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IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE IN ENTERPRISE OPERATIONS AS A TOOL FOR ENSURING THEIR ECONOMIC SECURITY

Summary

The research is dedicated to the pressing problem of implementing artificial intelligence in the practical activities of enterprises as a tool for ensuring their economic security under conditions of global uncertainty and martial law. The study analyzes the impact of AI technologies on global economic development, revealing that the global artificial intelligence market will grow from 224.4 billion dollars in 2024 to 1236.5 billion dollars in 2030, and generative AI tools are capable of providing annual growth of global GDP by 2.6-4.4 trillion dollars. A comprehensive statistical analysis of the implementation of artificial intelligence technologies at Ukrainian enterprises for the period 2022–2025 has been conducted, which revealed a complex picture of the digital transformation of the domestic economy. The research demonstrated that the overall level of AI implementation in Ukraine decreased from 5.4% to 4.6%, however, significant sectoral differentiation is observed: the IT sector demonstrates growth of 63%, the pharmaceutical industry – 711%, while telecommunications and the chemical industry show decline. The formation of a "digital divide" between enterprises of different sizes has been identified, where large companies (250+ employees) showed growth in AI implementation by 83%, while small enterprises demonstrated a decrease of 18%. It has been substantiated that AI technologies transform approaches to ensuring the economic security of enterprises through early threat detection, financial monitoring with accuracy up to 95%, and cybersecurity capabilities. The practical significance of this study lies in the possibility of using its results by enterprises to optimize strategies for the implementation of AI technologies and by public authorities to develop policies for the digital transformation of Ukraine's economy.

Introduction

The rapid development of the world's leading economies is associated with the implementation of technological approaches to forecasting economic processes in practical activities, which is conditioned by the introduction of innovative approaches based on artificial intelligence at both macro and micro levels. The practical

application of artificial intelligence tools in the activities of economically active entities has given impetus not only to the growth of global GDP levels, but has also contributed to the development of leading sectors of the economy. Recent years have demonstrated that economically successful and technologically advanced states invest and facilitate private business in allocating significant sums to the development of digital technologies. However, the implementation of artificial intelligence in the economic activities of the state or individual private entities requires the resolution of a number of problems related to the legislative regulation of emerging technologies and the socio-economic consequences of the automation of these processes.

The contemporary business environment is characterized by unprecedented levels of complexity and uncertainty, driven by geopolitical tensions, supply chain disruptions, cybersecurity threats, and rapid technological transformations. In this context, traditional approaches to ensuring enterprise economic security have proven insufficient to address the multifaceted nature of modern risks. The emergence of artificial intelligence technologies offers enterprises new opportunities to enhance their security frameworks through predictive analytics, real-time monitoring, and automated threat detection systems.

The integration of artificial intelligence into enterprise operations represents a paradigmatic shift in how businesses approach risk management and economic security. AI-powered systems enable organizations to process vast amounts of data from multiple sources, identify patterns and anomalies that human analysts might miss, and generate predictive insights that inform strategic decision-making. This technological evolution is reshaping the landscape of economic security, moving from reactive threat response to proactive risk prevention and mitigation strategies.

According to McKinsey Global Institute estimates, the global AI technology market demonstrates exponential growth with an expected volume exceeding $1.8 trillion USD by 2030 [21]. However, for Ukraine, this transformation is taking place in unique conditions: on the one hand, the country has a powerful IT sector and a high level of technical education, and on the other, it faces unprecedented challenges of martial law, an energy crisis, and the need to ensure the economic sustainability of enterprises. This necessitates the development of comprehensive research on the peculiarities of AI implementation in enterprise practical operations and their correlation with European and global trends.

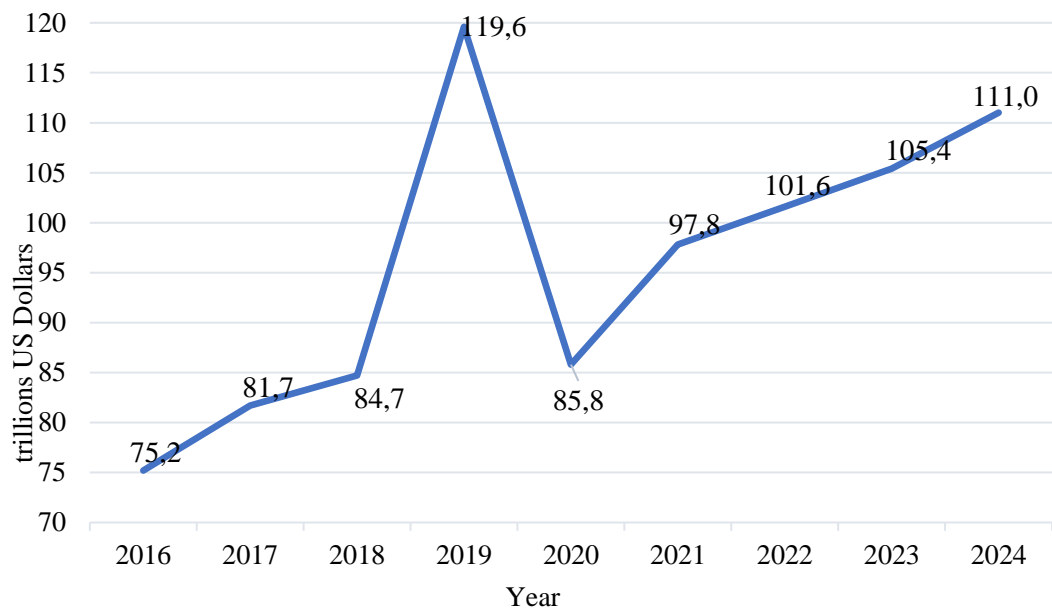This study is a continuation of the authors' previous research [2; 14].

Chapter 1. The impact of artificial intelligence on global economic development: benefits and challenges

The implementation and development of modern technologies leads to the formation of a unified information-digital space, which is based on the accumulation and processing of various formats and datasets. Expectedly, the expansion of information arrays necessitates the introduction of new digital tools into practical activities, which will enable analytical processing of large volumes of information for subsequent decision-making. The use of advanced technologies, including artificial intelligence tools, allows information analysis and, based on it, the

development of forecasts regarding economic trends at both macro and micro levels [6].

In 2024, the estimated value of the artificial intelligence market was 224.4 billion US dollars, and is projected to reach 1236.5 billion US dollars in 2030, maintaining an average annual growth rate of 32.9 percent [24].

In an analytical study conducted by the consulting company McKinsey, it is noted that generative artificial intelligence tools are capable of providing annual growth to global GDP of 2.6-4.4 trillion dollars, whereas in 2022 the growth of the world economy was estimated at 3.6 trillion US dollars [8, 31]. The dynamics of global GDP for 2016-2024 are presented in Figure 1.

Figure 1. Dynamics of Global GDP Change for 2016-2024, trillion USD

Source: compiled by authors based on [8; 18; 24; 31]

The implementation of artificial intelligence in the analytical component of government or individual entity activities creates new approaches to work process automation and reveals new possibilities for generating valuable, impartial analytics inaccessible to humans. This approach expands the demand for digital analytics at all management levels [27]. Thus, the world is currently discovering new opportunities for detailing specific directions of economic development and forecasting its trends by transforming and reconceptualizing conventional analytical approaches. Advanced digital innovative approaches provide impetus for changes in the development not of individual entities, but of entire sectors of the economy and industry. The implementation of artificial intelligence technology in economic processes indicates the globalization of world trends toward using digital approaches in forming the revenue and production components of countries' economies, which is accordingly imreflected in the assessment of growth of the main indicative of gross domestic product.

Artificial intelligence technology today is already being implemented in almost all macroeconomically significant sectors of the economy, industry, defense, and

education. New technologies have found application both in public administration and in their implementation into state policy, as well as becoming one of the drivers of global economic growth. We believe that the most positive impact of artificial intelligence in the global sense will be reflected in its implementation in the state governance sector for economic forecasting in the directions presented in Table 1.

Table 1

**Promising areas of artificial intelligence application
in the public administration sector for economic forecasting**

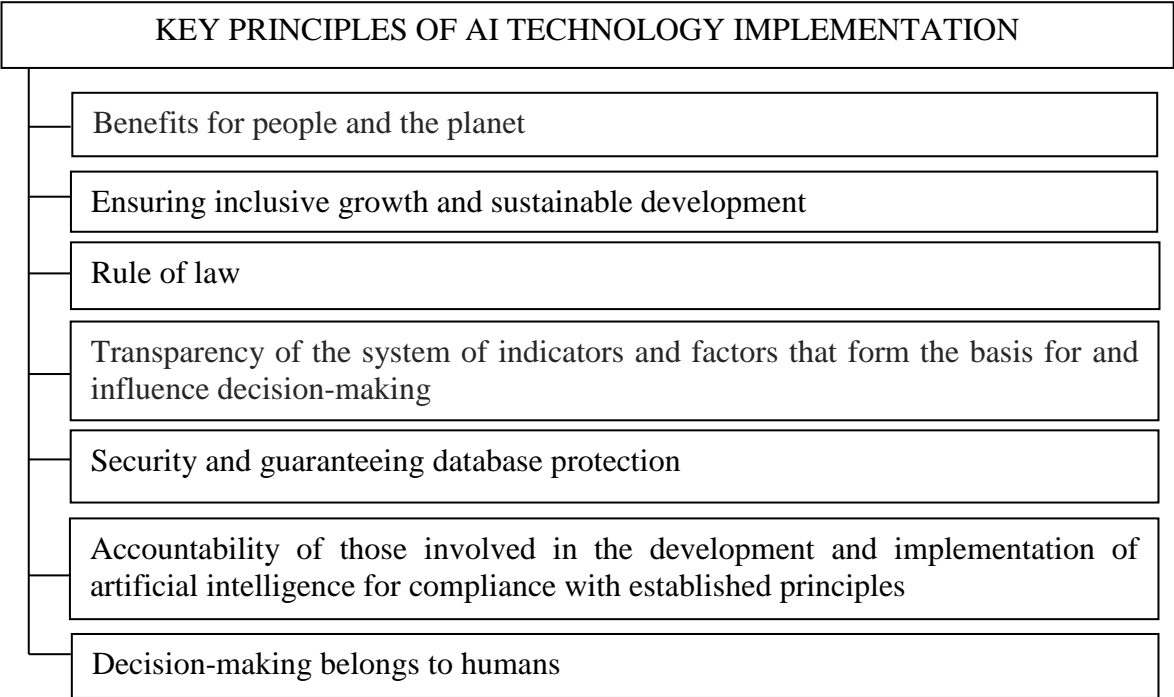| Direction	Purpose
Information Analysis	processes large data arrays, including those dispersed across various sources
Forecasting	analysis of economic processes and global trends with compilation of forecasts and financial-economic development indicators
Labor Optimization	automation of processes and optimization of production and human resource utilization
Legal Aspect	analysis of legal norms and e-court decision systems to avoid negative judicial-legal consequences
State Sector	use of digital products to reduce corruption and increase electronic communication

Source: compiled by authors based on [15; 34]

The implementation of digital governance approaches worldwide has not bypassed Ukraine, accordingly the government has developed a program for the integration and development of artificial intelligence [4] and a concept for using artificial intelligence technologies in priority sectors of the economy until 2026. These documents define priority steps and directions for implementing digital technologies at the national level using the "smart manufacturing" concept and provide main theses for artificial intelligence development in state governance.

According to the concepts proposed by the government, it is determined that in our country, artificial intelligence should be understood as: "a set of information technologies, with the application of which it is possible to perform complex comprehensive tasks through the use of a system of scientific research methods and algorithms for processing information obtained or independently created during operation, as well as to create and use proprietary knowledge bases, decision-making models, algorithms for working with information, and to determine methods for achieving set tasks" [5].

The concept developed by the government defines priority directions for state policy development regarding the primary implementation of artificial intelligence in the sectors of economy, education and science, industry, defense, information security, public administration, ethics, healthcare, and legal relations. The implementation of modern digital technologies based on artificial intelligence in priority sectors requires changes in approaches to reconceptualizing processes related to decision-making at various levels of state governance. Therefore, issues of increasing digital literacy of the population, updating databases, and developing digital documents and behavioral templates are important directions for

implementing new technologies in the state institutions activities, which must be based on the corresponding principles laid out in the concept (Figure 2).

However, the implementation of artificial intelligence in state institutions, due to the accumulation of extremely large information data arrays, including commercial and personal data, raises concerns regarding their protection from external interference, as well as unauthorized use by both humans and machines. Based on this, the issue of information protection when implementing artificial intelligence tools at the national level is one of the most complex, since digital information, especially of strategic, defense, and commercial nature, is under constant pressure from criminal encroachments, and therefore requires cyberprotection and amendments to legislative acts regarding technical and financial support of its security.

KEY PRINCIPLES OF AI TECHNOLOGY IMPLEMENTATION
Benefits for people and the planet
Ensuring inclusive growth and sustainable development
Rule of law
Transparency of the system of indicators and factors that form the basis for and influence decision-making
Security and guaranteeing database protection
Accountability of those involved in the development and implementation of artificial intelligence for compliance with established principles
Decision-making belongs to humans

Figure 2. Key principles of artificial intelligence technology implementation
Source: compiled by authors based on [8; 29]

The main task of cyberprotection and cybersecurity is the protection of communication, information and technological systems, information technologies, primarily those used by operators (providers) of key services (including critical infrastructure facilities) and are essential for the continuous functioning of the state, society, and the safety of citizens [2; 16]. Therefore, from the perspective of organizing state policy on the implementation of artificial intelligence, a comprehensive approach to solving the cybersecurity problem is required, in particular:
– improvement of legislation in the field of cybersecurity and cyberprotection;
– development of protocols and cybersecurity systems, including with the use of artificial intelligence tools themselves for its training and recognition of information leakage threats;

– implementation of certification of products based on artificial intelligence and licensing of their service providers;

– reduction in the use of foreign digital products and development of domestic information platforms and software;

– expansion of the use of domestic developments in the state sector of economy, governance, and defense;

– improvement of control mechanisms over access to information by establishing levels and limitations to its access;

– development of state policy regarding the implementation of artificial intelligence in priority sectors of the economy;

– updating and replacing state standards for information security and cybersecurity measures during the operation of information and communication systems and digital equipment by employees of state institutions [5; 6; 16].

Addressing pressing issues related to the implementation of artificial intelligence technologies will contribute to ensuring national interests in information security measures [4].

Along with this, the question remains one open regarding the creation of security safeguards to overcome the expansion of artificial intelligence capabilities when it is used by authorities for decision-making. Such mechanisms must provide for limitations and alternatives to decisions proposed by artificial intelligence and the human factor. Since machine thinking and a pragmatic approach may create circumstances that will threaten economic, legal, informational, or national security, both at the macro level and for a specific individual. Such circumstances may arise through manipulation of personal or information data, unauthorized access to networks, deliberately false or negligent input of source data, and so on.

Also, when considering the disadvantages of implementing artificial intelligence and process automation at the macro level, it is necessary to consider socio-economic aspects, such as:

– impact on the labor market due to decreased demand for certain positions resulting from the automation of routine tasks;

– insufficient level of digital and technical literacy among employees;

– ethical aspects related to ensuring the non-disclosure of confidential and private information.

However, despite possible and existing disadvantages related to the implementation of artificial intelligence and database protection, it is primarily necessary to analyze the positive and negative aspects of the expected result. Based on this, the state governance sector and the provision of state services need to find a balance between the necessity of ensuring cybersecurity and cyberprotection of data and the disclosure and provision of access to a possible volume of information. Security mechanisms for information access must be regulated by appropriate normative legal acts and include personal responsibility of individuals for information disclosure. Despite existing disadvantages related to the necessity of database protection and possible unauthorized interference in information resources, at present the advantages of implementing artificial intelligence contribute to its rapid development, and the issue of legislative and ethical regulation is becoming relevant at all levels. And although certain issues regarding

personal data protection are regulated by domestic legislation, however, considering that artificial intelligence is in the stage of development and implementation, the use of personal, commercial, or other data related to national security requires additional regulation at the state level [2].

It is worth noting that significant and rigid restrictions related to access to information resources and the use of obtained information only by its administrator may lead to the degradation of digital transformation and serve exclusively as an administrative resource. Regarding this, we believe that the improvement of the regulatory legal framework for the definition of datasets that are subject to publication or have general/personal access will enable the expansion of its use for the growth of economic potential. Therefore, the government needs, considering the economic, ethical, social, or security component, to develop a gradation scheme for determining users and their access possibilities to information, considering powers and purposes. Despite existing disadvantages and necessary limitations, artificial intelligence in practical activities opens significant economic prospects for the development both the country and a specific entity, from the point of view of activity optimization and efficient use of existing resources.

Recent trends in the global economy indicate that artificial intelligence is emerging as a key driver of the digital economy, positively impacting a wide range of industries and business processes. At the microeconomic level, factors such as raw material extraction and supply, product manufacturing, market distribution, market research, and the analysis of market trends play a crucial role in overall economic development [12]. The adoption of AI in high-tech industries, healthcare, education, and the banking sector is projected to boost company revenues by USD 200–340 billion [23]. Consequently, targeted microeconomic approaches to digital technology implementation not only enhance the performance of individual businesses but also contribute to broader macroeconomic transformation.

Chapter 2. Analysis of Artificial Intelligence Technology Implementation at Ukrainian Enterprises

The economic security of enterprises in the conditions of hybrid warfare and global uncertainty is acquiring new dimensions. Traditional approaches to risk management are proving insufficient to counter modern threats from cyberattacks and sabotage to logistical crises and energy blackmail. In this context, artificial intelligence technologies are becoming not just a tool for optimizing business processes, but a critically important component of the system for ensuring economic security and survival of enterprises [33].

Analysis of international experience demonstrates that enterprises actively implementing AI technologies show 15–25% higher operational efficiency and 30–40% better crisis resilience indicators compared to companies not utilizing such solutions [22]. At the same time, statistical data on the implementation of AI in Ukrainian enterprises demonstrate contradictory trends that require detailed analysis and scientific substantiation.

The research methodology of this chapter is based on a comprehensive approach combining statistical analysis of official data from the State Statistics Service of

Ukraine, comparative analysis of sectoral characteristics of AI implementation, and forecasting development trends. To build predictive models, trend analysis and linear regression methods are used, which allows extrapolating the identified trends to future periods, taking into account the statistical significance of the results obtained.

Analysis of statistical data from the State Statistics Service of Ukraine regarding artificial intelligence technology implementation in enterprises during 2022–2025 reveals a complex picture of digital transformation in the domestic economy under conditions of martial law and global challenges.

Table 2

Summary table of AI implementation in Ukrainian enterprises for 2022–2025

№	Sector	2022 (%)	2025 (%)	Variation (п.п.)	Growth rate (%)
1	Total	5,4	4,6	-0,8	-15
2	Computer programming and IT services	7,1	11,6	+4,5	+63
3	Information and telecommunications (overall)	5,4	7,9	+2,5	+46
4	Publishing and media production	4,1	7,6	+3,5	+85
5	Telecommunications	3,8	1,0	-2,8	-74
6	Pharmaceutical preparations	0,9	7,3	+6,4	+711
7	Chemical industry	7,9	2,3	-5,6	-71
8	Oil refining	0,0	3,2	+3,2	new
9	Manufacturing industry (overall)	5,3	4,4	-0,9	-17
10	Automotive industry	3,6	6,1	+2,5	+69
11	Food industry	4,5	5,0	+0,5	+11
12	Computers and electronics	1,5	4,3	+2,8	+187
13	Mechanical engineering and metallurgy	5,0	4,2	-0,8	-16
14	Textile industry	7,0	4,3	-2,7	-39
15	Professional and scientific activities	5,1	5,9	+0,8	+16
16	Consulting and architecture	5,1	6,4	+1,3	+25
17	Advertising and research activities	0,0	6,4	+6,4	new
18	Wholesale trade	5,8	6,3	+0,5	+9
19	Retail trade	5,4	4,5	-0,9	-17
20	Transport and logistics	5,4	4,0	-1,4	-26
21	Financial and insurance activities	7,8	4,6	-3,2	-41
22	Hotel and restaurant business	6,7	4,3	-2,4	-36
23	Construction	6,6	3,0	-3,6	-55
24	Energy and utilities	3,9	3,8	-0,1	-3
25	By number of employees	5,4	4,6	-0,8	-15
26	10–49 persons	4,0	3,3	-0,7	-18
27	50–249 persons	6,7	6,5	-0,2	-3
28	250+ persons	5,2	9,5	+4,3	+83

    – IT and telecommunications (technological sectors directly engaged with digital solutions)

    – Chemistry and pharmaceuticals (knowledge-intensive productions with high innovation potential)

    – Manufacturing industry (traditional production sectors of various technological levels)

    – Services (intellectual and professional services)

    – Trade and logistics (sectors oriented toward movement of goods and services)

    – Other Industries (finance, construction, energy, and other sectors)

Source: compiled by authors based on [30]

The overall dynamics of AI technology implementation in the Ukrainian economy demonstrates ambiguous trends. If in 2022 the share of enterprises using artificial intelligence technologies was 5.4%, by 2025 this indicator decreased to 4.6%, corresponding to a reduction of 0.8 percentage points or 15% relative to the baseline level [30]. This decline contrasts significantly with global trends, where AI technology implementation demonstrates stable growth at 20-30% annually.

However, these overall figures hide significant sectoral differentiation, indicating the heterogeneity of digital transformation processes across sectors of the economy. The information and communication technology sector shows the greatest growth, with computer programming and IT services growing from 7.1% in 2022 to 11.6% in 2025, an increase of 63%. This supports the thesis that technology companies remain the locomotive of digital innovation even in conditions of global uncertainty [19].

Particularly notable is the phenomenon of the pharmaceutical sector, where the adoption of AI technologies has exploded from 0.9% to 7.3%, an increase of 711%. This trend is consistent with global research by McKinsey, which shows that the pharmaceutical industry is one of the most promising for the application of AI technologies, especially in drug discovery and personalized medicine areas [20].

Simultaneously, traditional economic sectors demonstrate opposite trends. The construction industry suffered the greatest drop in AI technology implementation – decrease from 6.6% to 3.0% (55% decline). The chemical industry also shows negative dynamics with a reduction from 7.9% to 2.3% (71% decline). These trends correlate with PwC research indicating that energy-intensive industries face particular challenges when implementing digital technologies in the context of energy instability [26].

The financial sector also demonstrates negative dynamics with indicator decline from 7.8% to 4.6% (41% decline). This may seem paradoxical, as according to Deloitte research, the financial industry is traditionally a leader in AI technology implementation globally [7]. However, under crisis conditions, financial institutions often focus on ensuring basic operational resilience, which may temporarily push digital transformation projects to the background.

The development of new segments of the AI market is quite interesting. Advertising and research activities have shown an emergence in the market from zero to 6.4% in 2025. This is consistent with the trends described in Gartner reports, which predict a rapid growth in the use of AI in marketing and consumer behavior analytics [9].

Comparison with international indicators demonstrates significant lag behind developed countries. According to OECD data, the average level of AI technology implementation in member-country enterprises is 8%, which is twice over the indicators in our analysis [25]. However, it should be considered that this data was collected under unique circumstances, which may explain differences in dynamics.

Analysis of the dynamics of AI implementation suggests the emergence of a two-speed economy, where high-tech sectors focused on international markets continue to grow and innovate, while traditional industries face serious challenges and reduced investment in digital technologies. This trend may have long-term consequences for the structure of the economy and its competitiveness in international markets.

Detailed sectoral analysis of artificial intelligence technology implementation reveals profound structural changes in the Ukrainian economy, which are being formed under the influence of technological innovations, market conditions, and external shocks. Differentiation between sectors reaches critical values, creating a new economic reality with a clear division into digital leaders and lagging industries.

Information and communication technologies are undoubtedly leading the way in the implementation of AI solutions. Computer programming and IT services demonstrate the highest absolute rate of AI implementation at 11.6% in 2025, which is also accompanied by the highest growth rate among all industries – 63% over the analyzed period. This phenomenon is explained by several factors: the natural proximity of IT companies to advanced technologies; high qualification of personnel and understanding of the potential of AI; orientation towards international markets, where the implementation of AI is becoming a competitive necessity.

According to research by IBM (2024), companies that actively implement AI identify faster software development (25%) as one of the key indicators of return on investment, while process automation allows saving millions of hours of working time [11]. These advantages are especially critical for Ukrainian IT companies that compete in the global outsourcing market and product solutions.

The information and telecommunications sector overall also demonstrates positive dynamics with growth to 7.9% (+46% relative to 2022). Publishing activity and media production particularly stand out with an indicator of 7.6% and a growth rate of 85%. This reflects the transformation of the media industry, where AI is used for automation of content generation, personalization of recommendations, and audience analysis [17].

The pharmaceutical industry represents the most dramatic success story from the point of view of AI implementation. Growth from 0.9% to 7.3% (growth rate of 711%) makes this industry the absolute leader in terms of change dynamics. The main directions of AI application in pharmaceuticals are the development of original medications (reduction of new drug development time from 10-15 to 3-5 years), clinical research (optimization of design and conduct of trials), and personalized medicine.

The emergence of new segments of the AI market also deserves attention. Advertising and research activities, which practically did not exist as a separate segment of AI implementation in 2022, reached an indicator of 6.4% in 2025. This indicates the formation of an ecosystem of AI services oriented toward data analysis, marketing analytics, and market research.

The most critical situation is in the construction industry, which suffered the greatest absolute and relative decline in AI technology implementation – from 6.6% to 3.0% (55% decline). This dynamic directly correlates with the overall state of the construction industry, which is one of the most affected by external shocks. Research by Boston Consulting Group shows that the construction industry is traditionally characterized by low rates of new technology implementation, not undergoing fundamental changes over the past 50 years, especially in comparison with other industries [3].

The chemical industry demonstrates the second largest decline from 7.9% to 2.3% (71% reduction). This trend is closely linked to the energy intensity of the industry and the general challenges facing energy-intensive industries. Chemical companies facing an energy crisis typically put digital transformation projects on hold in favor of ensuring basic operational sustainability.

The financial sector is also experiencing a reduction in investments in AI technologies with a decline in indicators from 7.8% to 4.6% (41% decline). This may seem paradoxical, since the financial industry is traditionally a pioneer in the implementation of digital technologies.

The telecommunications industry shows a decline from 3.8% to 1.0% (74% reduction). This contrasts with global trends, where telecommunications companies actively invest in AI for network optimization, improvement of customer service, and development of new services. Such a tendency is not a statement for the entire industry. For example, the direction of Information and telecommunications demonstrated growth from 5.4% to 7.9%. On the other hand, the direction of Telecommunication services in telecommunications demonstrated a decline from 3.8% to 1%, which significantly affected the overall trend.

Manufacturing industry overall demonstrates moderate decline from 5.3% to 4.4% (17% reduction), however, within the sector significant differentiation between sub-sectors is observed. This heterogeneity reflects different levels of technological complexity, export orientation, and resilience to external shocks.

Automotive industry stands out as an example of successful adaptation with growth from 3.6% to 6.1% (69% increase). This trend is consistent with the global transformation of the automotive industry, where AI becomes critically important for the development of electric vehicles, autonomous driving, and smart technologies. According to industry research, AI in the automotive industry increases the speed and accuracy of production, helps automakers improve efficiency through reduction of human errors and adjustment of production lines [1].

Computer and electronics production shows significant growth from 1.5% to 4.3% (187% increase), which reflects the synergy between the production of high-technology equipment and the implementation of advanced technologies in production processes. This industry is naturally inclined toward digitalization due to the nature of products and requirements for production precision.
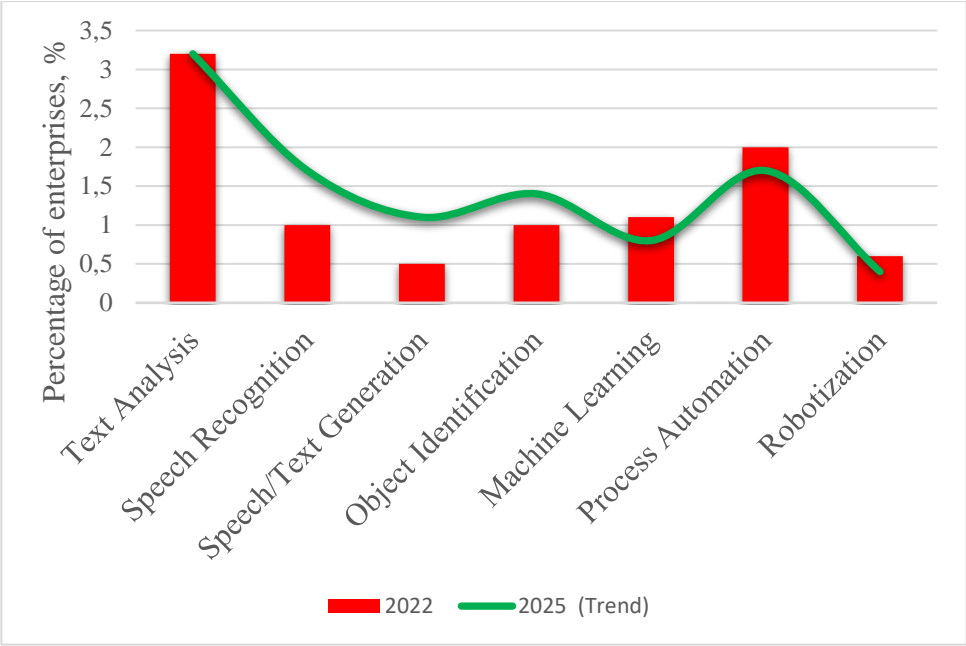
At the same time, the textile industry demonstrates significant decline from 7.0% to 4.3% (39% reduction), which may reflect the general challenges of traditional light industry sectors. Mechanical engineering and metallurgy also show moderate reduction from 5.0% to 4.2% (16% decline), which indicates stability but absence of dynamic growth in these sectors.

The food industry demonstrates relative stability with slight growth from 4.5% to 5.0% (11% increase). This industry is traditionally characterized by conservatism in the implementation of new technologies, but at the same time has stable demand, which allows maintaining investments in modernization at the basic level.

Analysis of sectoral differentiation indicates the formation of a new economic structure, where technological progressiveness becomes a key factor of competitiveness. Industries that successfully integrate AI technologies obtain

significant advantages in productivity, product quality, and adaptability to market changes, while industries that lag behind in digitalization risk losing competitive positions in the long-term perspective.

Research on the implementation of different types of AI technologies in enterprises reveals important patterns in the selection and prioritization of AI solutions. Analysis of dynamics for the period 2022–2025 allows identification of both technological trends and practical business needs for specific AI tools.

Figure 3. Implementation of various types of AI technologies in Ukrainian enterprises, 2022–2025 (%)

Source: compiled by authors based on [30]

The overall picture of AI technology implementation by types demonstrates a clear hierarchy of priorities for Ukrainian enterprises, which is formed under the influence of practical utility, technology accessibility, and the level of business environment readiness for the implementation of specific solutions.

Written language analysis technologies occupy leading positions with a stable indicator of 3.0% throughout the entire analyzed period. This stability indicates established demand for text data processing solutions, which include document flow automation, customer communication analysis, reputation monitoring, and legal analytics. According to Forrester research, Natural Language Processing (NLP) technologies demonstrate the highest return on investment among all types of AI technologies, since they have a wide range of applications and relatively low barriers to entry [10].

The stability of this indicator can be explained by several factors: firstly, the maturity of text analysis technologies, which have reached a level sufficient for commercial use; secondly, the versatility of application of these technologies in

various industries; thirdly, the relative simplicity of integration into existing business processes compared to more complex types of AI.

Process automation technologies are second in prevalence, although they are showing a downward trend from 2.1% in 2022 to 1.7% in 2025 (19% decline). These technologies include robotic process automation (RPA), intelligent document flow automation, and decision support systems. The decline in indicators may reflect the transition from simple automation to more complex AI solutions that integrate several technologies simultaneously [32].

Speech recognition technologies demonstrate the highest relative growth rate among all categories – from 1.0% to 1.7% (70% increase). This trend reflects the growing popularity of voice interfaces, automatic speech recognition systems for call centers, and voice assistants for business applications.

The growth of interest to these technologies is associated with several factors: improvement in the quality of speech recognition by modern algorithms, reduction in implementation costs, and growing user expectations regarding natural interfaces for interaction with digital systems.

Technologies for generation of written or spoken language also show positive dynamics from 0.5% to 1.2% (140% growth. This category includes automatic content generation systems, chatbots, speech synthesis, and tools for creating personalized communications. The rapid development of large language models (LLM) such as GPT has significantly expanded the capabilities and accessibility of these technologies.

The particularly intensive growth of this segment is associated with the revolution of generative AI, which began in 2022. Companies increasingly use these technologies for automation of creation of marketing materials, technical documentation, personalized offers, and customer service.

Object identification technologies based on images show moderate growth from 1.1% to 1.4% (27% increase). These technologies are applied in security systems, product quality control, automation of warehouse operations, and development of autonomous systems. The relatively slow growth can be explained by higher requirements for technical infrastructure and specialized equipment [28].

Object identification requires significant computational resources and specialized hardware (GPU, specialized processors), which can create barriers to implementation, especially for small and medium-sized enterprises. At the same time, the development of cloud solutions and API services makes these technologies more accessible.

Machine learning for data analysis demonstrates the most unexpected tendency: decline from 1.3% to 0.8% (38% decline). This trend may seem paradoxical, since machine learning is the basic technology for the majority of AI solutions. However, the decline in the indicator may reflect the evolution of the market from "pure" machine learning to more integrated solutions, where machine learning is part of comprehensive AI platforms.

Modern enterprises increasingly implement not separate machine learning algorithms, but comprehensive AI solutions that combine several technologies
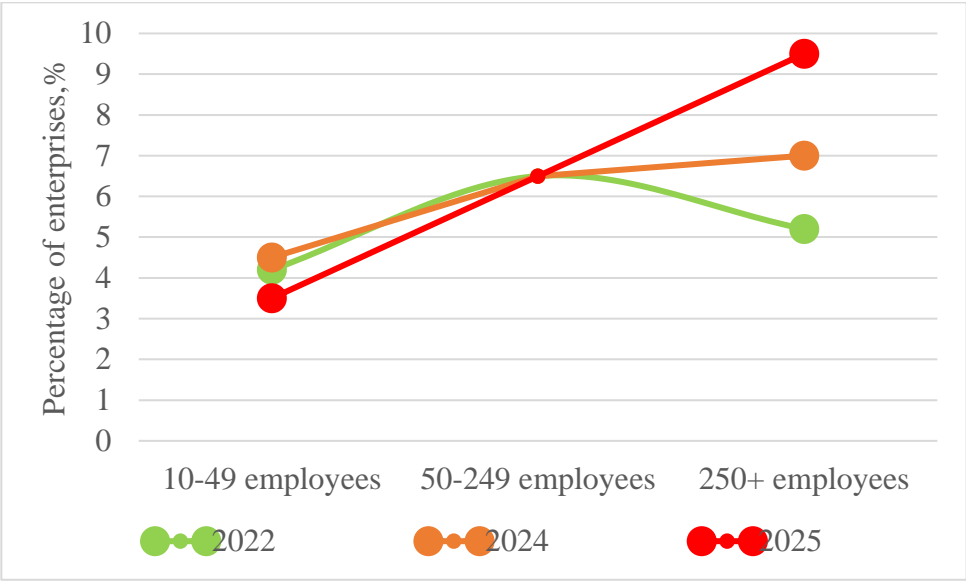
simultaneously. This can explain the apparent decline in "pure machine learning" solutions while more specialized AI applications are simultaneously growing.

Robotization technologies (physical movement of machines) show slight decline from 0.6% to 0.5% (17% decline). This segment includes industrial robotization, autonomous vehicles, and other systems that provide physical movement based on AI algorithms. Low indicators and declining dynamics may reflect high capital requirements and complexity of implementation of such systems.

The analysis of the distribution of AI implementation by technology types indicates a pragmatic approach of Ukrainian enterprises to the selection of AI solutions. Priority is given to technologies with clear business justification, quick payback, and minimal implementation risks. Technologies focused on text processing and process automation dominate due to their versatility and relative ease of integration.

At the same time, growing interest in next-generation technologies is observed, including text recognition and generation, which indicates market readiness for more complex AI solutions. This tendency is consistent with global trends, where enterprises gradually transition from basic automation to intelligent systems capable of learning and adaptation.

Analysis of the implementation of AI technologies depending on the size of the enterprise reveals critical patterns that are of fundamental importance for understanding the dynamics of digital transformation and forming business support strategies.

Figure 4. AI implementation by enterprise size in 2022–2025
Source: compiled by authors based on [30]

The data demonstrates a "digital divide" between enterprises of different sizes. Large enterprises (250+ employees) showed the most impressive growth dynamics from 5.2% to 9.5% (+83%), achieving the highest absolute indicator among all

categories. This confirms the hypothesis about the critical role of scale for successful implementation of AI technologies.

Medium-sized enterprises (50–249 employees) demonstrate stability with slight decline from 6.7% to 6.5% (-3%), while maintaining the second highest absolute indicator. This category proves to be the most balanced, combining sufficient resources for investments with the necessary flexibility for implementation of innovations.

Small enterprises (10–49 employees) show the lowest indicators with further decline from 4.0% to 3.3% (-18%). The gap between large and small enterprises reached a critical 6.2 percentage points, which indicates the aggravation of the digital inequality problem.

This differentiation is explained by several factors: large enterprises have greater financial resources for AI projects, access to qualified personnel, opportunities for experimentation and scaling of successful solutions. Small enterprises face limited resources, lack of expertise, and higher relative costs for technology implementation.

Artificial intelligence technologies transform approaches to ensuring economic security of enterprises, creating new opportunities for preventive protection, operational resilience, and strategic planning under conditions of uncertainty.

AI technologies provide enterprises with a powerful tool for analysis of market trends, demand forecasting, and assessment of competitive positions with accuracy unattainable by traditional methods. Scenario modeling allows preparation for various variants of event development and optimization of resource allocation.

AI systems are revolutionizing early threat detection through real-time analysis of large data sets. AI-based financial monitoring can detect suspicious transactions and fraud with up to 95% accuracy, which is 40-50% higher than traditional methods [13]. Cybersecurity is gaining a new level of protection thanks to algorithms that can detect unknown types of cyber threats and automatically respond to incidents very quickly.

The integration of AI into economic security systems creates a synergistic effect, where each component strengthens the overall resilience of the enterprise to internal and external threats, providing competitive advantages in the long term.

Conclusions

The study emphasizes that the use of artificial intelligence in both public economic administration and the private sector is one of the most relevant trends in the modern digital world. This provides competitive advantages and contributes to the economic growth of the economy. Artificial intelligence promotes economic development and resource optimization, however, its implementation in the state or individual private entities requires the resolution of several problems related to legislative regulation, cyberprotection and cybersecurity of existing commercial and personal information, as well as the socio-economic consequences of work process automation. Accordingly, the issue of implementing artificial intelligence in all aspects of state activity, including ensuring the economic security of information, is highly relevant and requires a comprehensive approach. Improving the regulatory and legal framework regarding the definition of data sets that should be published or have general or personal access will allow for expanding the ways they can be used to

enhance economic potential. Nevertheless, despite existing shortcomings and necessary restrictions, artificial intelligence in practical activities opens significant prospects for the development of the economy, both at the national level and for individual entities. It contributes to the optimization of operations and the saving of available resources.

The study is distinguished by a comprehensive analysis of the implementation of AI technologies in Ukrainian enterprises through the lens of economic security under martial law, a topic that has not yet been systematically explored in scientific research. Its practical significance lies in the applicability of the findings for enterprises across various industries and sizes to optimize AI adoption strategies, as well as for public authorities in shaping policies for the digital transformation of Ukraine's economy.

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