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ARTIFICIAL INTELLIGENCE AND BIG DATA IN THE DIGITAL TRANSFORMATION OF ENTREPRENEURSHIP

Background. *The article examines the current state of digital transformation in Ukrainian enterprises, with a particular emphasis on the roles of artificial intelligence (AI) and big data. It assesses companies' levels of digital maturity, the prevalence of digitalization strategies, and the main barriers to adopting new technologies. Using sociological survey results, the study examines how digital innovations impact large, medium-sized, and small enterprises as distinct business forms. It draws general conclusions and highlights promising directions for future research.*

Methods. *To obtain the research findings, a range of modern scientific methods was employed: historical and logical analysis to trace the evolution of the digital economy; the expert assessment method to interpret the results; and the index method for the quantitative evaluation of enterprises' digital maturity levels. The empirical basis consists of an online survey of 48 Ukrainian enterprises of varying sizes (small, medium, and large) and sectors (IT, industry, trade, logistics, finance, and agriculture). The sample was selected using purposive and stratified sampling principles: only enterprises that had implemented – or declared their intention to implement – digital technologies within the past two years were invited to participate. This approach ensured coverage of diverse business models and allowed for comparisons of digital maturity across industries and enterprise scales. At the same time, the authors acknowledge that the sample size is not representative of the entire Ukrainian economy. Consequently, the conclusions reflect typical trends and patterns observed among enterprises already engaged in digital transformation.*

Results. *The analysis revealed that most Ukrainian enterprises are at an intermediate level of digital maturity, with only a small proportion having achieved a high level. The study established a clear positive correlation between the presence or development of a digitalization strategy and higher digital maturity. Companies are most widely adopting customer relationship management (CRM) systems and industrial Internet of Things (IIoT) solutions for digital transformation. Organizations implement artificial intelligence (AI) and big data technologies more gradually. Large enterprises predominantly report positive outcomes from adopting digital technologies, whereas medium-sized and small enterprises show more heterogeneous results. The survey respondents identify financial constraints, employee resistance to change, inadequate technical infrastructure, and a shortage of qualified personnel as the primary barriers to digitalization.*

Conclusions. *The study confirms that the adoption of artificial intelligence and big data technologies enhances productivity, improves decision-making, and strengthens competitive advantage for Ukrainian enterprises. Nevertheless, significant barriers persist, including financial constraints, staff resistance to change, and deficiencies in technical infrastructure and skilled personnel.*

To amplify the benefits of digital transformation, comprehensive support measures are essential, such as financial incentives, targeted training programs, and professional consulting services.

Keywords: *digital transformation, digital maturity, artificial intelligence, big data, barriers to digitalization, digitalization strategy, innovative technologies, digitalization of entrepreneurship in Ukraine.*

Background

In today's environment, digital transformation is becoming increasingly critical to improving enterprise competitiveness. The integration of digital technologies (AI, IoT, cloud computing, mobile applications, etc.) into entrepreneurial activities is rethinking business models and company management. In particular, strategies based on artificial intelligence and big data can significantly optimize processes: improve planning, resource management, customer interaction, and product quality control. The digitalization of the economy is a key factor in the development of modern entrepreneurship (Mazur, Aliyev, & Zhelizko, 2020). The use of AI, big data, IoT, and CRM systems opens new opportunities to optimize processes in entrepreneurial activity, improve management efficiency, and gain a competitive advantage. There has been dynamic growth in the use of AI worldwide: in 2024, about 72% of companies will use it in at least one business function, and the share of generative AI use has doubled in a year (OECD, 2024). Ukraine is also seeing an intensification of digital transformation processes: 65% of enterprises already use AI, but the barriers to implementation remain significant (AI House, 2024). However, Ukrainian enterprises tend to underutilize such technologies. As our research shows, the

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level of digital tool adoption among SMEs lags behind the European level: only about 30% of small enterprises have websites, and overall IT adoption remains low (OECD, 2024). At the same time, the widespread use of AI solutions is already evident worldwide. For example, 65% of the companies surveyed use generative AI in at least one area (McKinsey, & Company, 2023). Thus, the tasks of digital transformation for Ukrainian businesses are not only technological modernization, but also overcoming internal barriers (financial, human resources, organizational) and developing favorable regulatory and political conditions (Sorokina, 2025).

Despite the active introduction of digital technologies in Ukraine, there are still gaps in the study of the digital maturity of enterprises of different sizes. The impact of the presence or absence of a digitalization strategy on the real results of business transformation has not been sufficiently studied. There are no comprehensive assessments of the spread of AI and Big Data among small and medium-sized enterprises, where barriers are most acute. There is insufficient research on how financial constraints, staff shortages, and technical infrastructure interact and form barriers to digitalization. There is a lack of analysis of industry differences in the implementation of digital technologies. The effectiveness of state support for the digital transformation of entrepreneurship, particularly within the legal regime of "Diy City," remains an open question. The relationship between public awareness of AI and its actual use requires further research. It is not sufficiently clear to what extent innovative tools (AI, Big Data, IoT) actually improve the competitiveness of small and medium-sized enterprises.

Results

The analysis revealed that most Ukrainian enterprises are at an intermediate level of digital maturity, with only a small proportion having achieved a high level. The study established a clear positive correlation between the presence or development of a digitalization strategy and higher digital maturity. Companies are most widely adopting customer relationship management (CRM) systems and industrial Internet of Things (IIoT) solutions for digital transformation. Organizations implement artificial intelligence (AI) and big data technologies more gradually. Large enterprises predominantly report positive outcomes from adopting digital technologies, whereas medium-sized and small enterprises show more heterogeneous results. The survey respondents identify financial constraints, employee resistance to change, inadequate technical infrastructure, and a shortage of qualified personnel as the primary barriers to digitalization.

The purpose of the study is to identify the advantages and disadvantages of the impact of artificial intelligence and Big Data on the digital transformation of entrepreneurship; to substantiate the problems and barriers to the digitalization of entrepreneurship, as well as to propose new opportunities and improve the management efficiency and competitive advantages of the digital transformation of entrepreneurship. The study examines the processes and tools of digital transformation in Ukrainian enterprises, in particular the implementation of artificial intelligence, big data, CRM systems, IoT, and other solutions, as well as the relationship between companies' digital maturity and the presence of digitalization strategies. The object of the study is Ukrainian enterprises of various sizes and industries at different stages of digital transformation, with varying levels of digital maturity and strategic planning for digitalization processes.

Methods

The sample of enterprises was selected purposively, using stratification by business size (small, medium, large) and field of activity (IT, manufacturing, trade, services). Enterprises were selected on a targeted basis, taking into account their availability to participate in the survey, which does not ensure full representativeness of the results at the national level. This approach ensured the representation of different types of enterprises at different stages of digital transformation. Enterprises that had implemented or declared their intention to implement the digitalization of business processes over the past two years were invited to participate, which was in line with the research objective – to analyze the factors and barriers to innovation implementation, rather than to form a statistical assessment of the situation in the country as a whole.

The total number of respondents (48 enterprises) enabled a comparative analysis of enterprises of different sizes and sectors and was sufficient to identify typical trends and relationships in digital transformation processes. The distribution of enterprises by quantitative characteristics (share of digital processes, duration of AI/Big Data use) ensured the analytical representativeness of the sample for establishing typical trends, rather than just describing individual cases. Thus, the results obtained are valid for drawing conclusions about digitalization models and for identifying factors that influence the level of digital maturity across enterprises of different sizes and industries.

Correlation analysis in the study was conducted to determine the relationship between the level of digital maturity of enterprises (which was assessed on a three-level scale: low, medium, and high) and the stage of digital transformation strategy availability (variables: "strategy approved," "strategy under development," "no strategy"). To convert qualitative assessment characteristics into quantitative ones, scaling was applied using the ordinal category principle. Qualitative data (open-ended responses from respondents) were analyzed using content analysis: key statements were grouped into thematic blocks (barriers, expected effects, support needs), which enabled identification of the dominant motives and problem areas in the implementation of digitalization. However, the methodology has a significant limitation: the sample size (48 enterprises) does not provide full representativeness for the entire Ukrainian economy, and the selection of enterprises was targeted rather than statistically random. In future studies, it would be advisable to expand the sample, apply stratification by industry and region, and supplement quantitative methods with in-depth interviews or case studies to more fully reveal the characteristics of AI and Big Data use in business.

In the study, the level of digital maturity of enterprises was determined by assessing the degree of use of digital technologies, the integration of digital solutions into business processes, and the presence of a strategic digital orientation. A low level of digital maturity was characterized by fragmented use of digital tools (primarily basic office services), the absence of a formalized digitalization strategy, and minimal impact of digital technologies on key business processes. The average level involved the presence of separate implemented digital systems (CRM, ERP, IoT), partial automation of operations, the formation or active development of a digital transformation strategy, and the presence of separate competencies in data analysis. The high level of digital maturity was determined by the deep integration of digital technologies into all key business processes, the systematic use of artificial intelligence and

Big Data tools, the existence of an approved digital transformation strategy, and specialized departments/teams responsible for digital development.

A positive result was the successful testing of a comprehensive toolkit (a combination of surveys, interviews, and content analysis), which provided a multidimensional view of digital transformation. At the same time, the implementation of the initial concept was complicated by unforeseen organizational barriers: some companies refused to provide detailed information, which required additional reminders and flexible adjustments to the sample. Problems with methodological tools were also identified, in particular, insufficient detail in the questionnaire questions, which reduced the depth of some conclusions. Despite these difficulties, the experience gained from conducting the survey demonstrated the effectiveness of the chosen methodology and identified areas for further improvement in larger-scale studies of Ukraine's digital economy.

Literature review. Contemporary scientific and analytical literature confirms that digitalization and the implementation of artificial intelligence (AI) are becoming decisive factors in economic development. Internationally, studies by McKinsey (McKinsey, & Company, 2023) and PwC (PwC, n. d.) note the rapid growth in the use of generative AI in business and its significant economic impact. The OECD and Eurostat (2024–2025) (OECD, 2024; Eurostat, 2025) reveal the extent of the spread of digital technologies across EU countries and provide analytical guidelines for digital transformation policy in both national economies and entrepreneurial activity in particular.

Ukrainian sources (Kyivstar Business Hub, 2025; AI House, 2024) focus on building a national AI ecosystem, highlighting leading companies and new educational initiatives to develop talent. Ukrainian authors (Vorobyov, & Butriy, 2024; Makhmudova, 2025) highlight the integration of AI and Big Data into business processes, community management, and international entrepreneurship, emphasizing their role in shaping competitive advantage.

The legal aspects of digital transformation are covered in the works (Lutsenko, V.R. & Pikulia, T.O., 2024), as well as in regulatory acts – Law of Ukraine No. 1667-IX of 2021 (Law of Ukraine…, 2021), which regulate the legal regime of "Diy City" and the peculiarities of taxation in the digital economy (KPMG, 2025).

Key findings. Technological innovations, particularly artificial intelligence (AI) and Big Data, play a key role in the development of modern entrepreneurship. At the same time, researchers note the lack of a unified definition of "AI." Researchers Vorobyov and Butriy propose interpreting AI as "a technological digital environment capable of performing tasks that traditionally require human intelligence" (Vorobyov, & Butriy, 2024). In the digital economy, several main areas of innovative development of business structures are distinguished:

Digitization and automation: optimization of business processes through digital transformation using cloud services and machine learning algorithms. This significantly increases operational efficiency, reduces costs, improves quality, and reduces the time spent on routine tasks (Kyrylenko, 2024).

Flexibility and decentralization: diversifying supply chains and adopting crowdsourcing approaches increase the enterprise's flexibility and resilience. For example, regional supply networks are being formed that "increase flexibility, reduce risks, and improve response times" (Frazer, 2025).

Integration of digital products: the introduction of the latest services and technological solutions (in particular, pay-per-use models, augmented reality, wearable devices, etc.) contributes to the creation of new products and services, opening up additional opportunities for enterprises (Mahmudova, 2025).

Artificial intelligence (AI) and big data analysis are considered key drivers of digital transformation in business. In today's environment, it is the innovativeness of a business model that determines an enterprise's ability to grow and attract investment. Thus, the study emphasizes that a startup, as a new organizational form of entrepreneurship, is based on rapid hypothesis testing and the use of digital technologies for scaling (Mazur, & Buga, 2020). The motivational aspects of entrepreneurial activity have also undergone a transformation: creativity, digital competence, and the ability to work in a data environment are becoming increasingly important (Mazur, Gura, & Solodovnikova, 2020).

In a global context, the digital economy is characterized by the strengthening of the roles of information and analytical resources, as well as intelligent management systems. Researchers note that integrating digital technologies increases competitiveness in international markets and shapes new economic interaction formats (Shevchenko et al., 2023). Under martial law in Ukraine, structural changes have occurred in the business environment: businesses are increasingly implementing automation, remote management models, data analytics, and forecasting algorithms, which contribute to their stability and adaptability (Mazur et al., 2024). In addition, the formation of entrepreneurial ideas and their practical implementation today are closely linked to the use of digital tools that enable rapid assessment of market opportunities and the minimization of risks (Mazur, Boguslavsky, & Moroz, 2025). From the above, we can conclude that AI and Big Data are not only changing the technical means of doing business, but also defining a new logic of economic development based on data, intelligent systems, and dynamic responses to market changes.

Research shows that the introduction of AI and big data analysis enables more accurate forecasting of market needs and the improvement of internal processes. Digital tools provide "the ability to process large amounts of data, identify hidden patterns, and predict market changes" (Kyrylenko, 2024). The digital economy opens up new horizons for innovation, process optimization, and value creation. In particular, the authors emphasize that the use of AI, Big Data, blockchain, and IoT technologies "increases the effectiveness of management decisions, improves interaction with customers and partners, and gives companies a competitive advantage" (Kyrylenko, 2024).

Global trends: the share of organizations using AI in at least one function has grown to almost 72% in 2024 (according to McKinsey). The use of generative AI is growing most dynamically, from 33% in 2023 to 65% in 2024 (Kyivstar Business Hub, 2025) (Fig. 1).

This trend indicates the growing accessibility and business value of innovative technologies. Specifically, McKinsey estimates that the application of generative AI could add $200–340 billion annually to the global banking sector (McKinsey, & Company, 2023). Analysts note that the implementation of AI/Big Data significantly enhances enterprise productivity and profitability.

Regarding Ukraine, digital transformation is regulated by a series of laws and concepts. Specifically, the following laws are in force: "On Electronic Trust Services," "On Electronic Commerce," "On Telecommunications," "On

Information," "On Information Protection in Information and Telecommunication Systems," "On Electronic Documents and Electronic Document Management," "On Administrative Services," "On Access to Public Information," and others. Strategic documents ("Information Society Concept," "E-Government Concept") define the development vectors for digital public services and interaction with businesses.

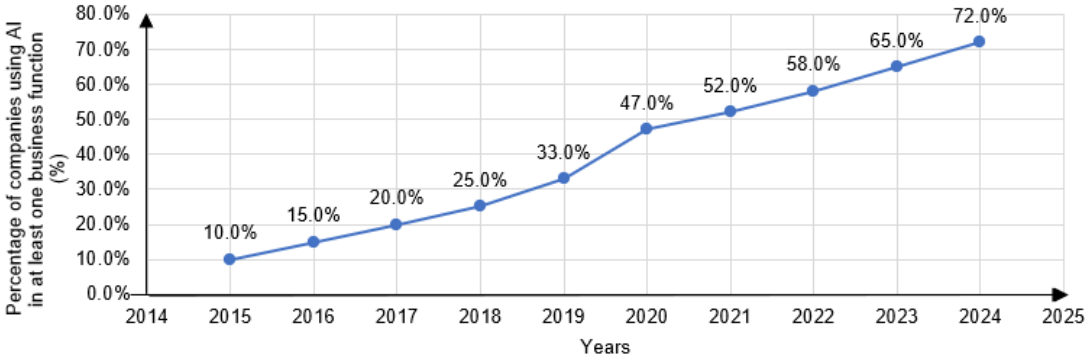


Fig. 1. Dynamics of AI and Big Data implementation in global business
Source: developed based on data from Kyivstar Business Hub, 2025.

Among the key laws is the Law of Ukraine No. 1667-IX dated July 15, 2021, "On Stimulating the Development of the Digital Economy in Ukraine," which introduced the legal regime of "Diia City" (a preferential ecosystem for IT companies). It establishes special instruments (e.g., "gig contracts") and preferential taxation (PIT 5.0%, Unified Social Contribution 22.0% for salaries) (KPMG, 2025). Requirements for "Diia City" residents are also established: a minimum average salary for engaged specialists (equivalent to 1200 euros) and maintaining this status for a certain period.

Law No. 4113-IX dated December 4, 2024, introduced amendments to the Tax Code regarding the digital economy. In particular, it clarified the taxation procedure for "gig specialists" within "Diia City": their income from employment and "gig" contracts is taxed at a PIT rate of 5.0% (individual entrepreneurs 2.0% single tax), provided certain criteria are met (salary ≥1200 € and number of employees ≥9 persons) (Lutsenko, & Pikulia, 2024). Thus, Ukraine's regulatory framework creates favorable conditions for institutionalizing the implementation of innovative IT solutions and for supporting entrepreneurship during the digital transformation.

Statistical data for Ukraine indicates the active implementation of digital technologies in entrepreneurship (Table 1).

Table 1

The state of AI and Big Data adoption in Ukrainian entrepreneurship (as of 2024)

Evaluation criteria	Percentage value (%)
Percentage of Ukrainian companies using AI in business processes	65.0
Percentage of companies using generative AI (GenAI)	65.0
Percentage of employees working with GenAI	75.0
Percentage of Ukrainians who are aware of AI	79.0
Percentage of Ukrainians who have experience using AI	29.0

Source: developed based on AI HOUSE data (2024).

Thus, 65.0% of Ukrainian companies have already integrated AI into their processes, and 65.0% also use generative AI. Meanwhile, 75.0% of employees have experience working with such tools. There are 243 companies operating in Ukraine that specialize in developing AI solutions (Ukrainian Startup Fund, AI House, & Roosh, 2023). Simultaneously, 79.0% of citizens know what AI is, but only 29.0% have had practical experience with it, indicating a gap between awareness and the technology's accessibility (AI House, 2024).

In the Ukrainian context, the digital transformation of entrepreneurship has several unique characteristics that set it apart from global trends. Specifically, the "Diia City" legal regime has become an institutional mechanism for stimulating innovative activity, creating favorable conditions for attracting investment, developing R&D teams, and commercializing products based on artificial intelligence. The development of local innovation communities, such as AI House, Kernel AI Community, and Ukrainian AI Cluster, fosters network effects: knowledge, expertise, and practical solutions spread faster than in traditional business ecosystems. These initiatives support the growth of startups and internal innovation units within large companies, which is reflected in the increasing demand for specialists in Data Science, MLOps, and product management for AI solutions.

At the same time, the impact of martial law and business relocation has prompted enterprises to accelerate the adoption of digital technologies to ensure the resilience, flexibility, and scalability of their business processes. The increased use of Big Data in the agricultural sector (AgriTech) and the financial industry (FinTech) demonstrates a shift from point application of digital tools to structural digitalization strategies. Thus, digital transformation in Ukraine is not merely a reflection of global trends but is shaped by the conditions of institutional reforms, the active role of technological communities, and demands for increased business adaptability, which give the Ukrainian experience unique characteristics and practical significance.

One illustrative example is Monobank, which integrates machine learning algorithms into creditworthiness assessment, risk forecasting, and personalization of banking products. A multi-level system for analyzing customer transactional behavior based on Big Data allows the bank to promptly adapt credit limits, offers, and tariff

models. In effect, the automation of financial decision-making processes reduces operational costs and decreases the share of non-performing loans, confirming the economic impact of AI implementation in Ukraine's financial sector (National Bank of Ukraine, 2023).

In the high-tech manufacturing sector, Ajax Systems demonstrates innovative practices (Forbes Ukraine, 2023). The enterprise implements computer vision and signal processing algorithms to improve the accuracy of security systems and reduce false alarms. Digital engineering of production, the application of predictive analysis in quality control, and the optimization of logistics processes create conditions for scaling products to international markets. This case demonstrates that AI implementation in Ukraine is not limited to digital services but extends to the real sector as well.

In the agricultural sector, digitalization is also becoming a key driver of competitiveness. The company Kernel develops its own AgriTech solutions based on the analysis of satellite imagery, IoT data from machinery, and yield prediction algorithms (Kernel, 2022–2023). The use of Big Data has enabled optimization of fuel and fertilizer costs, reduced productivity fluctuations between fields, and improved the efficiency of land bank management. This approach demonstrates a shift towards a "data as a strategic resource" model in a traditionally resource-intensive sector.

Overall, these cases indicate that Ukrainian enterprises apply AI and Big Data not only to automate individual functions but also as tools for strategic development that ensure scalability, cost reduction, and increased technological resilience in conditions of heightened uncertainty. Thus, the Ukrainian experience of digital transformation features unique characteristics, driven by a combination of internal innovation dynamics, adaptation to wartime and economic challenges, and active interaction between businesses and technological communities.

The presented data confirm a high level of interest among Ukrainian companies in implementing artificial intelligence and big data technologies. However, an imbalance persists between public awareness of AI's possibilities and the real experience of its use. This means that while Ukraine is gradually integrating into global digitalization trends, the level of digital maturity of entrepreneurship and society is still developing and depends on several internal factors–strategic planning, investment in digital infrastructure, and the development of human resource potential.

In light of this, analyzing the actual state of digital transformation in Ukrainian enterprises becomes particularly important. To ensure reliability and analytical representativeness, the study results are interpreted with the sample structure in mind. A total of 48 enterprises, differing by industry affiliation and scale of operations, were surveyed. The sample included companies from the IT sector (EPAM Systems, N-iX, SoftServe, Intellias, MacPaw, Genesis, Ajax Systems, Grammarly), industry and energy (DTEK, Metinvest, ArcelorMittal Kryvyi Rih, Ukrenergo, Naftogaz), the agro-industrial complex (MHP, AgroGeneration, Astarta Holding, NIBULON), the financial sector (UKRSIBBANK, Monobank, Oschadbank), logistics, and retail (Rozetka, Nova Poshta, Silpo, Foxtrot, ATB, Epicentr). By size, the sample included small (41.7%), medium (37.5%), and large enterprises (20.8%), allowing comparison of digital maturity levels by resource availability and operational scale. In terms of industry structure, the sample covers key sectors of the Ukrainian economy (Fig. 2). This enables a comparison of the features of digital transformation in businesses with varying levels of technological complexity and data intensity.

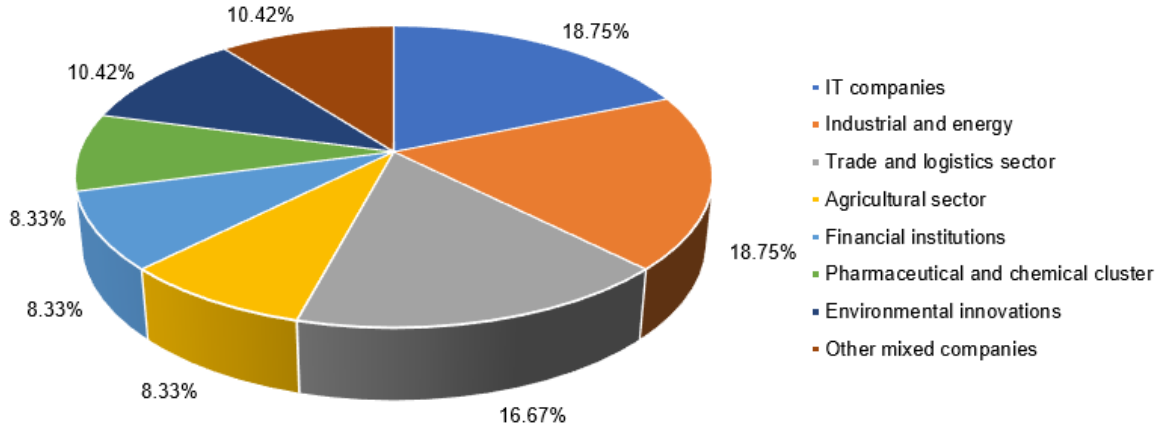


Fig. 2. Industry structure of the research sample
Source: based on data from the author's sociological survey.

The regional distribution indicates the dominance of enterprises from the Kyiv Innovation and Business Center (45%) and the Lviv IT cluster (15%), as well as the presence of large industrial and agricultural companies from the Central-Eastern and Southern regions (30%). This sample structure allows for considering different contexts of digital technology implementation; however, caution is required when generalizing the results to the entire country due to uneven regional representation. Respondents were selected based on the criterion of having or declaring digitalization processes, which aligns with the research goal of analyzing the implementation of AI and Big Data in enterprises where these processes are relevant. At the same time, the authors acknowledge that the sample is not statistically representative of the entire Ukrainian economy, as it does not fully reflect the regional distribution and the structural proportions of industries. This defines the direction for further research, which involves expanding the sample and conducting in-depth industry comparisons.

To determine how actively Ukrainian companies apply AI and Big Data tools, what barriers hinder this process, and what effects are already being observed, we conducted a

sociological survey among 48 enterprises in Ukraine of various sizes and industries (Fig. 3). The study used indicators of digital maturity such as "low level," "medium level," and "high level." The research revealed that the medium level constitutes the largest share – 64.58% of enterprises. This indicates that most companies already use digital tools but have not yet achieved systemic transformation. Only 20.83% of companies have a high level. These are enterprises actively implementing modern technologies and demonstrating digital competitiveness. A low level is characteristic of 14.58% of respondents, indicating lagging sectors where digitalization has not yet become a priority. Only 29.16% of enterprises already have a strategy ("Yes"). This is a relatively small share, indicating the limited prevalence of a strategic approach. The largest percentage – 47.91% – is developing a strategy. This demonstrates a general awareness of the importance of digital transformation, but also a delay in implementation. 22.91% of companies have no strategy at all, which creates the risk of falling behind in digital competition.

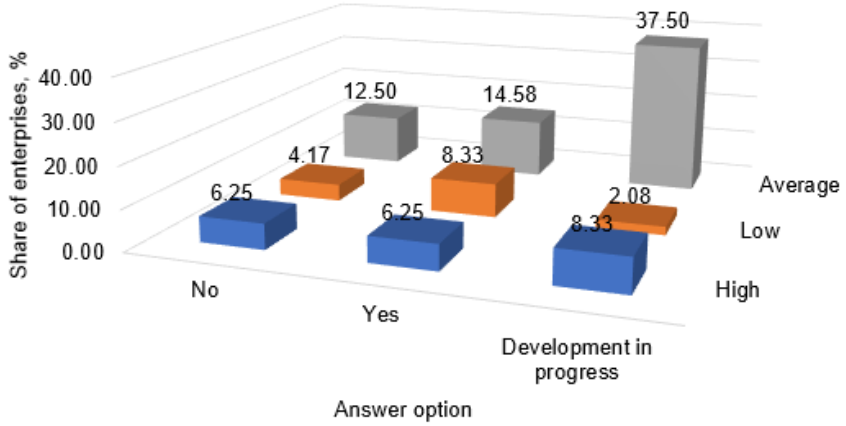


Fig. 3. Digital maturity of enterprises and the presence of a digitalization strategy
Source: based on the data from the author's sociological survey.

Among enterprises with a high maturity level, the majority either already have a strategy (6.25%) or are working on one (8.33%). This confirms that strategy is key to achieving maturity. In the low-maturity category, even the presence of a strategy (8.33%) does not always yield results; this may be due to a lack of resources or personnel capabilities. The medium level most closely aligns with the strategy development stage (37.50%), suggesting the potential for these enterprises to transition to a higher category.

Thus, the majority of enterprises (64.58%) are at a medium level of digital maturity, and most of them are currently formulating digitalization strategies. Only one in five enterprises (20.83%) has already reached a high maturity level. Overall, nearly half of the companies (47.91%) are developing strategies, which creates a positive trend but requires support (financial, educational, and infrastructural). It is advisable to further establish how closely the presence or stage of strategy development is linked to the company's level of digital maturity, using Pearson correlation coefficients (r) (Fig. 4).

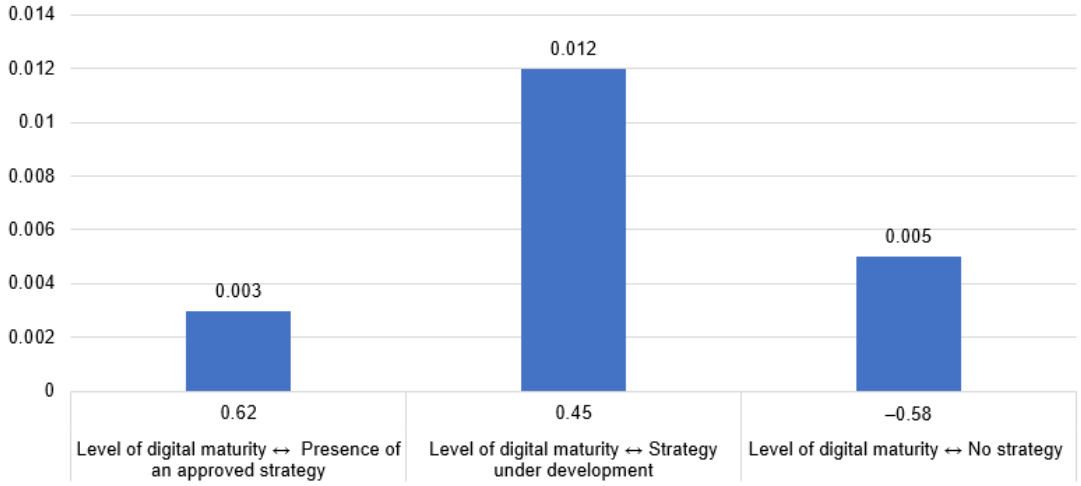


Fig. 4. Results of correlation analysis revealing the relationship between the level of digital maturity of enterprises and the existence of a digitalization strategy
Source: based on the data from the author's sociological survey.

A positive correlation (r = 0.62) between high digital maturity and the presence of an approved strategy indicates that enterprises that have achieved greater levels of digitization are significantly more likely to have adopted a digital transformation strategy. A moderately positive relationship (r = 0.45) with the "under development" stage

suggests that medium-digitization-level enterprises are actively preparing strategies. A negative correlation (r = –0.58) with the absence of a strategy indicates that the higher the level of digital maturity, the less frequently enterprises have no digitalization plans.

Furthermore, the study results established that the most common digital systems are CRM (50%) and industrial IoT solutions (40%). The use of AI and big data platforms was declared by 35% of respondents, while ERP systems by 31%. That is, the implementation of AI/Big Data is at a medium level: significantly lower than CRM and not substantially higher than ERP (Fig. 5).

Among large enterprises, the greatest impact is observed from CRM, AI, and IoT – the majority of companies reported clear improvements. Large enterprises reported no negative results (No), indicating sufficient resources and greater readiness for digitalization. Regarding medium-sized enterprises, the improvement indicators for CRM and ERP are most pronounced, but there are also cases of "Partial" and even "No" (especially with AI and Big Data). This points to contradictory implementation outcomes linked to funding limitations and a lack of specialized personnel. Among small enterprises, improvements are most often observed from AI, Big Data, and IoT, but cases of "No" are also present. This shows that for small enterprises; the impact of technologies is heterogeneous – success depends on specific conditions and state support.

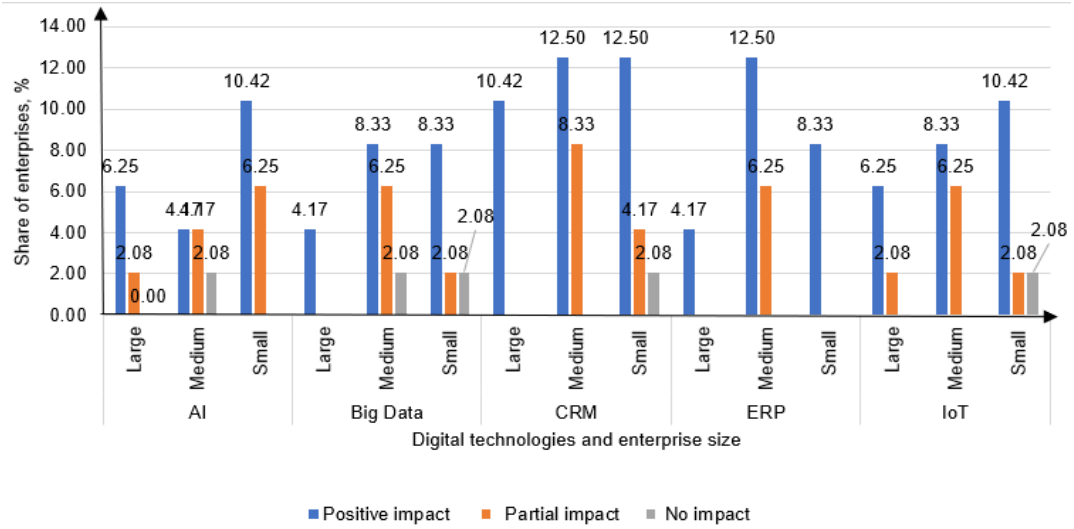


Fig. 5. The impact of digital technologies on the efficiency of business processes by company size
Source: based on the data from the author's sociological survey.

In our opinion, CRM and ERP consistently deliver the highest level of efficiency improvement across all groups. AI and IoT actively contribute, but their results depend on scale: small enterprises more frequently encounter difficulties. Large enterprises almost always experience a positive effect, while small and medium-sized enterprises require greater external support (financial, personnel-related, and consultative). This trend aligns with conclusions regarding the "limited use of artificial intelligence technologies" by Ukrainian enterprises. At the same time, despite a moderate level of use, digitalization is already yielding noticeable results: 63% of respondents noted significant improvement in business efficiency due to the application of digital technologies (with another 31% reporting "partial" improvement). This conclusion coincides with international research emphasizing the positive impact of digital innovations on enterprise productivity and operational flexibility (Sorokina, 2025).

The identified difference in the implementation levels of CRM (50%) and IoT (40%) compared to artificial intelligence and Big Data technologies (35%) is explained by their varying integration complexities and resource requirements. CRM systems are often implemented as "ready-made solutions" for automating customer interaction management, whereas AI requires prior data collection, structuring, and the availability of qualified Data Science specialists. According to additional analysis, most enterprises use machine learning algorithms for demand forecasting, customer scoring, and personalized marketing campaigns. The use of generative AI is primarily in content automation (product descriptions, chatbots, customer support). In industrial companies, predictive analytics and IoT sensor technology are widely used to monitor equipment condition and reduce downtime. Thus, the lower frequency of AI and Big Data implementation is not due to a lack of need, but to the greater technological and organizational complexity of their implementation. However, it is precisely these technologies that offer the greatest potential for efficiency gains – from cost optimization to improved accuracy in management decisions – indicating the strategic expediency of their expanded implementation.

For a deeper understanding of the impact of digital technologies on business efficiency, it is important to consider the specific business processes in which their results manifest. For instance, the use of CRM systems in trade-service companies (e.g., Rozetka and Foxtrot) reduced customer query processing time and increased the level of offer personalization, thereby boosting conversion rates and average transaction value. In the banking sector, the application of machine learning models (Monobank, UKRSIBBANK) optimized client scoring processes and risk management, reducing the share of non-performing loans and accelerating decision-making. At agribusiness enterprises (MHP, Astarta Holding), the use of Big Data and IoT sensors improved production cycle planning and reduced resource losses through more precise control of growing conditions and supply chains. In industrial companies (Metinvest, ArcelorMittal), data analytics and predictive equipment maintenance reduced downtime and repair costs. Therefore, the effect of digital technologies

manifests not only in a general increase in efficiency but also in the targeted transformation of key business functions – logistics, marketing, personnel management, financial control, and operational management.

Compared with international trends in business digital transformation, the results achieved by Ukrainian companies have several distinctive features. In particular, in EU countries and the USA, the implementation of AI and Big Data occurs within more mature institutional conditions, where accessible support ecosystems exist, data markets are formed, and a developed culture of using analytics in management decision-making is present (OECD, 2024; McKinsey, & Company, 2024). In contrast, in Ukraine, digitalization often serves as an adaptation mechanism to ensure business resilience amid war, economic, and logistical risks. This explains the simultaneous spread of basic digital tools (CRM, ERP, IoT) and the gradual implementation of AI / Big Data, which occurs "point-by-point" in the most critical processes – cost control, production planning, risk management, and customer service automation. The uniqueness of the Ukrainian experience lies in the fact that digital transformation is developing not only as a path to greater efficiency but also as a tool for ensuring business continuity and competitive resilience amid heightened uncertainty. Thus, Ukrainian enterprises demonstrate a mixed model of digitalization: rapid implementation of accessible technologies and gradual expansion of the application of intelligent solutions, forming their own trajectory of digital maturity, distinct from established global scenarios.

The main barriers (Fig. 6) to digital transformation, as considered by the respondents, are financial constraints (52%) and personnel resistance to change (52%). Almost half also cite insufficient technical infrastructure (50%) and a lack of qualified personnel (44%). The survey results indicate that the key obstacles to business digitalization differ substantially by enterprise size. Small enterprises suffer most from a lack of technical infrastructure (25.0%), financial constraints (22.9%), and resistance to change (22.9%). The impact of personnel shortages is also quite high (20.8%). This points to limited resources and insufficient readiness for large-scale digital transformation.

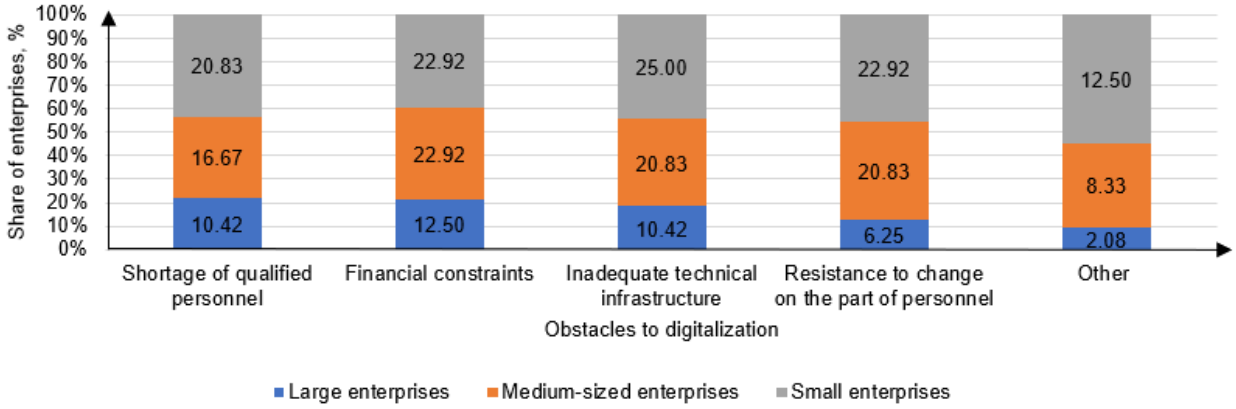


Fig. 6. Key obstacles to the implementation of digitalization
Source: based on the data from the author's sociological survey.

Discussion and conclusions

The digital transformation of Ukrainian enterprises is in a dynamic yet contradictory phase. The majority of companies are already integrating digital tools into their activities, but the level of maturity remains predominantly medium. This means that digital solutions are being actively applied, but do not yet ensure a systemic transformation of business models. Only a small fraction of companies can boast high digital maturity.

Technological innovations such as CRM systems, IoT, artificial intelligence, and big data analytics have already proven their effectiveness in business activities. The use of AI and Big Data, in particular, enables enterprises to increase productivity through automated analytics, accelerated decision-making, and more accurate demand and risk forecasting. It has been found that implementing machine learning algorithms and generative AI tools increases marketing campaign efficiency, enables personalized customer interactions, and optimizes logistical processes. Companies already using big data analytics demonstrate greater adaptability to market fluctuations and a faster ability to respond to external changes, creating tangible competitive advantages. At the same time, the impact of their implementation varies significantly by enterprise size: large companies achieve almost exclusively positive results, while medium and, especially, small enterprises often face limitations that reduce the effectiveness of digital implementation.

The key barriers are universal but affect enterprises with varying intensity: financial difficulties, personnel resistance to change, outdated technical infrastructure, and a shortage of qualified personnel. Small and medium-sized companies are most vulnerable to these challenges, as they lack resources and human capital. For large enterprises, the barriers are less critical but still remain risk factors.

Implementing digital transformation requires not only recognizing its importance but also practical support mechanisms at the state, industry association, and enterprise levels. At the state level, institutionalizing incentives for the implementation of AI and Big Data is important. In particular, it is advisable to expand the "Diia City" regime to companies in the real sector that use AI technologies in production and management, and to introduce tax incentives for enterprises undertaking digital modernization. An effective mechanism could be a grant support program like "Vouchers for Digitalization" (analogous to the EU's Digital Innovation Vouchers program), covering part of the costs of implementing CRM/ERP systems, big data analytics platforms, cybersecurity, and production automation. It is also crucial to integrate elements of AI and data analytics into state professional retraining programs, particularly through the National School of Digital Skills under the Ministry of Digital Transformation, focusing on training data analysts, algorithm developers, and digital managers.

At the level of business associations and clusters, it is necessary to expand networks for sharing successful cases, particularly based on the Ukrainian IT Association, EBA, and the Union of Ukrainian Entrepreneurs. Creating industry platforms for data and practice exchange, similar to European Digital Innovation Hubs, could provide SMEs with access to expertise currently concentrated in large companies. It is also important to support corporate-university partnerships, such as AI House Kyiv and SET University training programs, which provide AI and data management training for the real sector.

Enterprises themselves, regardless of scale, should view digitalization not as a one-time implementation of individual tools but as the strategic development of organizational culture and business processes. It is recommended to start by building internal competencies: creating small analytical teams, training staff in data work through courses such as Prometheus, Coursera for Business, and Google Digital Academy, and engaging external consultants at pilot stages. For small enterprises, a phased implementation model is advisable: starting with CRM and basic analytics, then operational automation, and only after that, AI algorithms for marketing personalization, demand forecasting, or logistics optimization. Large companies can develop their own R&D departments, invest in the systematic use of Big Data and artificial intelligence across all business processes, including financial planning and supply chain management.

Prospects for further research are linked to an in-depth analysis of specific AI/Big Data implementation mechanisms: which algorithms and models yield the greatest economic impact, how to overcome organizational resistance, and which forms of personnel training are most effective. It is also advisable to develop research in three interrelated dimensions, depending on enterprise size, as this factor has proven decisive in the nature of barriers and the effectiveness of digital innovations.

Overall, Ukrainian enterprises show strong interest in digital transformation and a desire to integrate modern technologies into their operations. However, to transition from partial solutions to systemic business digitalization, comprehensive state support is needed–financial, infrastructural, and educational. Only by combining enterprises' internal efforts with external facilitation can a competitive digital economy be formed, capable of integrating with global trends and ensuring the sustainable development of Ukrainian entrepreneurship in the future.

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ШТУЧНИЙ ІНТЕЛЕКТ І ВЕЛИКІ ДАНІ (BIG DATA) У ЦИФРОВІЙ ТРАНСФОРМАЦІЇ ПІДПРИЄМНИЦТВА

В с т у п . ***Розглянуто сучасний стан цифрової трансформації українських підприємств із наголосом на роль штучного інтелекту (ШІ) та великих даних (Big Data). Висвітлено рівень цифрової зрілості компаній, поширення стратегій цифровізації, а також ключові бар'єри впровадження новітніх технологій. На основі результатів соціологічного опитування проаналізовано специфіку впливу цифрових інновацій на великі, середні та малі підприємства як форми організації підприємництва. Сформовано узагальнені висновки та визначено перспективні напрями подальших досліджень.***

М е т о д и . ***Для досягнення результатів дослідження використано комплекс сучасних наукових методів: історичного та логічного аналізу для з'ясування еволюції цифрової економіки; методу експертних оцінок для інтерпретації отриманих результатів; індексного методу для кількісного оцінювання рівня цифрової зрілості підприємств. Емпіричною основою виступили результати онлайн-опитування 48 підприємств України різних розмірів (малий, середній, великий) і сфер діяльності (IT, промисловість, торгівля, логістика, фінанси, агросектор). Вибірка формувалася за принципом цільового та стратифікованого добору: до участі залучали підприємства, які протягом останніх двох років здійснювали або декларували впровадження цифрових технологій. Такий підхід дозволив охопити різні типи бізнес-моделей і порівняти рівні цифрової зрілості за галузевою та масштабною ознаками. Водночас автори визнають, що обсяг вибірки не є репрезентативним для узагальнення результатів на рівні всієї економіки України; отримані висновки відображають типові тенденції та закономірності серед підприємств, що вже перебувають на етапі цифрової трансформації.***

Р е з у л ь т а т и . ***Встановлено, що більшість українських підприємств перебувають на середньому етапі цифрової зрілості, тоді як високого рівня досягли лише окремі компанії. Доведено, що наявність або розроблення стратегії цифровізації безпосередньо пов'язано з вищим рівнем цифрової зрілості. Виявлено, що найбільш поширеними інструментами цифрової трансформації залишаються системи управління взаємодією з клієнтами та промислові рішення інтернету речей, а штучний інтелект і великі дані впроваджуються поступово. Обґрунтовано, що великі підприємства отримують переважно позитивні результати від цифрових технологій, тоді як середні та малі демонструють більш різнорідний ефект. Підтверджено, що ключовими бар'єрами цифровізації є фінансові труднощі, опір змінам персоналу, обмеженість технічної інфраструктури та брак кваліфікованих кадрів.***

В и с н о в к и . ***Результати дослідження підтвердили, що впровадження технологій штучного інтелекту та Big Data сприяє підвищенню продуктивності, покращенню управлінських рішень та зміцненню конкурентних переваг українських підприємств. Водночас виявлено ключові бар'єри цифровізації – фінансові обмеження, опір змінам персоналу та нестачу технічної інфраструктури й кадрів. Для розширення позитивного впливу цифрової трансформації необхідна комплексна підтримка бізнесу через фінансові стимули, програми навчання та консультаційний супровід.***

К л ю ч о в і с л о в а : ***цифрова трансформація, цифрова зрілість, штучний інтелект, великі дані, бізнес-бар'єри, стратегія цифровізації, інноваційні технології, цифровізація підприємництва в Україні.***

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