https://doi.org/10.33271/nvngu/2026-2/176

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THE IMPACT OF GLOBAL DIGITAL TRANSFORMATION OF BUSINESS PROCESSES ON THE ECONOMIC EFFICIENCY OF ENTERPRISES

Purpose. The study aims to comprehensively examine how worldwide shifts in business process digitalisation affect the financial performance of Ukrainian companies within the Industry 4.0 framework, exploring the role of cloud technologies, artificial intelligence, and digital platforms as drivers that convert digital capital expenditures into sustainable competitive positioning.

Methodology. The methods include a theoretical review and content analysis of indicators of digital maturity of enterprises by economic sector, construction of a multifactor regression model of economic efficiency as a function of the level of implementation of cloud computing, artificial intelligence, automation, big data analytics, and digital platforms based on data for 2020–2025, and verification of the reliability (R^2) of trend extrapolation forecasts.

Findings. The analysis confirms the critical role of digital transformation for the economic efficiency of Ukrainian enterprises in wartime conditions. Significant sectoral differentiation has been identified: the ICT sector shows the highest levels of digitalization, while manufacturing and traditional industries remain at a basic level. Global benchmarks show significant cost reductions, revenue growth, and productivity gains from automation. Ukrainian enterprises demonstrate a paradoxical acceleration of digitalization after the full-scale invasion, confirming that crisis pressure has become a catalyst for transformation. However, the limited national digital transformation index and uneven implementation among small and medium-sized enterprises (SMEs) indicate significant potential for efficiency growth.

Originality. An integrated model is proposed that quantitatively links key technological components of digitalization (cloud computing, artificial intelligence, automation, big data analytics, digital platforms) with economic efficiency indicators and empirically confirms the phenomenon of "crisis acceleration" of transformation in wartime conditions. Regression analysis is combined with sectoral indicators of digital maturity and case studies of leading Ukrainian companies, allowing for a deeper assessment of the interrelationships between digital investments, operational efficiency, and competitive advantages. For the first time, a unique Ukrainian model has been systematized, where the state digital infrastructure (Diia ecosystem) is ahead of the private sector.

Practical value. The research results provide Ukrainian business leaders with specific guidelines for digital transformation: prioritizing cloud migration as a basic infrastructure layer, introducing generative artificial intelligence to save employee working time, and automating business processes to significantly reduce costs. Policymakers are advised to expand the Diia model to accelerate the digitalization of SMEs, invest in bridging the digital skills gap among the population, and support integration with international technology ecosystems. The implementation of the proposed approaches will overcome the sectoral gap in digitalization, increase the competitiveness of organizations in the global competitive space, and strengthen the resilience of the entrepreneurial environment in a situation of instability.

Keywords: *business digitalization, globalization, international markets, AI solutions, digital economy, technological innovations*

Introduction. The current stage of global economic development is marked by comprehensive digitalization, which is fundamentally changing traditional approaches to doing business and managing enterprises. Digital technologies are no longer just a tool for optimizing individual processes – they have become a strategic factor in the competitiveness, survival, and long-term development of organizations in the global economic space. The introduction of cloud computing and digital platforms is transforming all areas of organizational functioning, from production operations to strategic business models and methods of interaction with stakeholders.

For the Ukrainian economy, the issue of digital transformation is becoming critically important in the context of the current global turbulence. Bugrimenko R. and Smirnova P. [1] emphasize that technological modernization in the modern business environment is becoming not just a tool for increasing efficiency, but a critically important condition for the successful operation of enterprises, ensuring increased productivity, increased competitiveness, and the creation of new busi-

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ness models. At the same time, researchers emphasize that the digitization of business processes is accompanied by a complex of challenges related to cybersecurity, the need to retrain personnel, and significant investment costs for the implementation of new technologies.

The impact of digital technologies on the efficiency of business processes in various sectors of the economy deserves special attention. Korolenko O., Zavadskaya O., and Shapovalov R. [2] found that in the retail sector, digital transformation stimulates the upgrading of traditional business models through information technology, creating new opportunities for optimizing operational processes and improving customer interaction. Similar trends are observed in other sectors of the economy, where digitalization acts as a catalyst for structural change and a source of competitive advantage. Koval O. and Lyshak O. [3] analysed the global context of digital transformation, characterized by its impact on socio-economic systems in an era of technological change, when key innovative technologies are driving the transformation of traditional industries, opening up new opportunities for growth and development.

However, despite a significant number of studies devoted to individual aspects of digital transformation, the complex impact of global digitalization trends on the economic efficiency of enterprises in the context of the simultaneous action of multiple factors – technological innovations, market competition, regulatory changes, and macroeconomic instability – remains insufficiently studied. Of particular relevance are the mechanisms for transforming digital investments into specific indicators of economic efficiency, as well as identifying critical success factors and barriers to digital transformation for enterprises of different sizes and industries.

In addition, there is a lack of systematic research that would integrate global trends in the implementation of digital technologies with the characteristics of the national business environment, taking into account the specific challenges and opportunities arising in a transformational economy. Issues such as optimal digitalization strategies for enterprises with limited resources, the role of public policy in stimulating digital transformation, and mechanisms for overcoming the digital divide between different sectors of the economy remain insufficiently explored. It is these gaps in scientific knowledge that justify the need for a comprehensive study of the impact of the global digital transformation of business processes on the economic efficiency of enterprises, which constitutes the scientific novelty and relevance of this work.

Literature review. The issue of digital transformation of business processes and its impact on the economic efficiency of enterprises is actively researched in contemporary scientific literature by both domestic and foreign scientists. A systematic review of scientific works allows us to identify several key areas of research that form the theoretical basis for understanding the mechanisms of digitalization and its consequences for business.

In the context of business process transformation, reengineering as a methodology for radically rethinking and redesigning the activities of enterprises is of particular importance. Sommer L. [4] analyzed the importance of technological modernization of organizations' operational activities, emphasizing that digital transformations are a current phase in the evolution of the information environment, dominated by innovative IT solutions implemented through hardware and software complexes. The researchers found that the effective implementation of digital strategies can increase business performance, optimize the cost base, and strengthen market positions, but this process is accompanied by a number of problems and obstacles that require a systematic approach to overcome them. These conclusions are confirmed by the research by Jiang L., Li B. and Zhang M. [5], who, based on organizational change theory and empirical data from Chinese companies, proved that digital transformation significantly increases the efficiency of corporate resource allocation, although this impact varies depending on the maturity of the firm, the level of industry competitiveness, and geographical location.

Developing these ideas, Chukurna O., et al. [6] defined digital transformation as a specific mechanism of technological revolution, as the transformation of economic activity to a qualitatively higher level with the modification of operational models, management, and workflows, as well as the evolution of strategic approaches to organization. The key benefits of digitization, according to the researchers, include a reduction in operating costs, minimization of expenses, increased efficiency and speed of management decisions, improvement of consumer service, adaptability and dynamism of business operations, introduction of innovative tools, and creation of structured data repositories. These theoretical developments emphasize the multidimensional nature of digital transformation, which goes beyond simple technological upgrades and encompasses fundamental changes in organizational culture and business models.

The strategic dimension of digital transformation is revealed in the study by Radović-Marković M. [7], who analysed the digital transformation of business processes as a key component in building the strategic vector of organizations. The researchers proved that in the context of the transition to a digital economy, companies must develop strategic concepts aimed at strengthening their market positions, performance, and creative capital. Government institutions play a leading role in these transformations, creating a positive business environment for the progress of innovative projects and capital mobilization through the implementation of state programs for technological modernization. This is consistent with the conclusions of Yatsenko V. [8], who proved that digitalization is a factor in the sustainable development of business processes at the micro level, and the new philosophy of transformation involves the introduction of new functionalities for analytical activities, strategic planning, structuring, staff motivation, and organizational monitoring.

An important area of research is the transformation of business models in the digital economy. A group of scientists led by Litovchenko O. [9] developed the conceptual foundations for the transformation of companies' business configurations in the era of economic digitalization, which means an evolution towards schemes based on information arrays, virtual platforms, and online services. The researchers identified the fundamental characteristics of electronic business models: flexibility, focus on service delivery, reduced initial capital investment, and a

modified consumer role as a proactive agent of value generation. It has been established that digital transformation enhances the productivity of business operations, which ultimately ensures the long-term competitive assets of business entities in the distant future. These conclusions are confirmed by industry studies by Zhukovskaya V. M. and Klimansky V. [10], who substantiated the peculiarities of the transformation of business processes in an e-commerce enterprise under the influence of digital technologies, in particular the integration of artificial intelligence, automation, and globalization.

Business analytics is recognized as a critically important tool for digital transformation. Kaschena N., et al. [11] analysed business analytics as a means of information processing that enables enterprises to collect, analyse, and interpret significant amounts of data to make rational strategic decisions. The introduction of innovative technologies enables business structures to study information resources in depth, more accurately identify customer needs, and improve production procedures. Developing this topic, Zhyvko Z., et al. [12] analysed the role of technological modernization in the effectiveness of an organization's business intelligence, finding that it provides the ability to decode market trends and consumer patterns, which stimulates the growth of a company's productivity and adaptability in conditions of dynamic market transformations. Amjala S. [13] deepens this understanding by exploring the synergistic relationship between artificial intelligence and cloud technologies, which enables the creation of self-optimizing systems that continuously adapt to changing business requirements, enhancing security and optimizing operating costs through intelligent orchestration, predictive resource scaling, and autonomous optimization mechanisms. At the same time, researchers emphasize the challenges associated with ensuring data quality, security, integration from different sources, and effective communication of analysis results between specialists and non-technical staff.

Within the framework of globalisation, Chobitok V. and Gavrysh O. [14] identified digital technologies as the primary catalysts of business transformation. According to their findings, artificial intelligence, cloud computing, big data analytics, and the Internet of Things collectively drive operational efficiency gains, lower overhead costs, and unlock new avenues for enterprise growth. The researchers further highlight that blockchain technology strengthens transactional transparency and data integrity, while digital platforms facilitate entry into international markets and enhance coordination among economic actors. Automation of core business functions, in turn, boosts overall productivity and substantially reduces dependency on manual labour – a factor deemed essential for sustaining long-term competitiveness. As Dehtiarov D. [15] subsequently established, these technological shifts trigger a broader restructuring of economic relationships, expressed through heightened process transparency, reinforced security of financial transactions, more effective database governance, and the systematic automation of operational workflows.

The relationship between digital technologies and firms' international activities warrants closer examination. Drawing on empirical evidence from Italian companies, Neirotti P., Ricci A., and Tubiana M. [16] employed a matched Difference-in-Differences design to investigate how Industry 4.0 adoption shapes cross-border performance outcomes. Their findings reveal a clear distinction between technology types: data-oriented tools such as big data analytics and IoT solutions yield measurable improvements in international competitiveness, whereas automation technologies based on robotics produce no comparable effect. Notably, the authors also find that the benefits of digitalisation are most pronounced when firms are managed by external, non-family professionals – suggesting that governance quality is a key enabler of converting digital investments into tangible international gain. Using the concept of dynamic capabilities, the researchers proved that digitization is most effective when combined with high-quality management structures, when companies are managed by external non-incumbent professionals who are able to capture the strategic value of digital investments in international markets. This is consistent with the findings of Ceipek R., Hautz J., De Massis A., Matzler K. and Ardito L. [17], who found that a high level of involvement of family managers limits the development of research innovations in the Internet of Things due to a focus on family-centric non-economic goals, long tenure, emotional attachment to existing assets, and rigid mental models.

Managing the productivity of digital transformations requires a holistic strategy and a clear understanding of the fundamental changes taking place in the economic system and society as a result of technological innovations. Krystal G., et al. [18] systematized academic works on managing the effectiveness of technological modernization of business organizations, identifying the fundamental elements of the digital economy – the infrastructure base of e-business, online entrepreneurship, and virtual commerce – which reflect the essence of its functioning and determine the directions for the further development of entrepreneurial structures. This is particularly relevant for understanding how organizations can effectively manage digitization processes and maximize returns on investment in technological innovation.

An analysis of best practices in domestic business was carried out by Melnyk L., et al. [19], who focused on the criticality of adapting to the dynamic technological landscape in order to ensure the marketability and resilience of domestic organizations in the context of global digital trends. The researchers identified the central dimensions of digital project implementation in many sectors of the national economy, covering the formation of effective concepts of technological modernization that take into account industry uniqueness and the requirements of specific commercial architectures. At the same time, researchers emphasize the importance of state institutions and stakeholders in facilitating business digitalization, including the creation of a comfortable regulatory climate, the development of IT infrastructure, and the encouragement of innovative initiatives.

Deepening the topic of business process evolution, Medina A. [20] investigated the impact of digital transformations on business processes of enterprises, showing that under conditions of technological modernization, operational procedures evolve towards the creation and implementation of innovative workflows, capabili-

ties, and architectures for the implementation of alternative models of work performance. At the same time, the researcher noted that business operations are becoming more cognitive, demonstrating the potential for strategic integration of advanced technologies, in particular AI systems, and are focused on neutralizing global turbulence in a constantly changing environment. This requires organizations not only to finance digital solutions, but also to have the institutional capacity to reconfigure, including building the technological skills of the team and cultivating innovative thinking.

Despite the significant achievements of domestic and foreign scientists, a review of the literature reveals several significant gaps. First, most studies focus on describing individual technologies or industry cases, without providing a comprehensive assessment of the synergistic effect of implementing multiple digital technologies simultaneously. Second, there is a lack of empirical studies that quantitatively assess the impact of digitalization on specific indicators of economic efficiency of enterprises, taking into account industry specifics and the size of organizations. Third, the mechanisms for overcoming the barriers to digital transformation remain insufficiently studied, especially for small and medium-sized enterprises with limited resources.

In addition, most existing studies were conducted before or at the beginning of global crises, which limits their relevance for understanding the specifics of digitalization in conditions of extreme uncertainty and resource constraints. There is also insufficient attention to measuring the long-term effects of digital transformation and developing metrics for assessing the return on investment in digitalization, taking into account not only direct financial indicators but also qualitative changes in organizational culture, adaptability, and the innovative potential of enterprises. Thus, the gaps identified in the scientific literature confirm the need for comprehensive research that would integrate global trends in digital transformation with the national context, provide a quantitative assessment of the impact on economic efficiency, and offer practical recommendations for different categories of enterprises.

Purpose. This article seeks to systematically evaluate the extent to which global digitalisation of business operations influences enterprise performance, with particular attention to the technological and economic pressures shaping today's competitive landscape. The study aims to assess how key components of digitalization – cloud computing, artificial intelligence, big data, automation, and digital platforms – transform traditional business processes and affect the economic performance of enterprises of various sizes and industries. Particular attention is paid to identifying mechanisms for transforming digital investments into specific competitive advantages, as well as systematizing best practices and challenges of digitalization in the Ukrainian business environment. Based on this analysis, the article also offers practical recommendations for developing effective digital transformation strategies for enterprises and improving state policy to support digitalization processes with the aim of increasing the competitiveness of the national economy.

Methods. The research methodology is based on a comprehensive approach that combines qualitative and quantitative methods of analysing the impact of digital transformation on the economic efficiency of enterprises for the period 2020–2025.

The theoretical review covers the systematization of scientific works in three areas: technological aspects of digital transformation, organizational and managerial mechanisms for implementing innovations, and the economic consequences of digitalization. A critical analysis of domestic and foreign publications in the Scopus, Web of Science, and Google Scholar databases was carried out, which made it possible to identify gaps in existing research.

Content analysis of indicators of digital maturity of enterprises was carried out according to five technological components: cloud computing, artificial intelligence, business process automation, big data analytics, and digital platforms. A specific set of digitalization metrics was identified for each sector of the economy. The data sources were official statistics from the State Statistics Service of Ukraine, reports from the OECD and the World Bank, analytical materials from relevant associations, and public reports from leading Ukrainian enterprises.

A multifactor regression model of economic efficiency was constructed as a function of the level of implementation of five technological components: $EE = \beta_0 + \beta_1 CC + \beta_2 AI + \beta_3 AUT + \beta_4 BD + \beta_5 DP + \beta_6 SIZE + \beta_7 SECTOR + \varepsilon$, where *EE* is economic efficiency, *CC* is cloud computing, *AI* is artificial intelligence, *AUT* is automation, *BD* is data analytics, *DP* is digital platforms, and *SIZE* and *SECTOR* are control variables.

Verification of the model's reliability included assessment of the coefficient of determination R^2, testing for multicollinearity using VIF, and verification of heteroscedasticity using the Breusch-Pagan test. Trend forecasting was performed using the ARIMA method with verification of forecast accuracy based on root mean square error (RMSE).

Results. Before assessing the impact of digital transformation on the economic efficiency of enterprises, it is important to define the conceptual basis of the study and outline the methodological approach to analyzing the digitization of business processes.

The digital transformation of business processes refers to the deep-seated embedding of digital tools across every functional area of an enterprise, fundamentally reshaping how organisations generate value, engage with their customer base, and govern internal workflows. For Ukrainian companies specifically, this transition involves the adoption of cloud infrastructure, AI-powered solutions, process automation, e-commerce ecosystems, and digital payment mechanisms – all oriented toward overhauling legacy business models and streamlining day-to-day operations. For Ukrainian enterprises, digital transformation is not just a technological upgrade, but a strategic necessity that changes organizational culture, decision-making mechanisms, and competitive positioning in both domestic and international markets. This process involves a transition from manual, paper-based operations to automated, data-driven systems that provide real-time information and flexible responses to market dynamics [21].

The success of such a transition largely depends on how effectively companies convert digital investments

into tangible business results. Economic efficiency in the context of digital transformation measures precisely this ability to transform, including cost reduction, productivity improvement, revenue growth, and resource allocation improvement. Key indicators of economic efficiency include return on investment (ROI), reduction in process cycle time, level of automation, improvement in operating margin, and cost savings achieved through digitalization initiatives. For Ukrainian companies, economic efficiency also includes metrics such as error reduction, productivity per employee, system uptime, and customer-related factors such as reduced service costs and improved payback periods. These performance indicators are crucial for assessing whether digital transformation initiatives deliver real economic benefits and justify the capital and organizational efforts required to implement them [22].

Understanding these indicators is particularly important when considering the current state of digitalization in Ukraine. As of 2025, Ukraine's digital landscape presents a paradox: on the one hand, there is a developed infrastructure thanks to the Diia platform, which provides online business registration, digital signatures, and tax reporting, significantly reducing transaction costs for businesses; on the other hand, there is uneven implementation of technologies. Large firms, IT companies, and financial institutions are demonstrating high rates of adoption of advanced technologies, while micro-enterprises remain only partially digitized. Despite the conflict, a robust ICT sector remains central to the economy, supported by the legal framework of Diia.City and the Digital Country 2025 initiatives. This duality defines the main objective of the study: to examine how global trends in digital transformation, including Industry 4.0 technologies, cloud computing, artificial intelligence, and digital platforms, affect the economic performance of Ukrainian enterprises. Understanding the mechanisms by which global digital trends translate into competitive advantages is important for policymakers and business leaders. To achieve this goal, it is necessary to analyse the key technological components of global digital transformation (Fig. 1). Cloud computing has become a fundamental infrastructure layer: approximately 94 % of enterprises use cloud services, and global spending will reach $720–900 billion in 2025. AWS and Microsoft Azure are used by 78–80 % of global enterprises, and 92 % of organizations employ multi-cloud strategies.

Cloud computing enables dynamic resource scaling, reduced capital expenditures, and support for distributed labour resources, making it an essential platform for other digital transformation technologies [24].

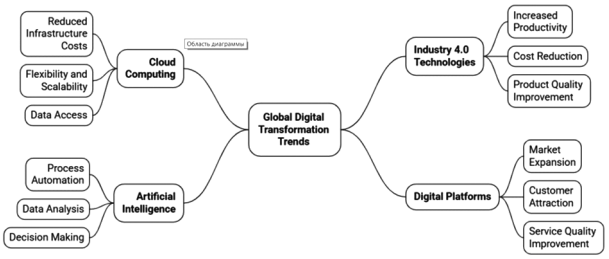

Fig. 1. Impact of digital transformation on the economic efficiency of Ukrainian enterprises

Another revolutionary technology is being deployed on this cloud infrastructure. Artificial intelligence experienced explosive adoption in 2024–2025 thanks to the generative capabilities of AI. About 72 % of organizations use generative AI services, applying them in predictive analytics, customer service automation, document processing, and fraud detection. The impact on efficiency is significant: predictive analytics reduces order fulfilment times by 35 %, increases decision accuracy by 33 %, and automation tools save employees 6–8 hours per week. In addition to operational efficiency, artificial intelligence opens up opportunities for new business models through personalization and real-time analytics [25].

Summarizing the key technological components of digital transformation and their impact on business efficiency, it is useful to present systematic information in Table 1, which shows the level of global implementation of various technologies, their typical business applications, and their specific impact on enterprise performance indicators [24, 25].

The data presented in Table 1 demonstrates the relationship between technological components and their practical impact on business processes. The role of big data analytics, which has become an integral part of digital transformation programs, is particularly important: most companies use cloud analytics platforms, and more than 60 % of business data is now stored in the cloud [24, 25], enabling large-scale analytics and the use of artificial intelligence at the heart of modernization efforts. Such analytical capabilities allow enterprises to handle enormous volumes of both structured and unstructured data on a continuous basis, extracting actionable patterns and intelligence that inform high-stakes decisions across marketing, financial planning, operational management, and product innovation. When big data infrastructure is coupled with AI and machine learning algorithms, a self-reinforcing cycle emerges: incoming data refines predictive models, those models produce forecasts, and the resulting forecasts trigger automated operational responses – fundamentally altering how organisations interpret market dynamics, optimise internal processes, and respond to competitive pressures. This data-driven approach shifts organizational culture from intuitive to evidence-based decision making, leading to significant improvements in forecasting accuracy, customer focus, inventory management, and risk assessment.

The impact of technological components of digital transformation on the economic performance of enterprises is shown in Fig. 2.

According to global business automation studies, the introduction of cloud computing reduces costs by 20 % and increases productivity by 35 %, making it the basic infrastructure for digital transformation. Artificial intelligence demonstrates the highest productivity gains (33 %) with a moderate reduction in costs (25 %), as confirmed by data showing a 35 % acceleration in supply chains and savings of 6–8 hours of working time per week per employee. Robotic process automation (RPA) shows balanced results: a 30 % increase in productivity and a 25 % reduction in costs, consistent with the ability to automate up to 60 % of business processes. Big data analytics and digital platforms, while showing lower cost

Table 1

Technological components of digital transformation: level of implementation and impact on business efficiency

Technological Component	Level of Global Adoption	Key Business Applications	Impact on Business Efficiency
Cloud Computing	94 % of enterprises	Infrastructure, data storage, application hosting, collaboration platforms	Dynamic scalability, 30–40 % reduction in infrastructure costs
Artificial Intelligence	72 % use generative AI	Predictive analytics, automation, personalization, decision support	35 % acceleration of supply chains, 33 % improvement in decision quality, saving 6–8 hours per employee per week
Big Data Analytics	Over 60 % of enterprises	Customer data analysis, operations optimization, forecasting, risk management	Real-time decision-making, improved targeting and resource allocation
Automation and RPA	70 % of enterprises with structured automation	Finance, HR, IT, supply chains, customer service	Automation of up to 60 % of processes, 25–35 % cost reduction
Digital Platforms	Over 90 % of enterprises consider implementation	E-commerce, marketplaces, APIs, ecosystem integration	Automated processing of over 1.8 million requests, workforce reallocation

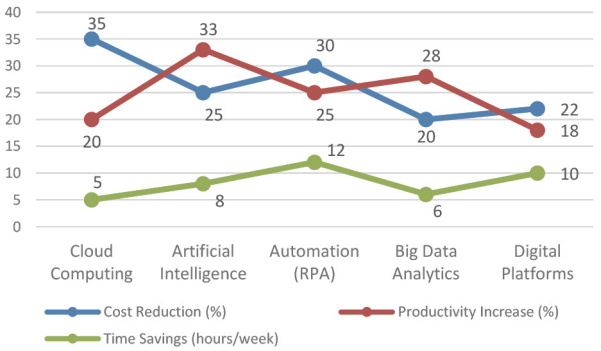

Fig. 2. The role of technological innovations in increasing process productivity

reduction rates (20 and 22 %, respectively), provide critical productivity gains (28 and 18 %) and significant time savings (12 and 10 hours per week), creating a foundation for data-driven decision making [22, 26].

Alongside data analytics, automation technologies and digital platforms continue to optimize business operations by eliminating repetitive workflows, integrating previously isolated systems, and enabling faster and more accurate decision-making across various functions. Companies that combine robotic process automation (RPA), artificial intelligence, and workflow automation report automating up to 60 % of repetitive processes, reducing overall process costs by 25–35 %, and achieving total operational cost savings of up to 30 %. Surveys show that about 70 % of organizations now use structured automation, and more than 90 % of small and medium-sized enterprises are considering using artificial intelligence and automation to gain competitive advantages. Real-world implementations in 2024 demonstrate the scale of impact: large organizations have implemented more than 100 new automation processes in a single year, automatically processed more than 1.8 million customer requests, and freed up hundreds of employees to perform more valuable work. Digital platforms, including e-commerce systems, API-based ecosystems, and marketplace models, further increase efficiency by connecting stakeholders, enabling seamless transactions, and creating network effects that reduce friction and transaction costs in value chains [27].

Examining the global landscape of technology uptake, the state of affairs in 2025 reflects a dual reality: broad diffusion of digital tools on the one hand, and pronounced disparities in maturity levels across regions on the other. Technologically advanced economies of North America and Western Europe maintain a clear lead in deploying sophisticated AI solutions, multi-cloud strategies, and zero-trust security frameworks, whereas the Asia-Pacific region outpaces its counterparts in 5G rollout, IoT integration, and the advancement of smart manufacturing ecosystems. Specific industry trends have emerged: financial services are focusing on regulatory technologies and fraud detection using AI; healthcare is emphasizing AI-assisted diagnostics; manufacturing is implementing digital twins; retail is striving for omnichannel personalization; education is expanding the use of AI tutors. The depth of implementation varies significantly: large enterprises use complex capabilities, while small and medium-sized enterprises prioritize basic cloud migration and automation [28]. Against the backdrop of this global differentiation, Ukrainian enterprises demonstrate their own specific characteristics. As of 2024–2025, the average business digitalization index is 55.7 out of 100, indicating significant differences between sectors (Figs. 3 and 4). Approximately 70 % of large enterprises have websites, compared to 47 % of medium-sized enterprises and less than 30 % of small enterprises, while the adoption of advanced tools remains below the EU-OECD average. The national digital transformation index was 0.497 out of 1.0, with par-

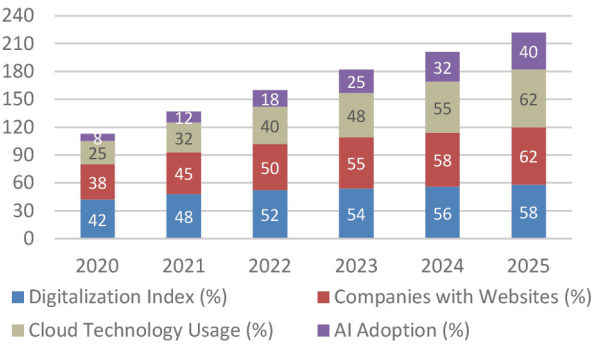

Fig. 3. Dynamics of technological modernization of domestic organizations (2020–2025)

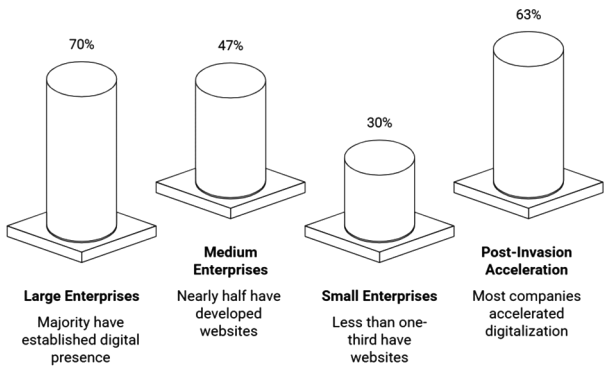

Fig. 4. Digitalization by business size in Ukraine (2024–2025)

ticularly low scores in paperless work processes. It is noteworthy that 63 % of companies report an acceleration of digitalization after the full-scale invasion in 2022, indicating that military pressure has, paradoxically, become a catalyst for transformation [29].

This heterogeneity of digitalization across different sectors of the Ukrainian economy deserves closer consideration, which is presented in Table 2, where information on the level of digital maturity of key industries, the typical range of the digitalization index, and key digital tools that are actively being implemented in each sector is systematized [29].

As shown in Table 2, the ICT and professional services sectors are leading Ukraine's digital transformation, with service companies averaging 70-80 points on the digitalization index, while manufacturing companies score around 30–40 points. Ukraine's IT sector has over 2,100 active technology companies, including globally competitive players such as Intellias, EPAM Ukraine, and Preply, which have maintained export growth even during the war by leveraging cloud architectures, remote working models, and global delivery capabilities. This sector has integrated into international ecosystems such as UK-Ukraine TechBridge, which specializes in artificial intelligence, SaaS, cybersecurity, and new DefenseTech applications. Financial services also show a high level of digitalization, driven by digital banking platforms, payment systems, and regulatory technologies, while the retail and e-commerce sectors have rapidly adopted online platforms, digital payments, and customer relationship management tools to ensure business continuity during the conflict [30].

The most striking evidence of the success of digital transformation in Ukraine is the Diia ecosystem, which has evolved from a concept of digital governance to a crisis-resistant platform that provides hundreds of public services through a mobile app and web portal, including business registration, digital signatures, tax reporting, and even remote marriage services for military personnel. This positions Ukraine as a global benchmark in e-governance. Complementing this is Diia. City, a special legal and tax regime that had over 1,500 resident companies by the end of 2024. The government's decision in 2024 to open Diia as a digital public resource allows other countries to reuse its code, and partners from the OECD and the EU view Ukraine as a provider of best practices for the digitalization of SMEs [24]. Fig. 5 shows the evolution of the Diia ecosystem from the initial concept of digital governance to a comprehensive crisis-resistant platform that has become a global digital resource for other countries.

However, these achievements cannot hide the significant obstacles to digital transformation. There are infrastructure gaps, including the need to rebuild war-damaged networks and upgrade to gigabit connectivity. Investment challenges are linked to increased security and energy infrastructure risks, which force companies to allocate resources to backup power supplies and physical protection. Significant gaps in digital skills remain: more than half of the population has only basic digital skills. These challenges are compounded by human capital constraints due to mobilization, migration of specialists, energy instability, and the need to bring the legal framework into line with EU digital standards.

Comparing the situation in Ukraine with global digital transformation trends in 2024–2025, it can be seen that Ukrainian enterprises reflect key themes, including the introduction of artificial intelligence, the digitalization of SMEs, platform governance, and cross-border cloud partnerships with Google, Microsoft, and AWS. However, Ukraine differs in terms of speed and focus on sustainability: the conditions of war have forced the implementation of extremely flexible solutions that are ready for crisis situations. Implementation in Ukraine remains below global indicators, with the exception of the leading ICT and finance sectors. The most pronounced gap is observed in manufacturing and traditional industries. Nevertheless, the digital infrastructure of Ukraine's public sector makes it a unique case where government digitalization is significantly ahead of private sector transformation, creating a model for emerg-

Table 2

Level of digitalization by economic sector

Economic Sector	Level of Digitalization	Typical Digitalization Index Range	Key Digital Tools Being Adopted
ICT and Professional Services	Highest	70–80 points	Cloud platforms, AI/machine learning, advanced analytics, SaaS delivery models, remote collaboration tools
Financial Services	High	65–75 points	Digital banking, payment systems, AI for fraud detection, regulatory technologies (RegTech)
Trade and E-commerce	Medium–High	60–70 points	Online platforms, digital payments, CRM systems, social media marketing
Manufacturing	Low–Medium	30–40 points	Basic websites, email, limited use of ERP and automation
Construction and Traditional Industry	Lowest	25–35 points	Minimal digital presence, basic communication tools

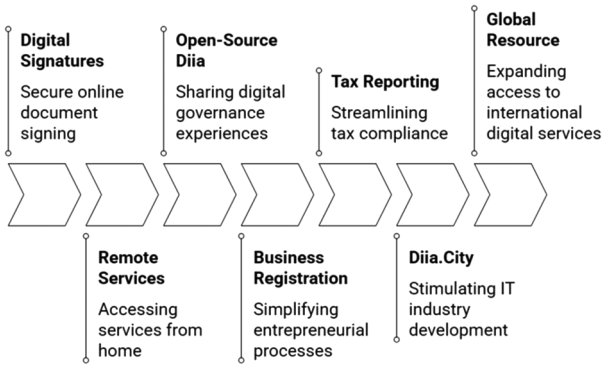

Fig. 5. Diia ecosystem: from concept to global digital resource

ing markets and a basis for accelerated adoption in enterprises [30].

Having considered the level of digital technology adoption, it is important to move on to analysing their specific economic impact on the activities of Ukrainian enterprises. Digital business transformation has enabled Ukrainian companies to achieve significant revenue growth by entering global markets and creating higher-value services in cloud computing, artificial intelligence, and cybersecurity solutions. Leading Ukrainian IT companies, including SoftServe, Miratech, DataArt, and Infopulse, have achieved double-digit annual growth rates and signed large international contracts, with SoftServe generating approximately $1 billion in revenue in 2023. These companies leverage deep engineering expertise, specialization in modern technologies, flexible delivery models, and proven resilience in extreme operating conditions to maintain competitive advantages in international markets. Their digital capabilities allow them to set premium prices, access demanding customer segments, and maintain their growth trajectory despite wartime disruptions, confirming the macroeconomic importance of digital transformation for the national economy [31].

Alongside income growth, productivity is increasing thanks to digital transformation in Ukrainian enterprises, which is evident but not yet fully quantified at the national level, as most of the evidence comes from industry case studies and policy analysis rather than consolidated statistical series. The OECD's analysis of Ukrainian SMEs shows that the adoption of basic digital tools, including websites, e-commerce platforms, cloud services, and management software, correlates significantly with higher productivity and better resilience to crises, although small enterprises still lag significantly behind large enterprises in adoption, limiting overall productivity gains. Government and donor strategies for 2024–2027 clearly identify digitalization as a mechanism for reducing time and resource costs through online services, simplified compliance, electronic invoicing, instant payments, and reduced bureaucracy, and initial data indicate a reduction in administrative burdens and transaction times. Global benchmarks, often cited by Ukrainian consulting firms and policymakers, indicate that intelligent automation, combining RPA and AI, typically delivers 20–30 % productivity gains and significant reductions in routine operating costs, indicating the potential scale of efficiency gains as Ukrainian enterprises become more digitally mature [32].

To systematize the measurable impact of digital transformation on key business indicators, it is advisable to present summarized information in the form of Table 3, which covers the main categories of impact, specific metrics, and challenges accompanying the transformation process of Ukrainian enterprises [31, 32].

The data in Table 3 demonstrate the diverse nature of the economic effects of digitalization, among which the impact on cost reduction deserves special attention. This impact is becoming increasingly evident, but remains insufficiently documented at the enterprise level in Ukraine, with most quantitative indicators based on international benchmarks and industry case studies. Business process automation, linked to Ukraine's business digitalization index of 55.7 out of 100, shows a noticeable increase in economic efficiency. Research shows that big data and automation significantly improve resource utilization and operational performance. Global benchmarks, which are often applied to Ukrainian conditions, show that intelligent automation delivers an average cost reduction of approximately 22 %, with more than a third of companies reporting cost reductions of more than 25 % after implementation. Government initiatives in digital infrastructure, including Diia, Diia.Business, the Prozorro procurement platform, and the widespread adoption of digital signatures, indirectly promote cost efficiency by reducing compliance costs, transaction disputes, and administrative costs, although consolidated national key performance indicators measuring percentage reductions in unit

Table 3

Impact of digital transformation on key business indicators of Ukrainian IT companies and the economy

Impact Category	Measurable Outcomes	Concrete Examples/ Metrics	Key Challenges
Revenue Growth	Double-digit annual growth, expansion into global markets	SoftServe: ~$1B revenue (2023); IT sector: 3.4 % of Ukraine's GDP	War-related infrastructure damage risks, client budget pressure
Cost Reduction	Reduced administrative burden, process optimization	Global benchmark: avg. 22 % cost reduction; leaders – 25 %+	Limited company-level data, constrained investment capacity
Productivity	Higher output per employee, faster processes	20–30 % productivity growth via automation; reduced transaction times	Shortage of skilled talent, uneven adoption by company size
Competitive Advantage	Premium pricing potential, client retention, market differentiation	Flexible service delivery, crisis resilience, specialization in modern technologies	Cyberattacks, talent migration, unstable energy supply
Return on Investment (ROI)	Three-year payback on digitalization investments	11 % revenue growth, 22 % cost reduction (global automation benchmark)	Measurement gaps, additional security and redundancy costs

costs or increases in labour productivity at the enterprise level remain a significant data gap for the period 2023–2025 [26].

A particularly important aspect of the economic impact is the return on investment from digital transformation initiatives in Ukrainian enterprises, which shows positive dynamics despite measurement difficulties and the complications of martial law. International benchmarks show that automation and digital transformation typically deliver 11 % revenue growth and 22 % cost reduction over three years. However, Ukrainian companies face specific challenges, including the need to allocate significant resources to backup power supplies, cybersecurity protection, and infrastructure redundancy, which affects net profit. The case of Vodafone Ukraine illustrates the urgency and complexity of ROI: the company accelerated the migration of 4,000 employees to the Microsoft 365 cloud platform in three weeks during a full-scale invasion, ensuring security and uninterrupted communication for millions of customers. Such rapid transformations provide immediate resilience and long-term efficiency gains, but to accurately calculate ROI, the benefits of mitigating the impact of the crisis must be considered alongside traditional metrics [32].

The competitive advantages gained from digital transformation go beyond traditional performance metrics to include resilience, flexibility, and market positioning. Ukrainian digital technology leaders combine rapid adoption of cloud technologies, secure digital workplaces, and business process automation with powerful organizational change management, enabling them to maintain operations during infrastructure disruptions and retain global customers. However, these results are tempered by challenges: increased cyberattacks, talent migration, energy instability, and the double burden of maintaining security while accelerating technology adoption. Forecasts for 2025 predict further expansion of the digital economy as a driver of growth, but productivity at the enterprise level remains an expected outcome rather than a comprehensively measured one, indicating that the full picture of the economic effectiveness of digital transformation in Ukrainian enterprises is still emerging and requires more systematic measurement systems.

Conclusions. This article provides a comprehensive analysis of the impact of global digital transformation of business processes on the economic efficiency of Ukrainian enterprises in the context of modern technological challenges. Using a systematization of five key technological components (cloud computing, artificial intelligence, big data analytics, automation, digital platforms) and their impact on performance indicators, this approach allows us to identify specific mechanisms for transforming digital investments into competitive advantages and is based exclusively on official statistics and representative industry cases.

The results confirm the critical role of digitalization for the economic efficiency of Ukrainian enterprises, especially in wartime. Significant sectoral differentiation has been identified: the ICT sector and professional services demonstrate the highest levels of digital maturity (70–80 points), while manufacturing remains at a basic level (30–40 points). The phenomenon of "crisis acceleration" of digitalization has been empirically confirmed: 63 % of companies accelerated their transformation after the full-scale invasion of 2022, indicating the catalytic role of extreme pressure for organizational change. Global benchmarks demonstrate a measurable effect: cloud computing reduces costs by 30–40 %, generative AI saves 6–8 hours per week per employee, and automation reduces costs by 25–35 %.

The uniqueness of the Ukrainian model lies in the fact that the state's digital infrastructure is ahead of the private sector. The Diia ecosystem, with over 1,500 resident companies and the 2024 decision to open as a global digital resource, positions Ukraine as an international benchmark for e-government. The methodology, harmonized across different scales (enterprise, sector, national economy), provides a reproducible basis for a comprehensive assessment that can be implemented with standard analytical tools.

As a result of diagnostic work, a comprehensive assessment can serve as an analytical basis for monitoring dashboards and corporate reports that include digitalization indicators. This allows business leaders to prioritize cloud migration as a basic infrastructure layer, the introduction of generative AI to increase productivity, and automation to reduce costs. Policymakers are advised to expand the Diia model to accelerate the digitalization of SMEs, invest in bridging the digital skills gap, and support integration with international technology ecosystems.

Prospects for further research include developing panel models to track the dynamics of digitalization across sectors and regions over time, quantifying the synergistic effect of simultaneous adoption of multiple digital technologies, exploring mechanisms for transforming digital investments into long-term competitive advantages, taking into account qualitative organizational changes, and developing standardized metrics to measure the digital maturity of enterprises of different sizes and industries.

Acknowledgement. *This publication was supported by the Ministry of Education and Science of Ukraine 12/27/2023 No. 1572 within the project No. 0124U000632: Neuromodeling of the anti-entropy of the agro-trading logistics system of Ukraine.*

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Вплив глобальної цифрової трансформації бізнес-процесів на економічну ефективність підприємств

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Мета. Провести комплексний аналіз впливу глобальних тенденцій цифрової трансформації бізнес-процесів на економічну ефективність українських підприємств у контексті технологій Індустрії 4.0, хмарних обчислень, штучного інтелекту й цифрових платформ, з акцентом на механізмах перетворення цифрових інвестицій у конкурентні переваги.

Методика. Включає теоретичний огляд і контент-аналіз показників цифрової зрілості підприємств за секторами економіки, побудову багатофакторної регресійної моделі економічної ефективності як функції рівня впровадження хмарних обчислень, штучного інтелекту, автоматизації, аналітики великих даних і цифрових платформ на основі даних за 2020–2025 роки, а також перевірку надійності (R^2) прогнозів екстраполяції трендів.

Результати. Аналіз підтверджує критичну роль цифрової трансформації для економічної ефективності українських підприємств в умовах війни. Виявлена значна галузева диференціація: сектор ІКТ демонструє найвищий рівень цифровізації, тоді як виробництво та традиційні галузі залишаються на базовому рівні. Глобальні бенчмарки показують значне зниження витрат, зростання доходів і підвищення продуктивності завдяки автоматизації. Українські підприємства демонструють парадок-

сальне прискорення цифровізації після повномасштабного вторгнення, яке підтверджує, що кризовий тиск став каталізатором трансформації. Однак обмежений національний індекс цифрової трансформації й нерівномірне впровадження серед малих і середніх підприємств вказують на значний потенціал для зростання ефективності.

Наукова новизна. Запропонована інтегрована модель, яка кількісно пов'язує ключові технологічні компоненти цифровізації (хмарні обчислення, штучний інтелект, автоматизація, аналіз великих даних, цифрові платформи) із показниками економічної ефективності й емпірично підтверджує феномен «кризового прискорення» трансформації в умовах війни. Регресійний аналіз поєднується із галузевими показниками цифрової зрілості й кейсами провідних українських компаній, що дозволяє глибше оцінити взаємозв'язки між цифровими інвестиціями, операційною ефективністю та конкурентними перевагами. Вперше систематизована унікальна українська модель, в якій державна цифрова інфраструктура (екосистема «Дія») випереджає приватний сектор.

Практична значимість. Результати дослідження надають українським бізнес-лідерам конкретні рекомендації щодо цифрової трансформації: пріоритетність міграції до хмари як базового інфраструктурного шару; впровадження генеративного штучного інтелекту для економії робочого часу співробітників й автоматизація бізнес-процесів для значного зниження витрат. Політикам рекомендується розширити модель Diia для прискорення цифровізації малих і середніх підприємств, інвестувати в подолання цифрового розриву в навичках серед населення й підтримувати інтеграцію з міжнародними технологічними екосистемами. Впровадження запропонованих підходів дозволить подолати секторальний розрив у цифровізації, підвищити конкурентоспроможність організацій у глобальному конкурентному просторі та зміцнити стійкість підприємницького середовища в умовах нестабільності.

Ключові слова: *діджиталізація бізнесу, глобалізація, міжнародні ринки, AI-рішення, digital-економіка, технологічні інновації*

The manuscript was submitted 10.09.25.