

DIGITAL BUSINESS TRANSFORMATION: TRENDS AND OPPORTUNITIES IN UKRAINE

Iryna Kalenyuk¹, Liudmyla Tsymbal², Marina Celika³

Abstract. The full-scale war in Ukraine has become a powerful catalyst for the digital transformation of national business. The article examines the current state, main drivers and challenges of business digitalisation in wartime. This paper presents the findings of a survey of Ukrainian enterprises on the digital activity of such enterprises, their adaptive capabilities, and the role of digital technologies in ensuring the continuity and sustainability of business processes. A substantial acceleration in the implementation of digital solutions and the possibilities of using artificial intelligence is revealed. Concurrently, disparities in digital preparedness have been documented among diverse sectors of the economy and across enterprise sizes. The features of the digitalisation of Ukrainian business and the expansion of economic activity opportunities are identified. The article focuses on digitalisation as a tool not only for survival, but also as a strategic opportunity for innovation, increasing competitiveness and integration into global markets. Separately, recommendations are provided for state policy and businesses to support digital development within the context of reconstruction. The article argues that digitalisation is a strategic resource for recovery and increasing competitiveness, as well as being an anti-crisis tool, and is essential for integrating Ukraine into global economic processes. The authors offer recommendations to strengthen business digital readiness and improve state policy to support digital transformation during and after wartime.

Keywords: digital transformation, Ukrainian business, digitalisation, war economy, business resilience, technological adoption, innovation under uncertainty, digital strategy.

JEL Classification O33, L86, M15, L26

1. Introduction

The full-scale war in Ukraine has posed a serious challenge to the country's economy, resulting in a humanitarian catastrophe and colossal economic losses. Virtually all businesses have suffered significant losses: supply chains have been disrupted, markets have become inaccessible, personnel shortages have emerged, and the risk to life has become an everyday reality. The Russian invasion of Ukraine has had a significant impact on the business sector in the country, giving rise to a number of major challenges. These include logistical difficulties due to the closure of transport corridors or their damage, the destruction of important infrastructure, including warehouses, offices and production facilities, the relocation of employees or their mobilisation into the ranks of the army, a decline in the purchasing power of the

population, financial instability, investor caution and difficulties in attracting capital, and a decrease in domestic demand in many traditional areas. Nevertheless, Ukrainian business has demonstrated resilience and the capacity for expeditious adaptation, a flexible approach, and proactive utilisation of digital technologies. In such challenging conditions, businesses that were able to swiftly adapt their operational processes were found to be sustainable. Those who prioritised mobility and innovation were better positioned to successfully navigate the crisis, in contrast to those who relied solely on the availability of substantial resources.

Digitalisation is one of the key tools for adapting a business to new conditions. It enables businesses to find new niches, enter new markets and identify new opportunities for producing and supplying products.

¹ Kyiv National Economic University named after Vadym Hetman, Ukraine
Riga Nordic University of Applied Sciences, Latvia (*corresponding author*)
E-mail: kalenyuk@ukr.net

ORCID: <https://orcid.org/0000-0003-1807-2849>

² Kyiv National Economic University named after Vadym Hetman, Ukraine
E-mail: ltymbal@ukr.net

ORCID: <https://orcid.org/0000-0002-0873-9227>

³ Riga Nordic University of Applied Sciences, Latvia
E-mail: marina.celika@isma.lv

ORCID: <https://orcid.org/0009-0008-7588-0539>



This is an Open Access article, distributed under the terms
of the Creative Commons Attribution CC BY 4.0

Digital technologies are transforming every aspect of human existence, from communication methods to production and logistics processes. This transformation is happening very rapidly and comprehensively. Digitalisation is the large-scale penetration of digital technologies into all areas of public life, particularly the economy. It involves the active use of digital tools to automate existing processes and communications in all areas of life, including the economy, politics and personal life. This global process inevitably covers all links and stages of economic processes, albeit at varying speeds. The latest digital technologies (AI, the Internet of Things, fintech, virtual reality, etc.) offer many opportunities. They not only accelerate the production and supply of products and services, but also create a whole new world. They offer new production methods and products, creating a whole new world.

This is why, in today's highly competitive world, businesses should actively engage in digital transformation processes. This applies to all businesses and occurs to a greater or lesser extent everywhere. At the same time, it is important to study these processes, identifying their main trends, problems and obstacles. To analyse these processes, a sociological survey was conducted with Ukrainian business representatives regarding their interaction with educational and scientific institutions, the public, and state administration bodies. A significant component of the survey comprised a series of inquiries pertaining to business involvement in digital transformation processes and perspectives on the potential for Ukraine's post-war recovery. The aforementioned survey was conducted in March 2025 as part of the research work "Smart imperatives of digital transformation of the knowledge ecosystem in the conditions of economic recovery in Ukraine", which is being carried out by scientists of the Kyiv National Economic University named after Vadym Hetman. The objective of the project is to examine the processes of digital transformation and smartization as the foundation for the recovery of the Ukrainian economy.

2. Literature Review

The pervasive penetration of digital technologies into the economy and other areas of life is rapidly expanding. Such a dynamic situation necessitates the expansion of the categorical apparatus and the clarification of such well-known concepts as "digitalisation" and "digital transformation". The issue of digitalisation is extremely relevant in scientific research. A huge number of publications are devoted to exploring the nature of this process, its characteristics, how it relates to other global processes and how it is phased, with each stage being allocated its own key characteristics.

The most well-known approach involves allocating stages such as: digitisation, digitalisation and digital transformation (Bokolo, 2020; Bumann & Peter, 2019; Haryanti, 2023; Kraus et al., 2022; Reis, Amorim, Melão, Cohen & Rodrigues, 2020; Verhoef et al., 2021; Vial, 2019). The advent of ICT in people's lives, and its subsequent large-scale dissemination, commenced with digitisation, which is defined as the transition from analogue to digital tools. Boratyńska (2019) defines it as the process of converting information from analogue to digital, which can result in changes to the existing business model in order to provide value to stakeholders. Bokolo (2021) defines digitisation as the process of converting information from analogue to digital, which can result in changes to existing business models to provide value to stakeholders. Bumann & Peter (2019) notes that digitisation refers to data. It is the process of converting analogue information into a digital format (i.e., zeros and ones), enabling computers to store, process and transmit it. Verhoef defines digitisation as the process of converting analogue information into digital information. Digitisation typically involves the conversion of internal and external documentation processes, but does not affect value creation activities (Verhoef et al., 2021).

The next stage, digitalisation, has different definitions, but the prevailing view is that it affects not only data (resources), but all processes in general. It is defined as the use of digital technology to transform existing business processes (Verhoef et al., 2021), and describes how digital technology transforms existing business processes (Haryanti, 2023). Digitalisation is the second phase, meaning "the process of using digital technology and its impact" (e.g., the digitalisation of a process) (Buman, 2019). An important feature of digitalisation is its impact on the processes of value creation: reducing costs, accelerating transactions, optimising logistics chains and giving rise to new digital products and services.

The term "digitalisation" is often used interchangeably with "digital transformation", but this is not entirely correct since they have different meanings. Digitalisation is associated with the spread of digital technologies, and from a business perspective, it relates to internal processes. According to Sutirtha Chatterjee and Suprateek Sarker, digitalisation can be understood in terms of three key aspects: hyperconnectivity due to the infusion of unprecedented technology; datafication/robotification; and platformisation (Chatterjee, 2024). Altering internal activities implies a transformation of the external environment. Digital transformation implies a change in business behaviour in the external environment, such as testing new products and services and developing new strategies. It is often associated with the term "creation". Businesses already operate within a context

of platforms, global interdependence and the spread of artificial intelligence. In the current dynamic business landscape, digital transformation is recognised as a critical driver of entrepreneurship, innovation and growth (Gkika, 2025). It represents the "transformation of business operations", involving the restructuring of organisational infrastructure through digital tools that fundamentally change operational processes and modes of customer interaction (Mackenzie, 2022). Digital transformation encompasses more than just the digitisation of processes and services (Mergel, 2019). It is when an organisation uses new technologies to redesign and redefine its relationships with customers, employees and partners. For businesses, digital transformation covers everything from modernising applications and creating new business models to developing new products and services for customers. Digital transformation is defined as "a process that aims to improve an entity by triggering significant changes to its properties through the combination of information, computing, communication and connectivity technologies" (Vial, 2019). Digital technologies themselves are not important; the real focus is on transforming the business, with technology serving only to support the new business model (Wade, 2018). Digital transformation involves the changes that digital technologies can bring about in terms of a company's business model, products, processes, and organisational structure (Hess et al., 2016).

Concurrently, the term "digital transformation" is subject to divergent interpretations. Transformation can vary widely in terms of scope and trajectory. It may pertain to internal processes, external relations, specific aspects of activity, or even fundamental shifts. As posited by Alshammari (Alshammari, 2023), Lozić (2019; 2024), and Patel (2019), the stage of digital optimisation functions as the basis for digital transformation. To leverage digital transformation, it is imperative that businesses optimise and enhance their operational processes (Alshammari, 2023). Digital optimisation involves using digital technology to enhance existing operating processes and business models (Patel, 2019). It improves business processes and customer relationships. Digital transformation directly impacts new products, services, and the development of new business models (Lozić, 2019). Lozić (2019; 2024) conducts fundamental research on the processes of digitalisation, digital optimisation, and digital transformation, linking these stages to the stages of the Industrial Revolution.

Gianluca Elia et al. proposed a conceptual framework to support digital transformation that includes the key dimensions of technology, processes, people, and value orientation. The authors view digital transformation as a new industrial revolution that generates benefits at the operational and strategic levels by disrupting traditional business models and transforming existing

processes. This revolution creates new systems, better working conditions, and innovative potential (Elia, 2024). Digital transformation is a multidisciplinary process that orchestrates value creation, structural changes, technology usage, and financial issues.

Thus, the logical chain of Digitisation, Digitalisation, Digital Optimisation, and Digital Transformation reflects the general sequence of deploying digital technology processes. For any business, this signifies the rationale underpinning its digital evolution: from the digitisation of all data to the digitisation of all internal operational processes, to the comprehensive optimisation of its digital environment with the external environment, and the transition to the development of new digital products and services. As G. Lanzolla observes, the process of digitisation and the utilisation of digital tools have the potential to reconfigure existing knowledge structures, thereby contributing to the emergence of novel business models, such as the "smartness" of contemporary products and the adoption of platforms (Lanzolla et al., 2020). The ability to comprehend the significance of such alterations, consistency, and the implementation of suitable strategic resolutions is paramount to attaining novel competitive advantages within the market and, in general, assuming leadership roles within the business.

The purpose of the article is to analyse the trends of the digital transformation of Ukrainian business in the current conditions of a full-scale war and the need to ensure economic recovery.

Methodology. The survey, conducted by the consulting company Aktiv-Group, was based on a combined study. The study incorporated both quantitative and qualitative elements. The quantitative element comprised an online questionnaire, while the qualitative element involved in-depth interviews with business representatives. A total of 300 enterprises were surveyed throughout the country, with the exception of the occupied territory.

3. Main Research Material

In the modern world, digitalisation is becoming a key condition for businesses to develop and achieve competitive advantages. This is particularly important for domestic businesses during the full-scale war in Ukraine. Digitalisation creates opportunities for companies to be flexible, accessible and competitive, even in extremely difficult conditions. Online stores, chatbots and mobile applications have become the primary sales channels. Social networks such as Instagram, TikTok and Telegram now function as trading platforms, with innovations such as online booking, electronic payments and digital queues becoming the norm. Using online accounting and electronic documents minimises paperwork. This transformation has the potential to engender

a number of benefits, including the conservation of resources, a reduction in human error, and a more efficient response to change. Cloud services such as Google Workspace and Microsoft 365 have become essential for remote teams. VPN tools, data encryption and access policies enhance information security, even during active combat operations. Online collaboration platforms such as Zoom, Slack and Trello help teams to stay productive, regardless of their physical location. Targeted advertising, SEO and email marketing have become the main channels for acquiring customers. Thanks to AI technologies and analytics, user behaviour can be tracked to allow personalised offers to be made. Online customer support platforms such as Zendesk and Intercom streamline communication.

Ukrainian entrepreneurs are making active use of platforms such as Diia.Business, Ednannia and EU4Business, among others, to access free courses, consultations, grants and business incubators. These resources help to develop digital skills and build teams online. Internet banking from providers such as Monobank, Privat24 and Sense has become widespread and is now the standard. QR payments, POS terminals and cryptocurrency are expanding the range of payment methods available. Electronic cash registers and online invoices ensure payment transparency and facilitate reporting to donors and partners. Artificial intelligence can be used to forecast demand, create content and improve customer service. Big data analysis enables informed business decisions to be made. Popular tools include ChatGPT, Midjourney, Power BI and Google Analytics. Digitalisation has become a kind of business immunity during the war. It enables Ukrainian companies to adapt quickly to new challenges, work in unstable conditions, expand into new markets, experiment with alternative working formats, maintain contact with customers and scale up their business while retaining their workforce.

One of the key factors influencing the current state of Ukrainian business development is enterprises' ability to adapt to extraordinary conditions caused by military action. According to the survey results, nearly a third of companies (29.7%) have fully restored their activities

and returned to normal functioning. Another third (27.3%) were able to partially restore their enterprises' activities to a significant extent, ensuring the minimum required level of operational activity (Figure 1). However, it is important to note that over 40% of businesses have yet to return to a stable operating mode. Among the respondents, 21.7% reported that, in order to achieve a full recovery, a significant amount of additional resources, including both financial investments and human capital, were required. Furthermore, 21.3% of business representatives are in the stage of an active recovery process, which indicates a gradual return to normal work. It is noteworthy that this process proved most successful in small settlements across the country, as well as in the northern and western regions of Ukraine, which demonstrated a capacity to adapt to new conditions with greater alacrity and to restore economic activity.

At the same time, respondents evaluate the degree to which their companies' activities are digitalised differently. Some companies strive to automate all possible processes but still assess their level of digitalisation as average. Some companies have a high level of digitalisation, ranging from going online in 2019 to the large-scale implementation of AI. However, some enterprises have a minimal level of digitalisation due to industry-specific factors and a lack of demand. In response to the question "How do you assess the level of digitalisation within your company's activities?", more than half of the enterprises (50.3%) reported being partially digitalised. A further 31.3% stated that their operations are fully digitalised, with some incorporating elements of artificial intelligence (AI). Although these figures may appear relatively positive, it is concerning that 12.3% of enterprises remain entirely non-digitalised. Such results are rather unfavourable in the current era of artificial intelligence and cannot be explained solely by the specific characteristics of individual industries (see Figure 2).

The main trends can be described as follows:

- The issue of robotisation is being discussed as a potential solution to the labour shortage. This is particularly pertinent given the substantial personnel

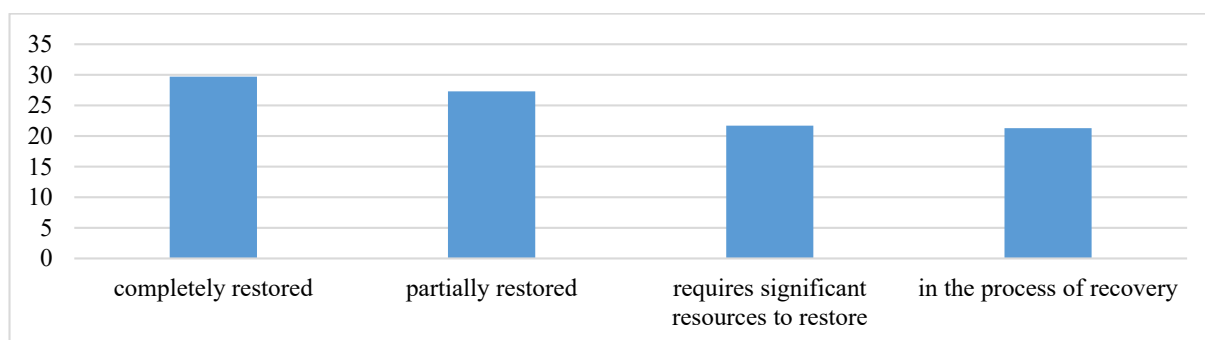


Figure 1. Level of assessment of the state of Ukrainian companies, 2025, %

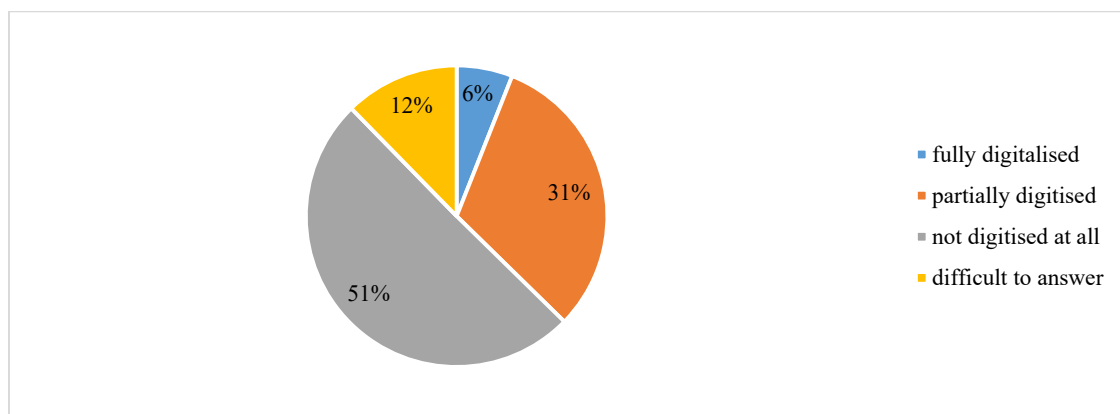


Figure 2. Assessment of the level of digitalisation of Ukrainian companies, 2025, %

shortage resulting from mobilisation and the aftermath of military operations.

– There is an urgent need for affordable Ukrainian software. The high cost of European solutions is prompting some users to turn to Russian products, which carries certain risks.

– An increasing number of businesses are forced to create their own software solutions. This approach is largely a consequence of the previous situation, in which a lack of local alternatives forced companies to develop their own software products.

One of the key ways to support business is to stimulate the development of affordable Ukrainian software at a competitive price.

The distribution of companies according to the types of urban settlements merits particular consideration, as it facilitates an assessment of their level of digitalisation. The highest concentrations of fully digitalised companies have been observed in various

types of settlements, with the largest number of such companies operating in cities with a population of up to 50 thousand people, where their share is 55.6%. In megacities, this figure reaches 36.2%, and in rural areas, it is 44.4%. This finding suggests a nascent interest in digital technologies, even within less urbanised regions. Concurrently, companies that are at the stage of partial digitalisation are most represented in large cities with a population of 100 to 400 thousand inhabitants. In this segment, the proportion of enterprises that have adopted such practices stands at 60.6%. A decline in figures was observed in cities with a population of 400,000 to 1 million people (55.0%), as well as in cities with a population of 50,000 to 100,000 people (52.4%). This distribution illustrates the gradual shift towards digital formats among companies, particularly in medium and large administrative centres where significant human, financial, and technological resources are concentrated (see Fig. 3).

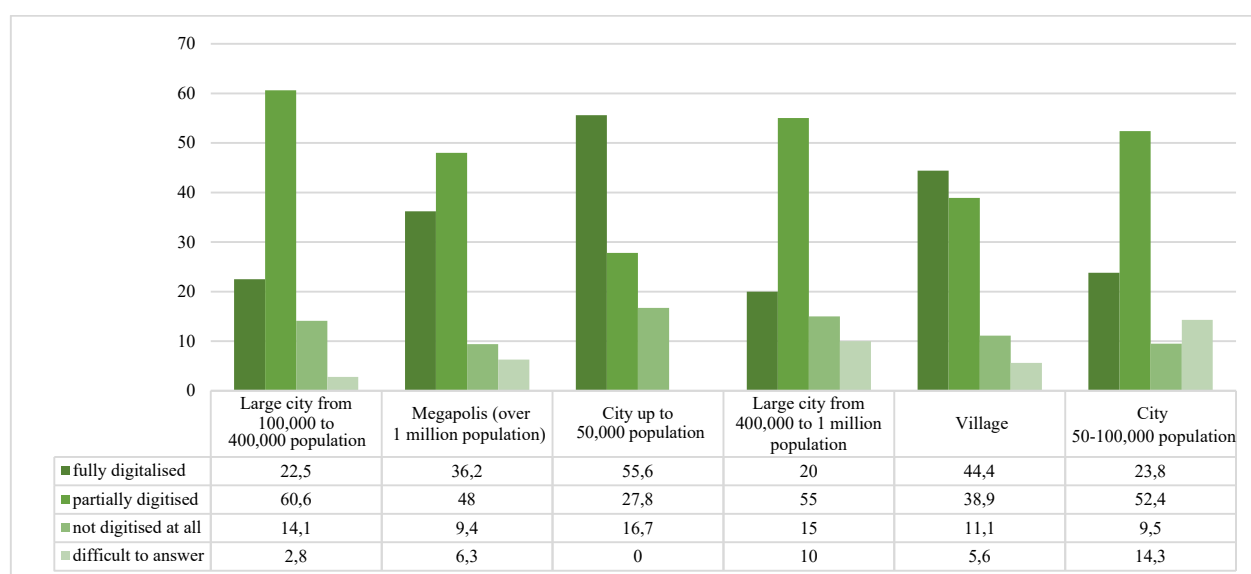


Figure 3. Level of digitalisation of Ukrainian companies depending on the size of settlements, 2025, %

It is also worth noting that the northern and western regions are the most active in terms of digitalisation processes. This may be primarily due to military action and the presence of relocated businesses that quickly become involved in innovation processes, including digitalisation (see Fig. 4).

An important question is how much the digitalisation process has changed since hostilities began in Ukraine. In general, the implementation of digital solutions has intensified since the start of hostilities. Such a stressful situation can lead to economic and personnel restrictions. In conditions where it is difficult to find personnel, owners are actively considering the possibility of replacing their functions with robots and computer programmes. Companies with an existing digital infrastructure were able to adapt quickly and even increase their level of digitalisation.

It is notable that certain companies were able to swiftly resume operations following the onset of a full-scale invasion by implementing remote work arrangements. This was primarily enabled by the experience gained

during the quarantine due to the COVID-19 pandemic. In certain corporate entities, the degree of digitalisation remained constant due to an absence of necessity and diminished demand. However, even in such cases, there are endeavours to apply digital technologies, particularly in the context of online trading (Fig. 5).

It is noteworthy that the most significant advancements in digitalisation are observed in cities with a population of up to 100,000 inhabitants, where the digitalisation rate among companies has reached 40%. In urban areas with a population exceeding one million, the proportion of digitally connected companies has reached 30%, while in cities with populations up to 400 thousand, the figure stands at slightly over 30% (Fig. 6).

Digitalisation is currently experiencing rapid growth, particularly in megacities and smaller towns, where the presence of flexible infrastructure facilitates expeditious adaptation to novel circumstances. Concurrently, approximately half of the rural population reports no perception of change, thereby highlighting the persisting

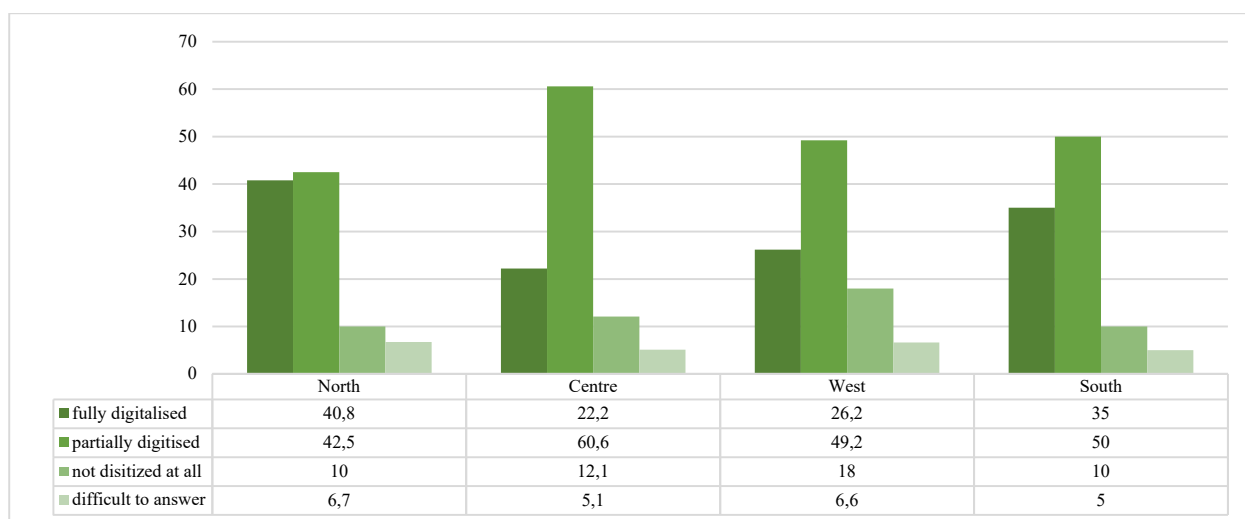


Figure 4. Level of digitalisation of Ukrainian companies depending on the region, 2025, %

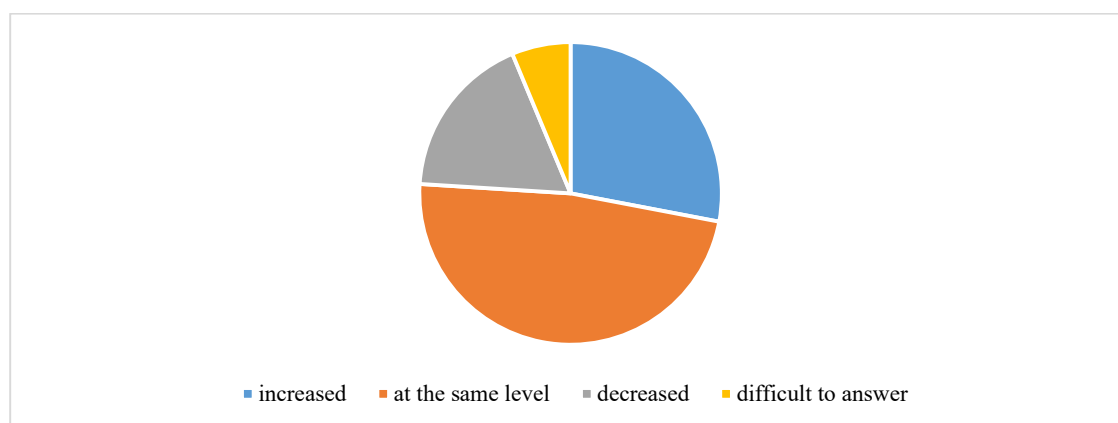


Figure 5. Change in the level of digitalisation of Ukrainian companies since the beginning of the war, 2025, %

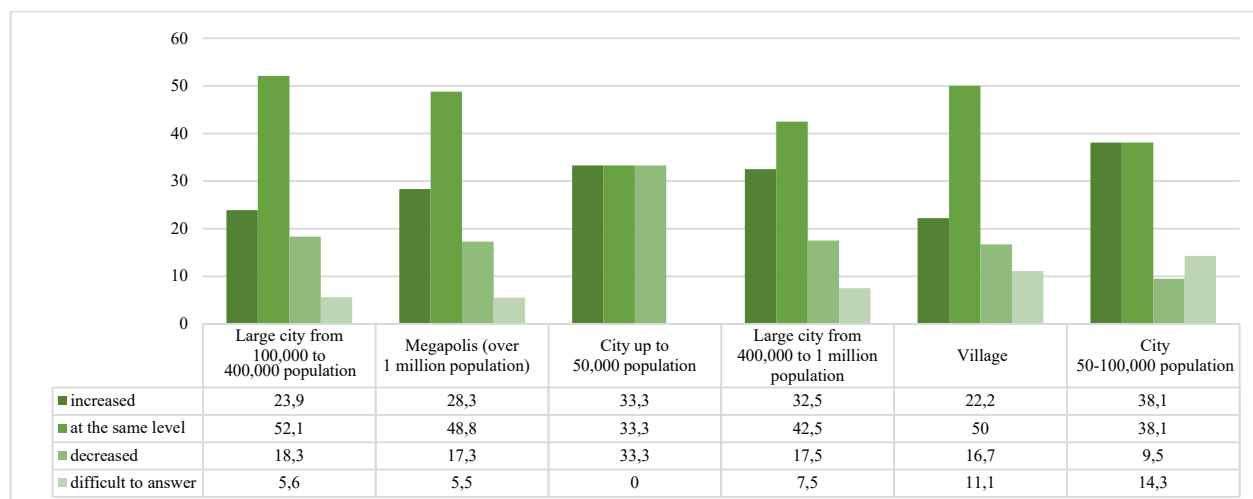


Figure 6. Level of digitalisation of Ukrainian companies depending on the size of the settlement, 2025, %

severity of the digital divide, which necessitates resolution. In medium-sized cities, a decrease in the pace of digitalisation is observed, indicating uneven adaptation processes. The absence of clarity in the responses highlights the prevalence of inadequate digital literacy skills across numerous regions of the country.

A greater increase in digital skills is observed in the north of the country, while the highest decrease in digitalisation occurs in the south. In the northern region, positive dynamics are expected in the development of digital skills, which are probably related to indicators of artificial intelligence use. In most regions, a trend of stability without significant improvement is observed, covering about half of the population. The situation in the south remains the most problematic, with not only minimal growth but also a noticeable decline in indicators and high uncertainty (see Fig. 7).

In the contemporary digital era, it is imperative to comprehend the extent to which businesses are incorporating artificial intelligence technologies into their operations. The survey results indicate that 27% of respondents answered in the affirmative, while an additional 20.3% noted that they are not currently using these technologies, but intend to implement them in the future. However, the majority of respondents (52%) reported that they do not use artificial intelligence in their work (Fig. 8).

A notable finding is that the majority of companies implementing artificial intelligence technologies are located in megacities (33.1%) and small towns with a population of up to 50 thousand people (50.0%) (Fig. 9).

Among the regions of Ukraine, the undisputed leader in this aspect is the northern region, while the lowest percentage is recorded in the western region.

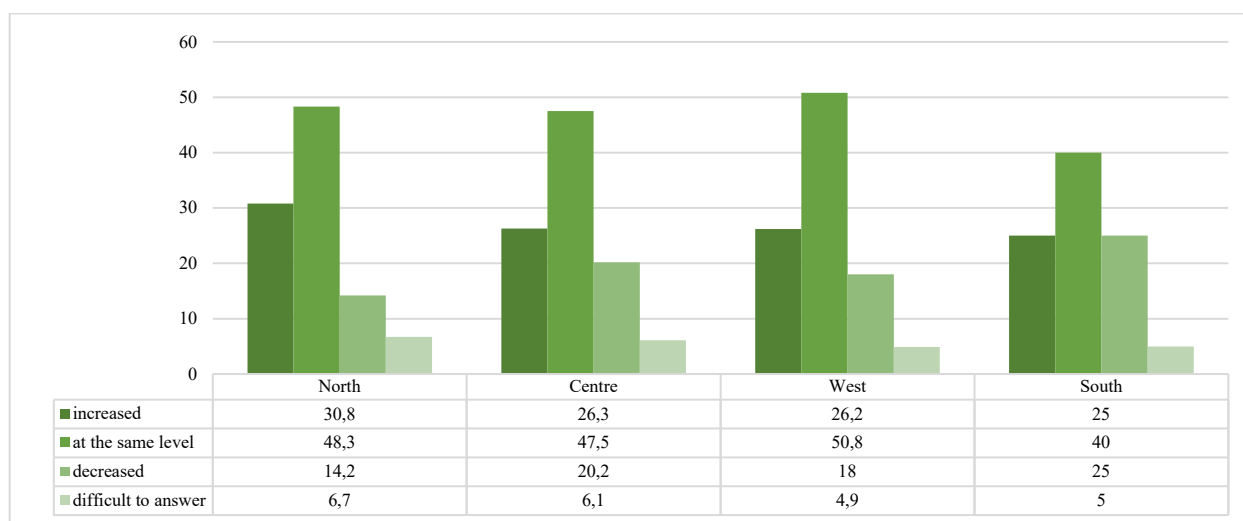


Figure 7. Level of digitalisation of Ukrainian companies depending on the region of location, 2025, %

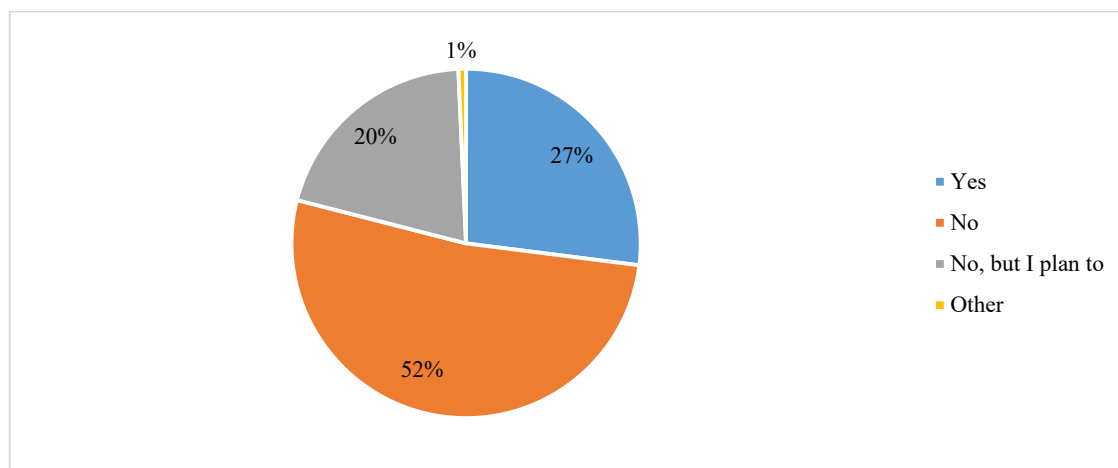


Figure 8. Level of AI use by Ukrainian companies, 2025, %

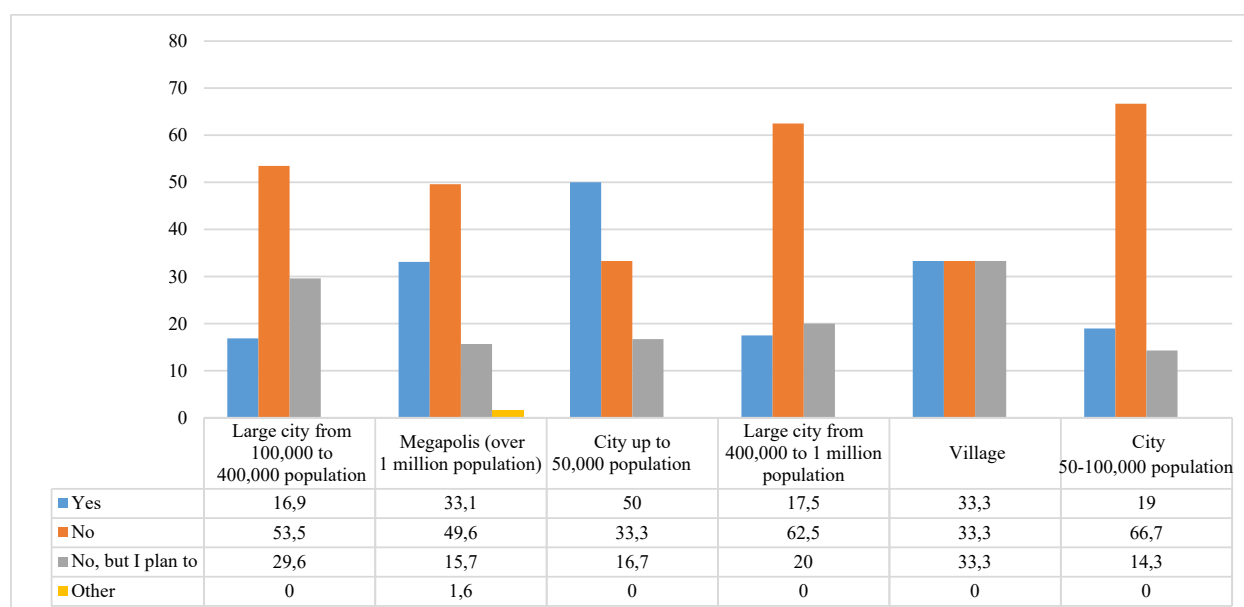


Figure 9. Level of AI use by Ukrainian companies depending on the size of the settlement, 2025, %

The use of artificial intelligence in Ukraine demonstrates significant regional disparities, which are primarily due to differences in the level of digital infrastructure development and technological culture. The north is characterised by the greatest progress in implementing such systems, supported by its developed infrastructure and active engagement of relevant resources, placing it significantly ahead of other regions. In contrast, the central and southern parts of the country lag behind both in the practical use of AI and in creating appropriate conditions for its active application, which negatively affects their technological development prospects. The western region, although currently showing a low level of technological implementation, demonstrates considerable potential for growth – provided that infrastructure stabilises and investments in advanced technologies are made (see Fig. 10).

Although the level of digitalisation has increased significantly, this process is developing unevenly. Around 30–33% of businesses have made significant progress with digitalisation, which is particularly evident in megacities and small towns. At the same time, however, more than 40–50% of respondents stated that the level of implementation of digital technologies has remained unchanged. This trend may be due to process inertia or insufficient available resources. The type of settlement significantly affects the dynamics of digitalisation. Megacities and large cities (those with a population of over 400,000) demonstrate faster progress thanks to their developed infrastructure and better access to digital services. Meanwhile, villages and small towns experience more modest rates of digitalisation. Here, too, a significantly larger proportion of respondents cannot identify any

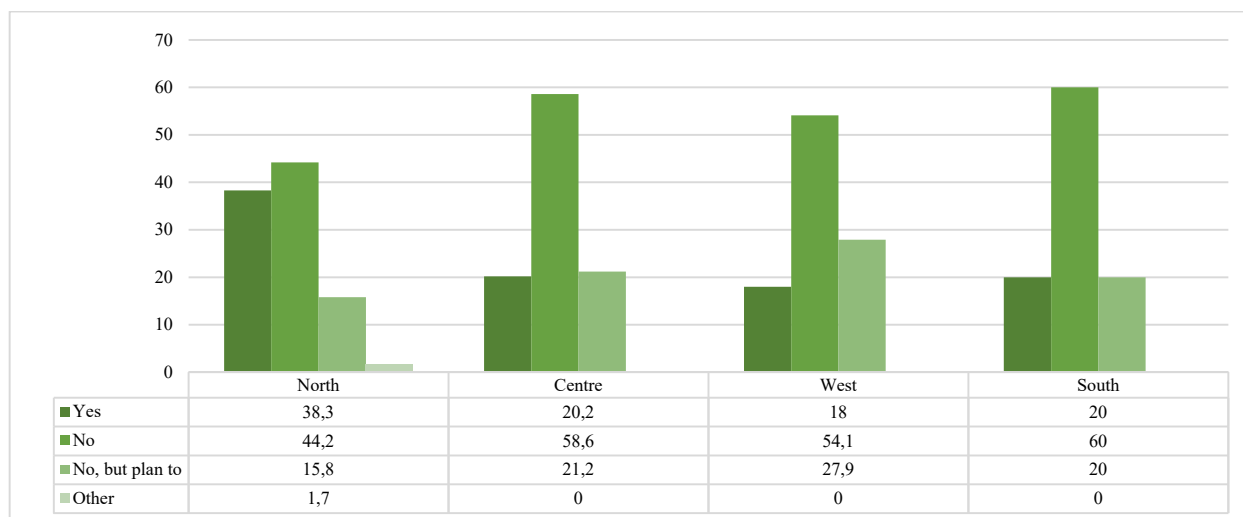


Figure 10. Level of AI usage depending on the region of the company's location, 2025, %

changes, emphasising the existence of digital inequality between regions. In different regions and settlements, between 14% and 25% of respondents reported a decline in digitalisation.

The primary factors contributing to this phenomenon may include damage to infrastructure, power outages, staff reductions, or constrained financial resources. The results demonstrate the relevance of implementing special digital support programmes for small and medium-sized businesses, particularly in the regions. It is necessary to focus on training entrepreneurs and their teams in the effective use of digital tools, as well as on improving digital infrastructure, including access to high-quality internet, stable energy supply and cybersecurity measures.

4. Conclusions

Although the level of digitalisation of Ukrainian businesses has shown positive dynamics during the war, it remains fragmented and uneven. The most

digitally advanced businesses are located in large cities and megacities. The main barriers are related to infrastructure, finance and education. Further digitalisation requires systemic support, skills development, and the elimination of digital inequality between regions and sectors.

Today, digitalisation is about more than just introducing the latest technologies. It has become a fundamental strategy for sustainable development, providing businesses with the flexibility to adapt quickly, focus on customer needs, and maintain a competitive position, even in difficult crisis situations. Digitalisation has introduced a new way of working for Ukrainian businesses. It has transformed a challenge into an opportunity, contributing to job preservation, export potential growth and the development of a new type of entrepreneurship. Going forward, it is digital models that will form the basis of Ukraine's economic reconstruction and innovative breakthrough, independent of geography, offline infrastructure or political stability.

References:

- Alshammari, K. H. (2023). The potential impacts of digital transformation on organizations. *Amazonia Investiga*, 12(64), 9–18. DOI: <https://doi.org/10.34069/AI/2023.64.04.1>
- Bokolo, A. (2021). Managing digital transformation of smart cities through enterprise architecture – a review and research agenda. *Enterprise Information Systems*, 15:3, 299–331. DOI: <https://doi.org/10.1080/17517575.2020.1812006>
- Boratyńska, K. (2019). Impact of Digital Transformation on Value Creation in Fintech Services: An Innovative Approach. *Journal of Promotion Management*, 25 (5), 631–639. DOI: <https://doi.org/10.1080/10496491.2019.1585543>
- Bumann, J., & Peter, M. (2019). Action fields of digital transformation—a review and comparative analysis of digital transformation maturity models and frameworks. *Digitalisierung Und Andere Innovationsformen Im Management*, 2(November), 13–40.
- Chatterjee, S., & Sarker, S. (2024). Toward a better digital future: Balancing the utopic and dystopic ramifications of digitalization. *The Journal of Strategic Information Systems*, Volume 33, Issue 2, 101834. DOI: <https://doi.org/10.1016/j.jsis.2024.101834>
- Elia, G., Solazzo, G., Lerro, A., Pigni, F., & Tucci, C. L. (2024). The digital transformation canvas: A conceptual framework for leading the digital transformation process. *Business Horizons*, Volume 67, Issue 4, Pages 381–398. DOI: <https://doi.org/10.1016/j.bushor.2024.03.007>

- Gkika, E. C., Kargas, A., Salmon, I., & Drosos, D. (2025). Unveiling Digital Maturity: Key Drivers of Digital Transformation in the Greek Business Ecosystem. *Administrative Sciences*, 15(3), 96. DOI: <https://doi.org/10.3390/admsci15030096>
- Hai, T. N., Van, Q. N., & Tuyet, M. N. T. (2021). Digital transformation: Opportunities and challenges for leaders in the emerging countries in response to COVID-19 pandemic. *Emerging Science Journal*, 5(Special Issue), 21–36. DOI: <https://doi.org/10.28991/esj-2021-SPER-03>
- Haryanti, T., Rakhmawati, N. A., & Subriadi, A. P. (2023). A comparative analysis review of digital transformation stage in developing countries. *Journal of Industrial Engineering and Management*, 16(1), 150–167. DOI: <https://doi.org/10.3926/jiem.4576>
- Hess, T., Matt, C., Benlian, A., & Wiesböck, F. (2016). Options for Formulating a Digital Transformation Strategy MIS Quarterly Executive, Vol. 15, No. 2, pp. 103–119. Available at: https://www.researchgate.net/publication/291349362_Options_for_Formulating_a_Digital_Transformation_Strategy
- Imran, F., Shahzad, K., Butt, A., & Kantola, J. (2021). Digital Transformation of Industrial Organizations: Toward an Integrated Framework. *Journal of Change Management*, 21:4, 451–479. DOI: <https://doi.org/10.1080/14697017.2021.1929406>
- Kraus, S., Durst, S., Ferreira, J. J., Veiga, P., Kailer, N., & Weinmann, A. (2022). Digital transformation in business and management research: An overview of the current status quo. *International Journal of Information Management*, 63 (2022), Article 102466. DOI: <https://doi.org/10.1016/j.ijinfomgt.2021.102466>
- Kryvinska, N., & Bickel, L. (2020). Scenario-based analysis of it enterprises servitization as a part of digital transformation of modern economy. *Appl Sci.*, 10(3):1076. DOI: <https://doi.org/10.3390/app10031076>
- Lanzolla, G., Lorenz, A., Miron-Spektor, E., Schilling, M., Solinas, G., & Tucci, C. L. (2020). Digital transformation: What is new if anything? Emerging patterns and management research. *Academy of Management Discoveries*, 6 (3), pp. 341–350. DOI: <https://doi.org/10.5465/amd.2020.0144>
- Li, F., Nucciarelli, A., Roden, S., & Graham, G. (2016). How smart cities transform operations models: A new research agenda for operations management in the digital economy. *Production Planning and Control*, 27(6), 514–528. DOI: <https://doi.org/10.1080/09537287.2016.1147096>
- Lozić, J., & Fotova Čiković, K. (2024). Digital optimization: Core concept of digital transformation. 108th International Scientific Conference on Economic and Social Development – "Financial Literacy for Economic and Social Development". Book of Proceeding., pp. 75–87.
- Lozić, J., & Fotova Čiković, K. (2024). Digital transformation: The fundamental concept of transformation of business activities. 107th International Scientific Conference on Economic and Social Development – Economic and Social Survival in Global Changes, Zagreb, pp. 326–337. ISSN 1849-7535.
- Lozić, J. (2019). "Core concept of business transformation: From business digitalization to business digital transformation." 48th International Scientific Conference on Economic and Social Development – "Managerial Issues in Modern Business". Warsaw, str. 159–167.
- Mackenzie, A., & Nygel, J. The 4 pillars of digital transformation. September 20, 2022. Available at: <https://www.thinkcompany.com/blog/the-4-pillars-of-digital-transformation/>
- Mergel, I., Edelmann, N., & Haug, N. (2019). Defining digital transformation: Results from expert interviews. *Government Information Quarterly*, 36(4), 101385. DOI: <https://doi.org/10.1016/j.giq.2019.06.002>
- Pagani, M., & Pardo, C. (2017). The impact of digital technology on relationships in a business network. *Industrial Marketing Management*, 67, 185–192. DOI: <https://doi.org/10.1016/j.indmarman.2017.08.009>
- Patel, M. (2019). "Digital Transformation vs. Digital Optimization". Medium. Available at: https://medium.com/@maxy_ermayank/digital-transformation-vs-digital-optimization-5c86cff1567b
- Reddy, S. K., & Reinartz, W. (2017). Digital Transformation and Value Creation: Sea Change Ahead. *NIM Marketing Intelligence Review*, 9(1), 10–17. DOI: <https://doi.org/10.1515/gfkmir-2017-0002>
- Reis, J., Amorim, M., Melão, N., Cohen, Y., & Rodrigues, M. (2020). Digitalization: A Literature Review and Research Agenda. In: Anisic, Z., Lalic, B., Gracanin, D. (eds), Proceedings on 25th International Joint Conference on Industrial Engineering and Operations Management – IJCIEOM. IJCIEOM 2019. Lecture Notes on Multidisciplinary Industrial Engineering. Springer, Cham. DOI: https://doi.org/10.1007/978-3-030-43616-2_47
- Verhoef, P. C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Qi Dong, J., Fabian, N. et al. (2021). Digital transformation: A multidisciplinary reflection and research agenda. *Journal of Business Research*, 122, 889–901. DOI: <https://doi.org/10.1016/j.jbusres.2019.09.022>
- Vial, G. (2019). Understanding digital transformation: a review and a research agenda. *The Journal of Strategic Information Systems*, 28, 2, 118–144. Available at: <https://www.sciencedirect.com/science/article/pii/S0963868717302196>
- Wade, M. R., Avagyan, K., & Stehli, S. (2018). "Digital business transformation – getting it right". IMD. Available at: <https://www.imd.org/research-Knowledge/articles/-DigitalbusinessstransformationGettingitright/>
- What is Digital Transformation? Available at: <https://cloud.google.com/learn/what-is-digital-transformation>

Received on: 23th of August, 2025

Accepted on: 07th of October, 2025

Published on: 13th of November, 2025