformation. It is stressed that knowledge transfer, access to cutting-edge technologies, and best practices in digital transformation can be facilitated via strategic relationships with global organisations, technology businesses, and academic institutions. The study provides practical recommendations for improving digital transformation and identifies the challenges that need to be addressed for the successful implementation of further digitalization strategies in Ukraine

■ **Keywords:** innovation; digitalization; e-commerce; business models; cybersecurity

■ INTRODUCTION

The modern world is experiencing the intensification of information technology (IT), where digital transformation plays an important role in the development of business and society as a whole. This transformation is defined as a comprehensive process of introducing digital technologies and digital thinking into various areas of business. The specificity of this process is that digital technologies are not limited to the implementation of information systems or automation of certain processes, but involve profound changes in the strategy, organisation, and culture of the enterprise.

Many authors and scholars have studied the theoretical and practical aspects of digital transformation. S. Bashlai & I. Yaremko (2023) focused on the peculiarities of digitalization in the context of European integration, pointing out the importance of the country's participation in the Digital Europe programme. Their conclusions on building a reliable data infrastructure for measuring the digital economy show strategic opportunities for Ukraine in the long term. A. Samoilenko (2023) analysed the directions of digital economy development in Ukraine. The author described the main digital trends and the role of regulations in modernising and building digital infrastructure, as well as in strengthening cyber defence and developing new digital technologies. The study also highlights the opportunities for digital transformation for Ukrainian business entities through participation in the European Union's Digital Europe programme until 2027 to improve the country's competitiveness. The author emphasises the importance of Ukraine's integration into the European Community's information space, in particular, the importance of digital transformation of financial transactions, e-government, and the personalisation of needs and production through IT.

G. Zhekalo (2019) examined the peculiarities of the digital economy development in Ukraine and identified its indicators using an assessment tool used to measure the development of the digital economy and society in the European Union. The author analysed such indicators as the quality and accessibility of the Internet, the level of digital skills and human capital, the use of information and communication technologies (ICT) by citizens and businesses, and the level of accessibility of digital public services. The study also identified the main problems and obstacles that

hinder the development of the digital economy in Ukraine. It is noted that the development of the digital economy can act as an important mechanism for the transition from old to new governance systems, increasing competitiveness and stimulating economic growth in the country. T. Shtal & K. Pliekhanov (2023) analysed Ukraine's digital competitiveness, considering the digital competitiveness index, considering Ukraine's place in this ranking, and assessing the value of its components. The study also covered various indices, such as the Digital Economy and Society Index, the Ease of Doing Digital Business Index, and the ICT Development Index. It is noted that some of these indices do not assess the level of development in Ukraine according to the relevant indicators.

A. Cherep & O. Cherep (2022) considered the digital transformation of society as a prerequisite for its innovative development. In their work, the authors argued that by 2025, digital transformation will become necessary for all spheres of life in most countries in the world. They identified that this transformation is associated with the development of an innovative information society and is based on the use of innovative IT, which leads to qualitative changes in social relations and improves the quality of services and labour productivity. The authors also defined the goals and strategic directions of digital transformation and summarised the advantages and disadvantages of the digital economy in Ukraine. O. Shevchenko & A. Strelts (2022) pointed out that digitalization opens up new opportunities and helps to optimise and improve business processes, which is especially relevant for Ukrainian businesses during martial law.

Given the large number of existing studies covering various aspects of digital transformation, the question of its impact on the innovative development of business processes under martial law in Ukraine remained open. The full-scale invasion of Russia and the blackouts highlighted the importance of business adaptation to emergencies and change. Digital transformation could play a key role in ensuring the resilience of business process infrastructure and the ability to continue effective operations even under martial law. Therefore, studying the impact of digital transformation on business processes under martial law could help

develop strategies and solutions that would assist businesses and the government in adapting to new realities and ensuring the resilience of the economy in the face of uncertainty. The purpose of the study was to identify and analyse the theoretical and practical aspects of the digital transformation of business structures in Ukraine under martial law, as well as to develop recommendations for improving the development of digitalization transformation processes.

■ MATERIALS AND METHODS

The study of the digitalization of economic processes in Ukraine utilised a variety of methods, covering a wide range of areas. The use of the economic and statistical method in this study allowed for a comparative analysis of the level of Ukraine's digital economy with the best digital economies in the world. This method was based on the processing of a large amount of statistical and empirical data, which made it possible to assess the level of digitalization in Ukraine and include this data in the ranking of the best digital economies. The assessment was based on three key comprehensive criteria: the level of knowledge, the technological environment, and openness to the future (IMD world digital..., 2021; Global innovation index..., 2022; Nominal GDP..., 2022; IMD world digital..., 2022; IMD world digital..., 2023). This analysis showed how countries used digital technologies to develop their economies and societies. The economic and statistical methods of analysis contributed to a deeper understanding of not only the level of digital transformation in Ukraine but also its reflection in the international context.

In the study of the digitalization of economic processes, the use of charts and graphs helped visualise complex phenomena, processes, and patterns. Diagrams facilitated the identification of relationships between economic factors and the impact of digital innovations on the country's economic development. The article presented data on the share of digitalized enterprises in the world gross domestic product (GDP), the ranking of countries in global digital competitiveness, and the dynamics of digital transformation in Ukraine. This assessment was based on key indicators such as knowledge, the technological environment, and openness to the future.

The methods of analysis, synthesis, and comparison allowed for a detailed study of the phenomenon under investigation by analysing its main elements, considering the synergistic effect between digital technologies and economic processes, and comparing the achievements and

challenges of digitalization in Ukraine with other countries. The systematisation method enabled a careful consideration and organization of the main disadvantages and advantages of digital transformation for the country. Furthermore, the application of this method facilitated the structuring and summarising of the results, providing a comprehensive understanding of the primary challenges and opportunities in the digital sphere for the country. The grouping method allowed for the collection of international rankings based on different criteria over a specific period. The application of this method to compile international rankings by different criteria enabled the identification of the dynamics of changes in these criteria over a certain time, which was crucial for understanding trends and their impact on the country's digital competitiveness.

The methods of induction and deduction were used to critically analyse the information obtained, which enabled the identification of the main threats and trends in the further development of digitalization in Ukraine. The method of generalisation allowed for the drawing of objective conclusions, the identification of key trends, and the emphasis on the need for a comprehensive approach to digital transformation for the country, providing a basis for further strategies and development.

■ RESULTS

Digital transformation is the process of transforming and modernising the organisational, economic, and technological aspects of an organisation or society through the use of digital technologies. It involved the introduction of digital tools, processes, and approaches to improve efficiency, innovation, competitiveness, and the ability to adapt to a changing environment (Bashlai & Yaremko, 2023). Digital transformation included the transformation of existing analogue (sometimes electronic) products, processes, and business models of organizations. This process was based on the effective use of digital technologies and aimed to increase the productivity of innovative products and services (Feliciano-Cestero *et al.*, 2023).

The digital economy is a model of an economic system where digital data, such as binary information and network transactions, are the main resources and tools of production. Such data was used to improve the productivity and efficiency of processes, as well as to increase the value of the goods and services created (Laudon & Traver, 2023). Table 1 shows the advantages and disadvantages of digital transformation for the country.

Table 1. Advantages and disadvantages of digital transformation for the country's business and economy

Aspect	Advantages	Disadvantages
Competitiveness	The implementation of modern digital technologies ensures speed, quality, and innovation in business activities.	Increase in cyber-attacks and data security breaches due to increased digital processes and data sharing.
Productivity	Optimises production processes and resource management, leading to increased labour productivity and efficient resource use.	Requires significant investment in infrastructure, staff training, and equipment upgrades.
Access to services	Facilitates online access to education, healthcare, financial services, and more.	Automation and robotization may lead to job losses in some sectors, necessitating workforce reskilling.
Cost efficiency	Lowers production and management costs through process automation and optimisation.	Not all population groups have equal access to digital technologies, contributing to increased societal inequality.

Table 1. Continued

Aspect	Advantages	Disadvantages
Innovation	Stimulates the development of new technologies, products, and services, fostering innovation and new economic sectors.	Raises concerns about privacy protection and ethical use of personal data with increased collection and processing of data.
Adaptability	Enables quick adaptation to environmental changes and new challenges.	Dependence on digital technologies increases societal vulnerability to failures or disruptions in technology.
Infrastructure development	Attracts investments and opens new economic development opportunities.	Shifts in culture and social interactions due to digital transformation provoke societal resistance.
Environmental impact	Promotes efficient resource use and minimises harmful emissions, improving environmental conditions.	Dependence on technology providers creates risks for national security.
Job creation	Increases demand for skills in digital literacy and tech proficiency, providing opportunities for training and career advancement.	In certain industries, automation and robotization may result in job losses, requiring the workers to undergo extensive retraining and reskilling.

Source: made by the authors based on S. Nadkarni & R. Prügl (2021), I. Revak & R. Gren (2022)

The digital transformation of Ukraine’s business and economy represents a shift towards an economic model centred on digital data and network transactions as primary resources and production tools. This transition aimed to enhance productivity, streamline processes, and elevate the value of goods and services. As Ukraine embraced digitalization, it anticipated improvements in efficiency, innovation, and overall quality of life for its citizens. Nevertheless, challenges such as cybersecurity vulnerabilities, initial implementation costs, and potential job displacements require careful consideration. Additionally, addressing disparities in access to digital technologies and safeguarding data

privacy emerged as critical concerns in this evolving landscape. By recognising and preventing such challenges, the country could achieve more balanced and sustainable development through digital transformation (Yuan *et al.*, 2023).

The accelerated development and implementation of digital tools in business processes and everyday life became important factors in the competitiveness of countries and various business structures (Ulan, 2023). The forecast suggested that over the next decade, more than 70% of global value added would be based on digital products, which in 2023 had already reached USD 53.3 trillion, almost four times higher than in 2018 (Fig. 1).

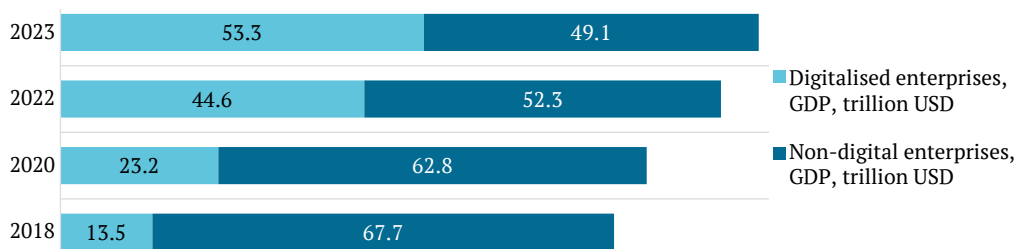


Figure 1. Digitized enterprises in world GDP, trillion dollars

Source: made by the authors based on Nominal GDP driven by digitally transformed and other enterprises worldwide from 2018 to 2023 (2022)

This trend defined a new reality in the world economy and the role of digital technologies in the global business environment. Figure 2 presents the ranking of the best digital economies in 2019-2023. The presented comparative data on the level of digitization of the economy and society in different countries was interesting because of the World

Digital Competitiveness Rating. This ranking assessed countries on their ability to adopt and effectively use digital technologies to change regulation, business models, and society in general. The assessment was based on three key comprehensive criteria: knowledge, technological environment, and openness to the future.

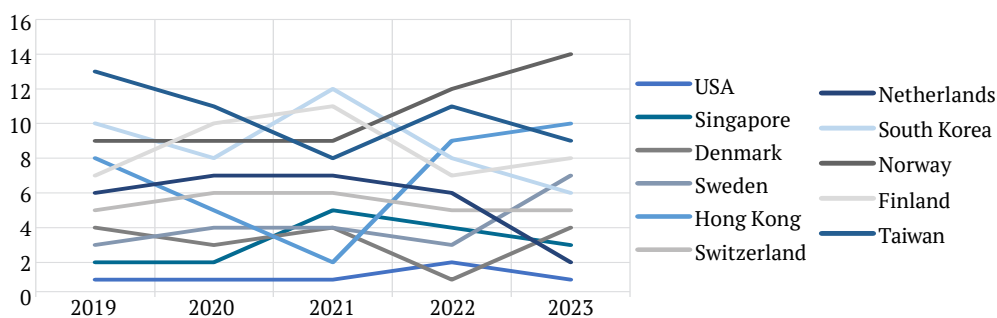


Figure 2. Top 10 countries in the IMD world digital competitiveness rating

Source: made by the authors based on IMD world digital competitiveness ranking (2021; 2022; 2023)

Figure 3 illustrates the dynamics of the share of the digital economy in Ukraine’s GDP from 2021 to 2030, showcasing both historical data and future forecasts. The data indicates a steady increase in the contribution of the digital economy to GDP, reflecting Ukraine’s ongoing digital transformation and economic modernization

efforts. According to Figure 3, by 2030, the digital economy is projected to account for 65% of Ukraine’s GDP, highlighting its critical role in the nation’s economic growth and development. Figure 4 shows the dynamics of the level of digital transformation in Ukraine over the period 2017-2021.

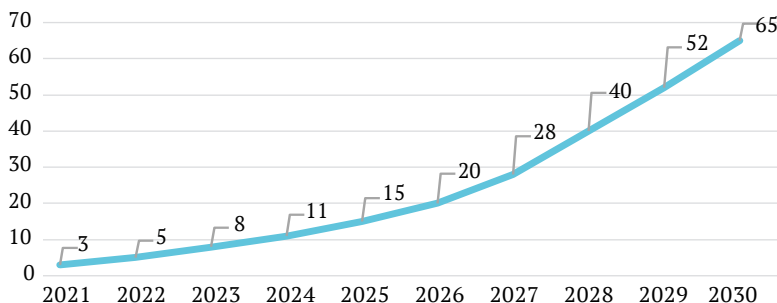


Figure 3. Dynamics of the share of digital economy in the Ukraine’s GDP with a forecast until 2030, %
Source: made by the authors based on Ukraine 2030E – a country with a developed digital economy (2019)

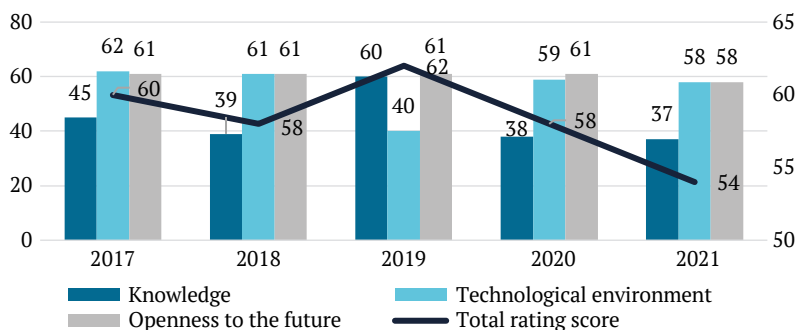


Figure 4. Dynamics of the level of digital transformation in Ukraine, assessed on the basis of a set of key indicators
Source: made by the authors based on the IMD world digital competitiveness ranking (2022)

Thus, Ukraine’s position is characterised by instability and a lack of positive dynamics. Figure 5 shows that the most problematic indicators for Ukraine are related to the criterion of openness to the future, especially in the area of IT integration, where Ukraine ranks 58th overall (according to the results of 2021). The best result can be seen in knowledge, which improved from 45th in 2017 to 37th in 2021, indicating some progress and efforts to develop education and research in Ukraine. The improvement in this index also reflects the growing level of digital literacy and the improvement of educational programmes in the country. The overall score dropped significantly in 2020 and continued its negative trend in 2021. Unfortunately, there is no data on Ukraine’s participation in 2022 and 2023 in this ranking. The digital economy is proving to be a key factor of resilience and a reliable source of tax revenues, as it is less dependent on physical assets, which is especially important in a crisis (Zhang *et al.*, 2023). An example is the Ukrainian IT industry, which became one of the most stable sectors of the economy after the start of military aggression and showed an increase in exports in 2022, confirming the importance of digital sectors for economic resilience (Report on the activities..., 2023).

The development of the ICT sector largely depends on the demand of society for products and services in this area. The ICT sector has seen significant growth, with the number of companies and enterprises providing digital

services contributing 7.35 billion USD or 4.5% of the GDP to Ukraine’s economy in 2022 (Stender *et al.*, 2024). The rate of digital innovation is growing every year, with the number of end-users increasing, and the number of mobile users, active Internet users, and users of social networks also seeing significant growth. The digital economy has the potential to provide stability and growth in necessary financial revenues, especially for post-war reconstruction. Key factors contributing to the development of the digital economy include a well-developed field of ICT, strong educational institutions, and competitive innovations. The digital transformation of the Ukrainian economy has become an important condition for improving management decisions in the context of the full-scale invasion of Ukraine by the Russian Federation. The implementation of digital initiatives has been crucial to supporting the inclusive and sustainable growth of the digital economy. Key events that influenced the implementation of systemic measures include the following.

Ukraine has joined the National Pavilion Account pilot innovation project, which is one of the e-commerce accelerator initiatives under the EU4Digital initiative. The project is aimed at harmonising e-commerce in key areas with the European Union, implementing solutions for the development of cross-border e-commerce, increasing the competitiveness of enterprises, creating new jobs, and improving the quality of life of citizens. A memorandum

was signed between the Ministry of Digital Transformation and the European trade association DIGITALEUROPE aimed at attracting investments from the European Union to build digital infrastructure in Ukraine and develop Ukrainian small and medium-sized businesses, in particular, in the field of artificial intelligence. A decree has been issued approving the list of indicators of the Digital Economy and Society Index (DESI) in Ukraine, as well as the procedure for collecting and exchanging information on these indicators in accordance with the EU methodology. Ukraine's inclusion in the DESI will help to realise the state's potential in the field of digital competitiveness and facilitate Ukraine's integration into the European Union's Digital Single Market.

In 2023, Recorded Future, a private intelligence analytics company, invested in Ukraine by expanding access to its Intelligence Cloud software platform, which provides intelligence to government agencies and businesses to protect critical infrastructure through tools such as Recorded Future Network Intelligence, phishing data, and malware information. Ukraine has taken a significant step towards accelerating its digital transformation with the adoption of Resolution of the Cabinet of the Ministers of Ukraine No. 1340 "On Approval of the Plan for the Allocation and Use of Radio Frequency Spectrum in Ukraine" (2023). This resolution establishes a framework for implementing cutting-edge technologies like 5G across the country, paving the way for businesses and the economy to leverage the benefits of advanced wireless connectivity. By ensuring efficient management of the radio frequency spectrum, the resolution addresses the challenges posed by the digital era, enabling businesses to harness the power of emerging technologies. This measure is crucial for bridging the digital divide between urban and rural areas, allowing companies in remote regions to access high-speed internet and digital services on par with their counterparts in cities. Thus, new tools for the digital transformation of the economy have the potential to help overcome the vulnerabilities caused by the war and improve the ability of businesses to adapt to the risks of military conflicts and actively participate in the country's recovery process.

The expansion of new digital transformation tools indicates the possibility of ensuring economic sustainability in a very difficult period for the country and attracting additional financial resources for technological progress in the recovery process (Mossberger *et al.*, 2022; Zhang *et al.*, 2023). Creating and supporting innovative enterprises based on advanced digital solutions and technologies has significant potential to provide Ukraine with a competitive advantage on the global stage. This will also help the country recover from the war and support its development once the conflict is over.

Ukraine's digital transformation under martial law faces a number of serious challenges that affect various aspects of the economy. Martial law conditions, especially when a country is in a state of conflict, can increase the threat of cyberattacks and cyberespionage (Kryvovvazyuk & Kryvoviaziuk, 2023). One of the most vulnerable areas is critical infrastructure, which includes energy facilities, transport systems, the banking industry, and other sectors that ensure the normal functioning of the country. Attacks on such facilities can have serious consequences for the

lives of citizens and the stability of the country. For example, on December 12, 2023, the world's largest hacker attack on the telecommunications infrastructure (Kyivstar) in Ukraine was carried out, resulting in the loss of communication for 24 million subscribers. The disruption affected the entire infrastructure that used Kyivstar services, causing serious infrastructure problems across the country. It is worth noting that this attack took place in the context of the Russian invasion of Ukraine. Microsoft, Cisco, Ericsson, and other companies were involved in the response to the attack. Therefore, it is extremely important to ensure a high level of cybersecurity for these facilities and systems. Cybersecurity measures include the development and implementation of modern systems for protecting, monitoring, and responding to cyber threats. It is also important to raise awareness among the public and cybersecurity professionals to avoid social engineering and other types of attacks (Cheberyako & Herus, 2023; Yehorycheva *et al.*, 2023).

Scholars see the importance of digitalization for the economy and businesses in the context of the modern world. The main common points that can be distinguished from this are the following. Theoretical and legislative framework – Ukraine has the necessary basis for the development of digitalization, both in terms of theoretical research and legislation. However, for the successful development of digitalization, it is important to combine theoretical research with the needs and capabilities of stakeholders such as business, government, and society (Endres *et al.*, 2022; Skare *et al.*, 2023). For the successful development of digitalization, Ukraine really lacks only a theoretical framework and relevant legislation. This is only the first step in the transition to a digital economy. The integration of digital strategies should be tailored to the specific requirements of industries and markets, providing a favourable climate for innovation and the development of the digital technology ecosystem. Only such a comprehensive approach will allow for truly maximising the potential of digitalization to improve the country's competitiveness.

Innovative nature: digitalization is innovative and important for business organisations, especially in the context of fierce competition and rapid technological development. It affects various aspects of business operations, including customer experience, partnerships, data management, innovation, resource management, and more (Bagheri *et al.*, 2019; Hokkanen *et al.*, 2021; Feliciano-Cestero *et al.*, 2023). Digitalization has indeed become a major catalyst for business organisations in the modern world. This process affects all aspects of their operations: from optimising customer experience to better managing resources and driving innovation. Thus, it is not just a tool for improving efficiency, but also a means of achieving strategic goals and developing an enterprise as an adaptive and open system. It is the key to successfully adapting to changes in modern fast-paced business environment and securing a competitive advantage.

Digitalization strategy: to ensure the competitiveness of enterprises, it is important to develop and implement a digitalization strategy that covers various aspects of business, such as customer service, partnerships, and collaborations with other stakeholders, data development and analysis, innovation, human resource management strategy, and corporate culture (Ultan, 2023; Yuan *et al.*, 2023).

Such a strategy should include not only technical aspects but also focus on cooperation with customers, partners, and other stakeholders, as well as data analysis and utilisation for driving innovation. Leveraging digital channels to enhance communication, co-create solutions, and deliver personalised experiences will be crucial for aligning digital initiatives with market needs and fostering ecosystem-wide synergies.

Consistency of implementation: it is important to follow a consistent and cyclical approach to the implementation of the digitalization strategy to minimise mistakes and effectively implement digital technologies in the business. Work on digitalization should be a constant iterative process (Bagheri *et al.*, 2019; Yuan *et al.*, 2023). It is worth believing that this is the right approach. Continuous improvement and iteration in digitalization work allows a company to adapt more quickly to changes in technology, market conditions, and customer requirements.

With restrictions on external contacts and customs, it is difficult to supply components, technologies, and services used in digital processes, which slows down the development of digital companies and limits their ability to innovate. In addition, martial law leads to a decrease in demand for digital products and services in domestic markets. Under such conditions, consumers and companies become more conservative and refrain from investing in digital technologies, which leads to a decrease in the revenues of companies operating in this sector. To foster the digital economy, several critical measures are essential across IT, education, science, and innovation. These include establishing a robust legal framework to regulate alternative funding sources and streamline investment procedures, thereby encouraging private sector investment in IT and innovation. Reforming higher education by granting universities more autonomy and updating curricula to meet labour market demands will significantly enhance the training of IT professionals. Initiatives to enhance digital literacy among the population through subsidised training programmes aim to bridge the digital divide, especially among non-internet users. Local authorities are urged to implement digitalization projects that improve community-level infrastructure, expand broadband access, and promote electronic services for residents, thereby advancing local digital development. Moreover, aligning Ukrainian intellectual property laws with EU standards will protect rights to inventions, copyrights, and intellectual property, thereby stimulating innovation and technological progress.

The digital transformation of Ukraine's economy has gained significant momentum, with the digital sector contributing substantially to the country's GDP and demonstrating resilience amidst the challenges posed by the ongoing military conflict. However, Ukraine's performance in global digital competitiveness rankings has been inconsistent, highlighting areas requiring improvement, such as future readiness and technological integration. Addressing cybersecurity vulnerabilities, bridging the digital divide, and fostering an enabling environment for innovation through legislative reforms and strategic partnerships are crucial for accelerating the country's digital transformation journey. Ultimately, a comprehensive approach that aligns digital strategies with industry-specific

requirements and fosters collaboration among stakeholders will be instrumental in maximising the potential of digitalization to enhance Ukraine's competitiveness.

■ DISCUSSION

Digital transformation affects various aspects of business, including internal processes, interactions with customers, suppliers, and partners, and the development of new products and services. However, it is important to keep in mind that digital transformation can be particularly challenging in the context of martial law. Martial law and instability pose serious challenges for Ukrainian businesses. But modern businesses are trying to adapt to the new conditions and find new opportunities in the digital space. Thus, the challenges of martial law are becoming catalysts for faster and more radical digital transformation in Ukraine (Buka *et al.*, 2022). This context gives the topic even more practical and academic significance, as it highlights the need to understand the relationship between digital innovation and the challenging economic and political environment. Under the influence of these challenges, the business environment and the government have begun to see digital transformation as a strategic imperative for the innovative development of Ukrainian business, which will not only allow it to survive in an unstable environment, but also to develop and create new innovative processes and products (Pyrih, 2023).

D. Kotelevets (2022) analyses the readiness of the Ukrainian economy for digital transformation. The author points out that Ukraine is currently not a world leader in terms of the pace of digitalization of the economy and does not use its full potential in this area. The article analyses basic indicators, including the number and structure of enterprises with Internet access, the availability of websites and chat services for communication with customers, and the sending of invoices in electronic or paper form. The author also points out the importance of digital transformation for the competitiveness of enterprises in the current competitive market environment and in the context of a pandemic and military operations. The article emphasises the importance of further research into the trends in the use of modern IT and their role in the development of the digital economy in Ukraine. The authors agree that digital transformation is crucial for Ukraine's economic competitiveness and resilience, but they differ in their emphasis on specific challenges and solutions. The authors highlight the need for a multifaceted approach, including the development of a legal basis for digital transformations, the creation of opportunities for innovation and entrepreneurship, and the integration of advanced technologies such as artificial intelligence and blockchain.

A study of the digital economy by A.A. Oloyede *et al.* (2023) covers the concept of the digital economy, the measurement of its impact, and the involvement of regulators in this process. It describes the challenges and seeks to harmonise definitions and indicators used in different countries. Instead, this study focuses on specific aspects of the digital transformation of business structures in Ukraine during martial law. It focuses on the essence of digital transformation in Ukraine, conducting a comparative analysis with the best digital economies in the world, assessing the level of digitalization, and identifying

initiatives and challenges that arise in the context of this transformation. The authors agree with the researchers' opinion that accurately defining and measuring the impact of the digital economy remains a complex endeavour, particularly in developing countries. Both studies acknowledge the challenges in harmonising definitions and metrics used across different countries due to the scarcity of appropriate datasets and variations in country-specific approaches.

The work of A. Fernández-Portillo *et al.* (2020) aims to analyse the impact of ICT on the economic growth of the European Union. The authors used the least squares method and the Digital Economy and Society Index databases for their analysis. The results of the study showed that progress in the introduction and use of ICTs has a positive impact on the economic growth of countries that are part of the developed European economies. The authors' conclusions about the driving force of ICTs in the economic growth of developed European economies reflect the essential aspects of this issue. It is worth agreeing with their conclusion that ICTs have an impact on economic development. Effective public policy should focus on the development of physical infrastructure and the efficient use of ICTs (Shpykuliak *et al.*, 2024). Compared to this study, which aimed to analyse the digital transformation of Ukraine's business structures under martial law, the work of the researchers is more general in its focus.

The study by P. Leão *et al.* (2023) examined the institutional problems that hinder companies' innovation activity, including the lack of clear rules, skilled labour, access to data and financial resources, which turned out to be the main factors hindering digitalization. The study also found that companies are able to identify opportunities and implement digital strategies that support the digitalization process, even despite the challenges. The authors correctly noted the positive impact of digitalization on business in all its aspects, including facilitating decision-making processes, increasing communication with customers and stakeholders, and improving products and services. It is particularly important to note that, in the context of small and medium enterprises, digitalization fosters innovation and facilitates opportunities for international expansion. In terms of challenges identified in emerging markets, low levels of regulation and insufficient data skills and resources are mentioned as impediments to rapid digitalization (Makedon *et al.*, 2022). However, it is important to note that companies are actively learning how to innovate and create their strategies using data to overcome these challenges. Compared to this study, which analyses the digital transformation of business structures under martial law, the study by the researchers focuses more on institutional constraints to innovation and digital transformation, while this study contains specific tasks aimed at assessing the level of digitalization in Ukraine and identifying existing problems and possible solutions in the context of war.

The study by Đ. Mitrović (2020) describes the use of data conversion analysis methods and the Malmquist Productivity Index to assess the effectiveness of digital economy development in the European Union. It is worth agreeing with the author's conclusions regarding the applied methodology, as it is an important tool for understanding the effectiveness of national strategies for the development of the digital economy in the European Union.

This methodology makes it possible to identify both the strengths and weaknesses of such strategies, which allows policymakers to focus on specific aspects to improve and optimise digital development. Compared to the present study, which examines in detail the aspects of digital transformation of business structures under martial law in Ukraine, the study by the researcher analyses the level of development of the digital economy in various European countries and focuses on the digital divide between the European Union and the Western Balkans. Both studies cover aspects of digital development but have a different geographical and thematic focus in their analyses.

The constraints faced by emerging economies can be an obstacle to the progress of the Ukrainian economy. Such economic processes, albeit indirectly, have the potential to increase employment and attract foreign capital in the form of wages to the country. Thus, digitalization is an important tool for increasing the competitiveness of Ukrainian enterprises and the economy, which requires further study and implementation of digital technologies in various aspects of business and society.

■ CONCLUSIONS

The digital transformation of Ukraine's business and economy is a critical endeavour that holds immense potential for enhancing competitiveness, productivity, and resilience in an increasingly digitalized global landscape. While the country has made strides in this direction, as evidenced by the growing contribution of the digital sector to GDP, persistent challenges underscore the need for a comprehensive and strategic approach. Addressing cybersecurity vulnerabilities must be a top priority, particularly in the face of heightened risks posed by the ongoing military conflict. Robust measures to protect critical infrastructure, such as energy facilities, transport systems, and the banking industry, from cyber threats are imperative. Developing and implementing modern systems for cybersecurity monitoring, protection, and incident response is crucial for safeguarding the digital ecosystem.

Furthermore, ensuring consistent access to digital technologies and services across all segments of society is essential to prevent the exacerbation of existing inequalities. Initiatives aimed at bridging the digital divide, such as subsidised training programmes and the expansion of broadband infrastructure in underserved areas, can foster inclusivity and maximise the benefits of digitalization. Legislative reforms play a pivotal role in creating an enabling environment for the digital transformation of businesses. Establishing a robust legal framework to regulate alternative funding sources, streamline investment procedures, and align intellectual property laws with EU standards can stimulate private sector investment, foster innovation, and protect intellectual property rights.

Strategic partnerships with international organizations, technology companies, and academic institutions can facilitate knowledge transfer, access to cutting-edge technologies, and best practices in digital transformation. Collaborative efforts can drive innovation, co-create solutions tailored to market needs, and accelerate the adoption of emerging technologies, such as 5G and artificial intelligence. As Ukraine navigates the complexities of digital transformation, prospects for further research include

exploring effective models for public-private partnerships, assessing the impact on traditional industries and employment patterns, and evaluating the role of digital technologies in post-conflict reconstruction and economic recovery efforts.

■ ACKNOWLEDGEMENTS

None.

■ CONFLICT OF INTEREST

None.

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Цифрова трансформація як імператив інноваційного розвитку бізнес-процесів в умовах воєнного стану (досвід України)

■ **Анотація.** Цифрова трансформація в бізнесі стає ключовим фактором, що визначає конкурентні переваги та життєздатність сучасних підприємств в економічному середовищі. Актуальність дослідження набуває особливого значення з огляду на важливість забезпечення безперервності бізнес-процесів в умовах нестабільного зовнішнього середовища. Метою дослідження було встановлення теоретичних, концептуальних та практичних засад цифрової трансформації на прикладі України в умовах воєнного стану та розробка рекомендацій щодо вдосконалення розвитку процесів цифрової трансформації. У дослідженні використано змішаний підхід. Економіко-статистичний аналіз з використанням таких методів, як обробка даних та порівняльний аналіз, виявив непослідовність України у світових рейтингах цифрової конкурентоспроможності, а також визначив сфери для покращення у сфері майбутньої готовності та технологічної інтеграції. Якісні методи, такі як аналіз, синтез, порівняння, систематизація, групування, індукція, дедукція та узагальнення, сприяли всебічному розумінню переваг, недоліків та викликів, пов'язаних із цифровою трансформацією в Україні, зокрема вразливостей кібербезпеки та цифрового розриву. Зокрема, метод систематизації дозволив ретельно розглянути основні недоліки та переваги цифрової трансформації. Метод групування дозволив скласти міжнародні рейтинги за різними критеріями в динаміці з метою виявлення тенденцій, що впливають на конкурентоспроможність. Було визначено, що усунення недоліків у сфері кібербезпеки має бути першочерговим завданням, особливо з огляду на посилення загроз, спричинених тривалою війною. Законодавчі зміни, зокрема, вважаються вирішальними для створення атмосфери, сприятливої для цифрової трансформації бізнесу. Підкреслено, що передачу знань, доступ до передових технологій та найкращих практик цифрової трансформації можна полегшити за допомогою стратегічних відносин зі світовими організаціями, технологічним бізнесом та академічними установами. У дослідженні надано практичні рекомендації щодо вдосконалення цифрової трансформації та визначено виклики, які необхідно вирішити для успішної реалізації подальших стратегій цифровізації в Україні

■ **Ключові слова:** інновації; цифровізація; електронна комерція; бізнес-моделі; кібербезпека