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ЗАПОРІЗЬКИЙ НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ

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Управління проєктами та фінансово-економічна безпека в умовах глобалізації



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ЗМІСТ**ЕКОНОМІКА ТА УПРАВЛІННЯ ПІДПРИЄМСТВАМИ****Ткаченко С.М.**

ПРЕДИКАТ ЦИФРОВІЗАЦІЇ В СТРАТЕГІЧНИХ ПРІОРИТЕТАХ УПРАВЛІННЯ
 КОНКУРЕНТОСПРОМОЖНІСТЮ ПРОМИСЛОВИХ ПІДПРИЄМСТВ
 ІЗ ЗАСТОСУВАННЯМ СУЧАСНИХ МЕТОДІВ ІНФОРМАЦІЙНО-КОМУНІКАЦІЙНИХ ТЕХНОЛОГІЙ...9

**РИНКОВІ МЕХАНІЗМИ ОБЛІКУ, АНАЛІЗУ ТА АУДИТУ
В НАЦІОНАЛЬНІЙ ЕКОНОМІЦІ****Проскуріна Н.М., Гончарова В.Г., Коновалова А.В., Батерук Я.Ю.**

ПОРІВНЯЛЬНИЙ АНАЛІЗ КОНЦЕПТУАЛЬНОЇ ОСНОВИ ОБЛІКУ ПАСІВ
 ЗА МІЖНАРОДНИМИ ТА НАЦІОНАЛЬНИМИ СТАНДАРТАМИ.....13

Саєнко О.Р., Сьомченко В.В., Носов А.Д.

ПОДАТКОВЕ КОНСУЛЬТУВАННЯ ЯК НАПРЯМ ОПТИМІЗАЦІЇ ПОДАТКОВОГО ПЛАНУВАННЯ19

Сейсебаєва Н.Г., Проскуріна Н.М., Пушкарь І.В., Шпигун Л.П.

ВНУТРІШНІЙ АУДИТ ПОСЛУГ ВАРТІСНОГО ОЦІНЮВАННЯ:
 НАУКОВИЙ ОГЛЯД СУЧАСНИХ ТЕНДЕНЦІЙ.....23

**ТЕОРЕТИКО-ПРИКЛАДНІ АСПЕКТИ
ЕКОНОМІЧНИХ ПРОЦЕСІВ В УКРАЇНІ ТА СВІТІ****Дугієнко Н.О., Гончар В.В.**

МІЖНАРОДНА КОНКУРЕНТОСПРОМОЖНІСТЬ ІТ-ПОСЛУГ УКРАЇНИ
 В УМОВАХ ВІЙНИ ТА ПОВОСННОГО ВІДНОВЛЕННЯ.....29

Дугієнко Н.О., Степанян Н.

ІМПОРТНА ПОЛІТИКА ЯК ІНСТРУМЕНТ ФОРМУВАННЯ ЗОВНІШНЬОЕКОНОМІЧНОЇ СТРАТЕГІЇ:
 ДОСВІД ЕНЕРГЕТИЧНОЇ МОДЕЛІ НІДЕРЛАНДІВ ДЛЯ УКРАЇНИ.....35

Кусакова Ю.О., Дергач А.В., Куріленко А.І.

ЗРОСТАННЯ КОНКУРЕНТОСПРОМОЖНОСТІ УКРАЇНИ НА МІЖНАРОДНОМУ РИНКУ
 КОНСАЛТИНГОВИХ ПОСЛУГ: НАУКОВО-МЕТОДИЧНІ ТА ПРАКТИЧНІ АСПЕКТИ.....40

Кусакова Ю.О., Тимофеев В.О.

АГРАРНИЙ СЕКТОР ЯК ОДИН ЗІ СТОВПІВ ПОВОСННОГО ВІДНОВЛЕННЯ
 ТА ПОДОЛАННЯ БОРГОВИХ ВИКЛИКІВ УКРАЇНИ.....44

Слободяник І.М., Голубченко А.А.

НОВІТНІ ФОРМИ МІЖНАРОДНОГО БІЗНЕСУ, ЇХ ВПЛИВ ТА ПЕРСПЕКТИВИ.....49

ФІНАНСИ І ГРОШОВИЙ ОБІГ**Батракова Т.І., Ковальова К.І.**

ВПЛИВ ЗБІЛЬШЕННЯ ДЕРЖАВНОГО БЮДЖЕТУ НА РОЗВИТОК УКРАЇНИ.....54

Кущик А.П., Проноза Н.О.

АНАЛІЗ ФІНАНСОВОЇ ЗВІТНОСТІ В УМОВАХ ЦИФРОВІЗАЦІЇ.....61

**ЕКОНОМІКА ПРАЦІ, УПРАВЛІННЯ ПЕРСОНАЛОМ
ТА МАРКЕТИНГ****Бехтер Л.А., Руднік О.Р.**

ПЕРСПЕКТИВИ ВПРОВАДЖЕННЯ ІННОВАЦІЙ У КАДРОВУ ПОЛІТИКУ УКРАЇНСЬКИХ
 ПІДПРИЄМСТВ.....66

Бондаренко А.Є., Іванов М.М.

УДОСКОНАЛЕННЯ МАРКЕТИНГОВОЇ СТРАТЕГІЇ УЧАСТІ ЕКОНОМІЧНИХ СУБ'ЄКТІВ
 У ТЕНДЕРНИХ ЗАКУПІВЛЯХ.....70

Дашко І.М., Бехтер Л.А.
РОЛЬ АНАЛІТИЧНИХ МОДЕЛЕЙ У ВИЯВЛЕННІ ЗАКОНОМІРНОСТЕЙ У ПОВЕДІНЦІ ЛЮДЕЙ.....75

Дашко І.М., Михайліченко Л.В.
МЕТОДОЛОГІЧНІ ТА ЕКОНОМІКО-ПРАВОВІ ЗАСАДИ ТРАНСФОРМАЦІЇ
СОЦІАЛЬНО-ПРАВОВОГО ЗАХИСТУ ГРОМАДЯН В УМОВАХ ГЛОБАЛІЗАЦІЇ ТА ЦИФРОВІЗАЦІЇ.....79

УПРАВЛІННЯ ПРОЄКТАМИ ТА ФІНАНСОВО-ЕКОНОМІЧНА БЕЗПЕКА В УМОВАХ ГЛОБАЛІЗАЦІЇ

Череп А.В., Щєбликіна І.О., Щєбликіна З.В., Гуль Я.В.
ТЕХНОЛОГІЧНЕ БЕЗРОБІТТЯ В УМОВАХ ЦИФРОВОЇ ЕКОНОМІКИ УКРАЇНИ:
МІФ ЧИ РЕАЛЬНІСТЬ?..... 84

Андрушків Б.М., Череп А.В., Гагалюк О.І., Кирич Н.Б., Позайдак О.Б.
ОРГАНІЗАЦІЙНІ ПРОБЛЕМИ ТА МЕХАНІЗМИ УДОСКОНАЛЕННЯ УПРАВЛІННЯ СУСПІЛЬНИМИ
ПРОЦЕСАМИ, ЗАБЕЗПЕЧЕННЯ СТАБІЛЬНОСТІ І МИРУ У ПОВОСННИЙ ПЕРІОД
(Про роль і місце політичних лідерів (особистостей) в попередженні конфліктів, стабілізації
Міжнародних стосунків та досягненні миру)..... 94

ВИСЛОВЛЮЄМО СПІВЧУТТЯ РОДИНІ, БЛИЗЬКИМ І КОЛЕГАМ ДЕКАНА
ФАКУЛЬТЕТУ МЕНЕДЖМЕНТУ ІРИНІ ШАВКУН..... 102

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TECHNOLOGICAL UNEMPLOYMENT IN THE CONTEXT OF UKRAINE'S DIGITAL ECONOMY: MYTH OR REALITY?

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Key words:

artificial intelligence, automation, technological unemployment, digital transformation, labor market, labor shortage, digital technologies, business processes.

This article examines the phenomenon of technological unemployment in the context of digital transformation of the economy, particularly in Ukraine, which is experiencing both an armed conflict and a labor shortage. With the active integration of artificial intelligence (AI) into business processes, an increasing number of companies worldwide and in Ukraine are adopting automated solutions to optimize costs, improve efficiency, and address workforce shortages. This trend is accompanied by the replacement of routine and specialized jobs that do not require strategic thinking. Based on an analysis of global and European trends, it has been identified that the highest level of AI adoption is observed in countries with well-developed digital infrastructure, while less developed regions significantly lag behind. The article provides examples of workforce replacement by AI in global companies, confirming the global trend of changing employment structures. At the same time, in Ukraine, AI primarily serves as a tool for maintaining economic stability during wartime. It is noted that mobilization, migration, and a reduction in labor resources increase the need for automation. Examples of Ukrainian companies that have already integrated AI into their processes are presented, showing that it reduces the workload on personnel and increases productivity. The conclusion is drawn that although the risks of technological unemployment remain relevant in the long term, in wartime conditions, automation and AI are mainly compensatory. Further research should focus on workforce retraining, government regulation, and the development of policies for adapting to digital transformation.

ТЕХНОЛОГІЧНЕ БЕЗРОБІТТЯ В УМОВАХ ЦИФРОВОЇ ЕКОНОМІКИ УКРАЇНИ: МІФ ЧИ РЕАЛЬНІСТЬ?

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Ключові слова:

штучний інтелект, автоматизація, технологічне безробіття, цифрова трансформація, ринок праці, кадрова криза, цифрові технології, бізнес-процеси.

У статті досліджено феномен технологічного безробіття в умовах цифрової трансформації економіки, зокрема в Україні, яка перебуває в ситуації воєнного конфлікту та кадрової кризи. В умовах активного впровадження штучного інтелекту у бізнес-процеси, все більше компаній у світі та в Україні використовують автоматизовані рішення для оптимізації витрат, підвищення ефективності та подолання дефіциту працівників. Така тенденція супроводжується заміною рутинних і спеціалізованих професій, що не вимагають стратегічного мислення. На основі аналізу глобальних і європейських тенденцій виявлено, що найвищий рівень впровадження ІІІ спостерігається в країнах із розвинутою цифровою інфраструктурою, тоді як менш розвинені регіони значно відстають. У статті представлено приклади заміни працівників на ІІІ в світових компаніях, що підтверджує глобальний тренд зміни структури зайнятості. Водночас, в Україні ІІІ здебільшого виступає інструментом збереження економічної стабільності в умовах війни. Визначено, що через мобілізацію, міграцію та зменшення трудових ресурсів зростає потреба в автоматизації. Представлено приклади українських компаній, які вже інтегрували ІІІ у свої процеси, що дозволяє зменшити навантаження на персонал і підвищити продуктивність. Зроблено висновок, що хоча ризики технологічного безробіття в довгостроковій перспективі залишаються актуальними, в умовах воєнного часу автоматизація та ІІІ мають переважно компенсаторний характер. Подальші дослідження мають бути зосереджені на питаннях перекваліфікації кадрів, державного регулювання та розробки політик адаптації до цифрової трансформації.

Problem Statement

With the development of digital technologies and the gradual transition of businesses to digitized processes incorporating artificial intelligence, the labor market is undergoing significant change and total transformation. Although Ukraine lags behind in the implementation of business process automation technologies, the war and the growing labor shortage have accelerated progress in this area. Continuous mobilization in the country significantly reduces the workforce potential, prompting companies to implement AI technologies in business processes and gradually replace jobs that do not require strategic thinking and are highly specialized. This is already observable, for example, in chatbots gradually replacing consultants, dispatchers, and operators. Such gradual replacement may lead to technological unemployment, which is a long-term reality, since replacing humans with technology allows companies to save hundreds of thousands of dollars, and positions that can be replaced by AI or robots will simply no longer be needed in the labor market. Therefore, a more detailed study of technological unemployment in Ukraine

as a potential future problem is a relevant topic for deeper analysis.

Analysis of Recent Studies and Publications

The issue of technological unemployment in the digital era has been examined by the following scholars and researchers. Opanasiuk V.V. [1] explored the phenomenon of neo-Luddism in the context of digital dictatorship, focusing on societal resistance to digital technologies and their impact on the economy and employment. Author D. [2] analyzed labor market transformations under technological change, emphasizing the transition from enthusiasm to growing uncertainty about future employment. Tang Y. [3] examined the causes of unemployment in connection with processes of job creation and destruction in the modern economy. Finseraas H. and Nyhus O.H. [4] studied the political consequences of technological changes, particularly those affecting low-skilled labor.

Research Objective. To investigate general trends in technology adoption as a factor contributing to technological unemployment and to assess its reality in the context of Ukraine.

Main Research Material

In the current context of rapid digital technology development, Ukraine, like many other countries, is facing a new socio-economic reality – technological unemployment [1]. Active implementation of automation, particularly artificial intelligence and robotics, on the one hand, opens up new opportunities for economic growth, improved production efficiency, and cost optimization [2–3]. On the other hand, these changes radically transform the labor market, reducing the need for human labor in many sectors. According to forecasts, nearly half of existing professions are potentially subject to automation, creating real risks of job loss for millions of Ukrainians [4].

Before examining the state of digital technology adoption in the context of worker replacement, it is advisable to analyze global and European labor market trends. Figure 1 shows the ranking of countries by the number of robots per 10,000 employees

As can be seen from the data in Figure 1, the leading countries are South Korea and Singapore, where the share of robots accounts for 10% and 7%, respectively, indicating a high level of replacement of manual labor professions. Germany ranks third, with 415 robots per 10,000 employees, reflecting a high level of robot integration into the economy. Ukraine is not included in this ranking; however, according to various sources, there are only 5–6 robots operating in the country, although this information is not officially confirmed. It should also be noted that robots have not yet been widely implemented in Ukraine,

which is associated with low funding levels and the high cost of technologies.

Next, an analysis of AI technology adoption by European companies is presented (Figure 2).

The analysis of Figure 2 shows that the lowest level of AI adoption is traditionally observed among small enterprises; however, even in this group, growth is evident—from 6.38% to 11.21%. Medium-sized enterprises demonstrate higher dynamics: the share of companies using AI increased from 13.04% to 20.97%. Large enterprises remain the most active, with a relatively high adoption rate already in 2023 (30.40%), which reached 41.17% in 2024.

These data indicate that AI is becoming increasingly accessible and strategically important for businesses of all categories. At the same time, the spread of automated solutions leads to a gradual transformation of the labor market, as automation of specific business processes and the replacement of routine operations with AI solutions reduce the demand for certain professions, especially in sectors dominated by manual or repetitive labor.

Figure 3 presents the dynamics of the share of European companies by country that utilize AI.

Analyzing the data in Figure 3, it is evident that AI adoption is growing most actively in Northern and Western European countries, such as Denmark, Sweden, Belgium, Finland, Luxembourg, and the Netherlands, which demonstrated the highest rates, with the share of companies using AI exceeding 20%. In Denmark, this indicator increased from 15.17% to 27.58%, the highest value in Europe. Central European countries, including Austria, Slovenia, and

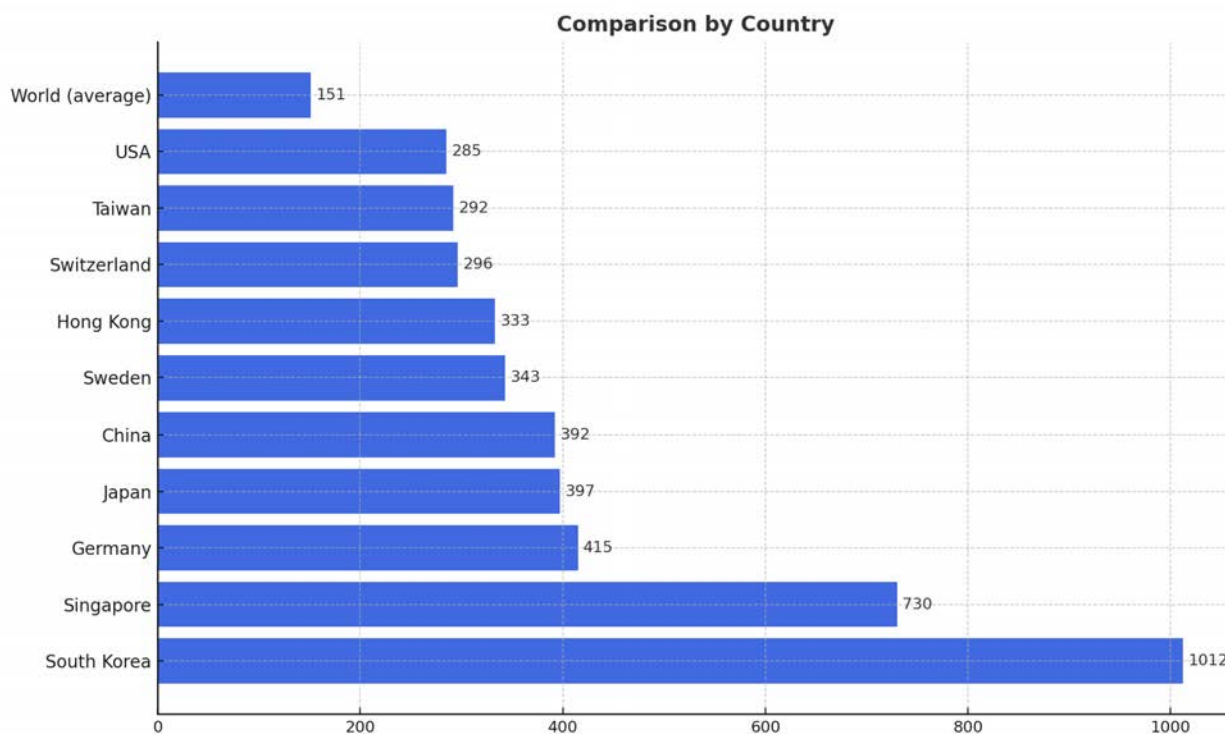


Fig. 1 – Ranking of countries by the number of industrial robots per 10,000 employees as of 2023, %
Source: [5–6]

Germany, show moderate growth (around 20%). Southern and Eastern Europe generally lag behind; in countries such as Bulgaria, Romania, Poland, Hungary, and the Balkans, the share of companies implementing AI remains below 10%, although some progress is observed.

Thus, it should be noted that AI adoption is concentrated in economically more developed countries with strong IT sectors, while less developed regions require additional support for digital transition. This potentially deepens technological and economic inequality and affects the dynamics of technological unemployment differently across EU countries.

Next, the areas of business by types of AI utilization in business processes are presented (Table 1).

Based on Table 1, the highest AI adoption rates are observed in the information and communication sector, where text analysis (30.11%), speech generation (25.83%), and machine learning for data analysis (25.66%) are particularly active. A significant level of AI application is also recorded in professional, scientific, and technical activities, where the share of enterprises using AI exceeds 10% in several areas. In sectors such as manufacturing, construction, and transport, AI adoption remains low (mostly up to 5%), which may be related to higher implementation barriers or lower digital readiness.

Thus, it should be noted that AI adoption remains predominantly concentrated in sectors with a high intensity of digital technologies, while traditional industries still lag behind, which may result in varying impacts on productivity and levels of technological unemployment in the future.

Table 2 presents the use of AI by global companies in the context of replacing human workers with technology.

Analyzing Table 2, it should be noted that many global companies implement AI not only as a means of increasing efficiency but also as a tool for cost optimization through the replacement of employees with automated solutions. For example, companies such as MSN, Dukaan, BlueFocus, and Microsoft openly reduce a significant portion of their workforce, while Ikea combines automation with workforce retraining, reflecting a global trend in labor market transformation. AI is replacing both routine and intellectual work, with the scale ranging from several dozen to thousands of employees affected.

In the context of Ukraine, which is experiencing a full-scale war, the situation is further complicated, as the conflict has caused a workforce crisis, particularly in the fields of manufacturing, logistics, and service. Under such conditions, AI implementation can be viewed not so much as a threat but as a business survival tool, helping to compensate for labor shortages.

To begin, data illustrating the growing workforce crisis in Ukraine are presented (Figure 4).

Analyzing Figure 4, it is evident that since early 2022, the Ukrainian labor market has undergone sharp changes. After a decline in activity in March due to the full-scale invasion, gradual recovery in the second half of the year was accompanied by rising unemployment. In 2023–2025, the opposite trend is observed, as the number of job vacancies consistently exceeds the number of resumes, indicating a workforce shortage amid mobilization, migration,

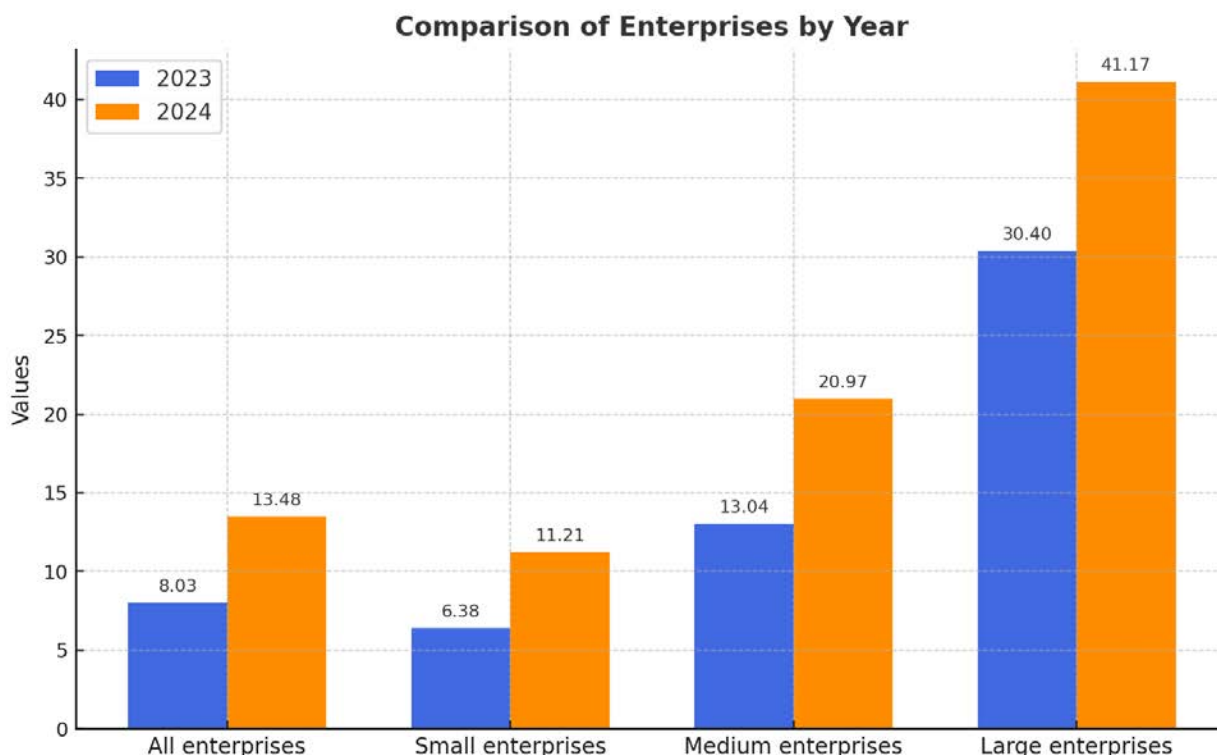


Fig. 2 – Comparative dynamics of AI technology adoption by business type in the EU for 2023–2024, %

Source: [7]

Table 1 – Share of enterprises in EU member states using AI technologies, by type of AI technology and economic activity as of 2024, %

Economic Activity	Text Analysis	Text or Speech Generation	Speech Recognition	Machine Learning for Data Analysis	Automation of Various Workflows	Identification of Objects or Persons Based on Images
Manufacturing	4.58	3.53	2.94	2.73	3.23	2.74
Construction	2.81	2.42	2.54	0.83	0.95	1.49
Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles	5.98	5.03	3.83	2.96	3.24	2.63
Retail Trade, Except Motor Vehicles and Motorcycles	5.06	4.52	3.23	2.63	2.79	2.87
Transportation and Storage	3.70	3.32	2.83	1.98	2.33	2.40
Information and Communication	30.11	25.83	20.13	25.66	21.20	13.54
Real Estate Activities	7.20	5.80	6.75	2.93	4.52	2.15
Professional, Scientific and Technical Activities	15.61	11.51	12.49	11.35	10.30	7.35
Administrative and Support Service Activities	8.06	4.96	4.91	3.96	4.26	2.96

Source: [9]

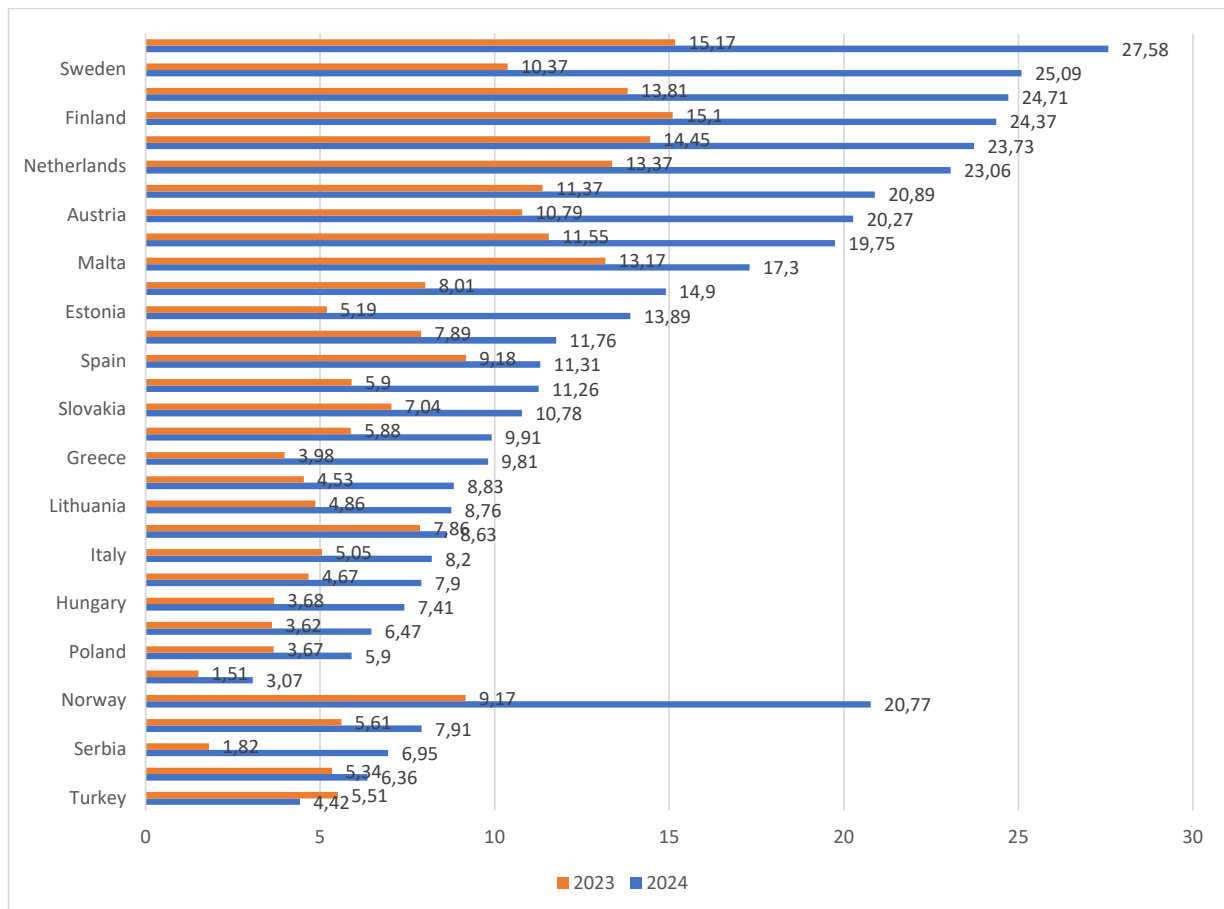


Fig. 3 – Geographic dynamics of AI adoption by European companies for 2023–2024, %

Source: [8]

Table 2 – Characteristics of employee replacement with AI in global companies

Company	Nature of Replacement	Approximate Number of Employees Affected
MSN	In 2020, MSN laid off dozens of journalists responsible for preparing news for the portal’s homepage. Instead, AI-based software was implemented to automatically generate news content. It should be noted that this decision was driven by financial difficulties rather than the pandemic.	Dozens of employees
Google	In 2024, Google announced two waves of layoffs, primarily affecting advertising division employees. Although the company did not officially state that the layoffs were due to AI, they coincided with the active implementation of AI in customer service and advertising sales, indicating a link between automation and workforce reductions.	Data not available
Dukaan	In July 2023, the e-commerce company Dukaan replaced 90% of its customer support staff with an internally developed chatbot, ultimately reducing costs by 85% and decreasing customer waiting times.	90% of online support staff
Ikea	In June 2023, Ikea began replacing call center operators with the Billie bot. Unlike other companies, Ikea did not lay off employees but offered them retraining as interior design consultants.	Thousands of employees redirected to training
BlueFocus	In April 2023, the Chinese marketing agency BlueFocus terminated contracts with all copywriters and designers in favor of generative AI, immediately after obtaining a license for OpenAI Azure and collaborating with Baidu ERNIE Bot. Although the company did not publicly announce AI replacement, its actions speak for themselves.	Data not available
Salesforce	In 2024, Salesforce laid off 700 employees (1% of its workforce) amid reduced hiring budgets and AI development investments. Although the company did not confirm a direct link to AI, experts believe many functions are being replaced by automated solutions.	700
Duolingo	In January 2024, Duolingo announced the termination of contracts with 10% of external contractors. Company representatives explained this as a partial transition to AI-based automated content translation, part of the company’s strategy.	10% of contractors
Turnitin	In 2023, Turnitin CEO Chris Caren announced staff reduction plans due to increased efficiency from AI. By the end of the year, 15 employees were laid off, with an 18-month plan anticipating up to a 20% workforce reduction through process automation.	15 laid off; 20% planned reduction
Klarna	Klarna stated that its AI can perform the work of 700 customer support employees. However, these services were outsourced, so no direct layoffs occurred among its own staff.	Work of 700 employees outsourced
Best Buy	In 2023, Best Buy underwent restructuring and workforce reductions amid declining sales. Shortly afterward, the company announced an AI project in partnership with Google Cloud and Accenture to improve customer experience.	Data not available
Microsoft	In May 2024, Microsoft conducted a major workforce reduction affecting approximately 6,000 employees, mostly programmers, coinciding with the CEO’s statement that 30% of all company code is now generated with AI.	6,000

Source: [10]

and reduced labor resources. In these conditions, artificial intelligence acts as a critically important solution, as automation enables Ukrainian companies to compensate for labor shortages, reduce personnel workload, and ensure continuity of business processes during wartime and the ongoing workforce crisis.

As evidence of AI development in Ukraine, its dynamics over the past few years are presented (Figure 5).

The analysis of Figure 5 indicates that from 2020 to 2025, the AI market in Ukraine grew from USD 157.7 million to USD 419.4 million. It should be noted that this threefold increase over a five-year period reflects the rapid development of the sector and the growing interest in implementing AI solutions across various areas of the economy.

Figure 6 presents a visualization of data on the use of AI technologies by Ukrainian companies.

The analysis of Figure 6 shows that cloud technologies have been implemented in 28% of companies, while

artificial intelligence technologies are used by 24%, indicating that AI is gradually moving from the category of innovation to a practical tool for optimizing business processes.

Next, a description of Ukrainian companies that already use AI is presented, demonstrating a trend toward partial automation of specific functions (Table 3).

Analyzing Table 3, it is evident that Ukrainian companies are increasingly integrating AI into key business processes, covering areas such as customer service, logistics, manufacturing, finance, HR, and analytics. The main goal of these changes is to enhance efficiency for both the company and its employees, reduce costs, and respond promptly to workforce shortages caused by war, mobilization, and labor migration.

AI systems successfully perform functions that previously required significant human resources, as they can quickly and efficiently analyze data, generate content, manage logistics, screen personnel, assess customer

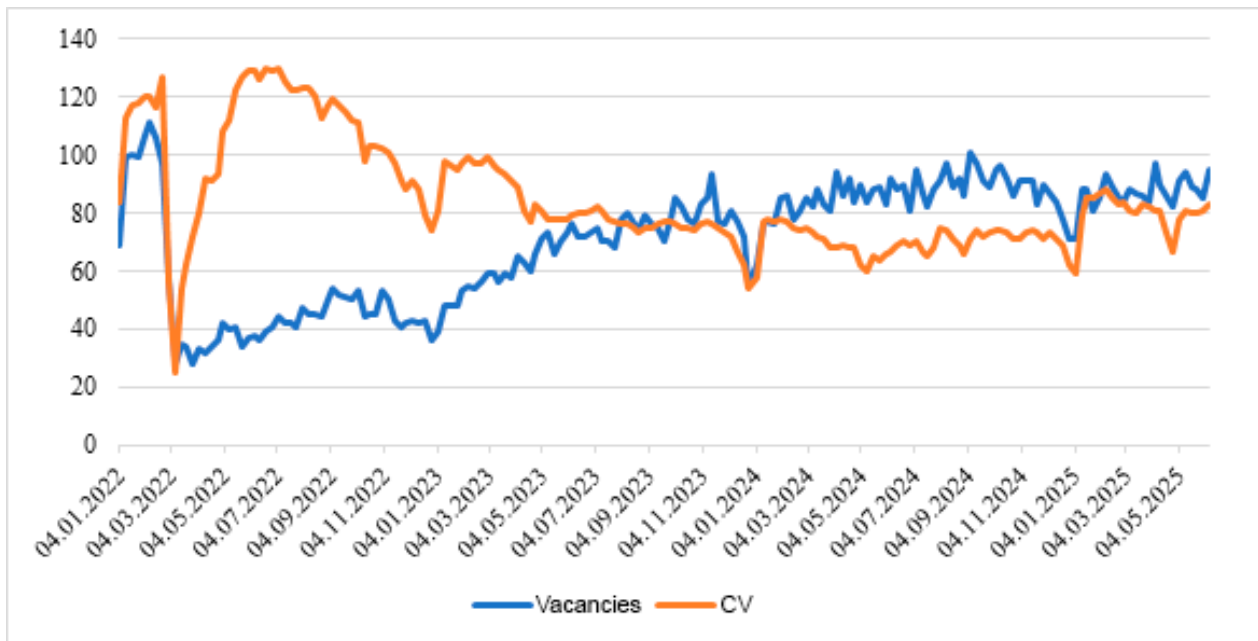


Fig. 4 – Quantitative dynamics of job vacancies and submitted resumes in 2022–2025, thousands

Source: [11]

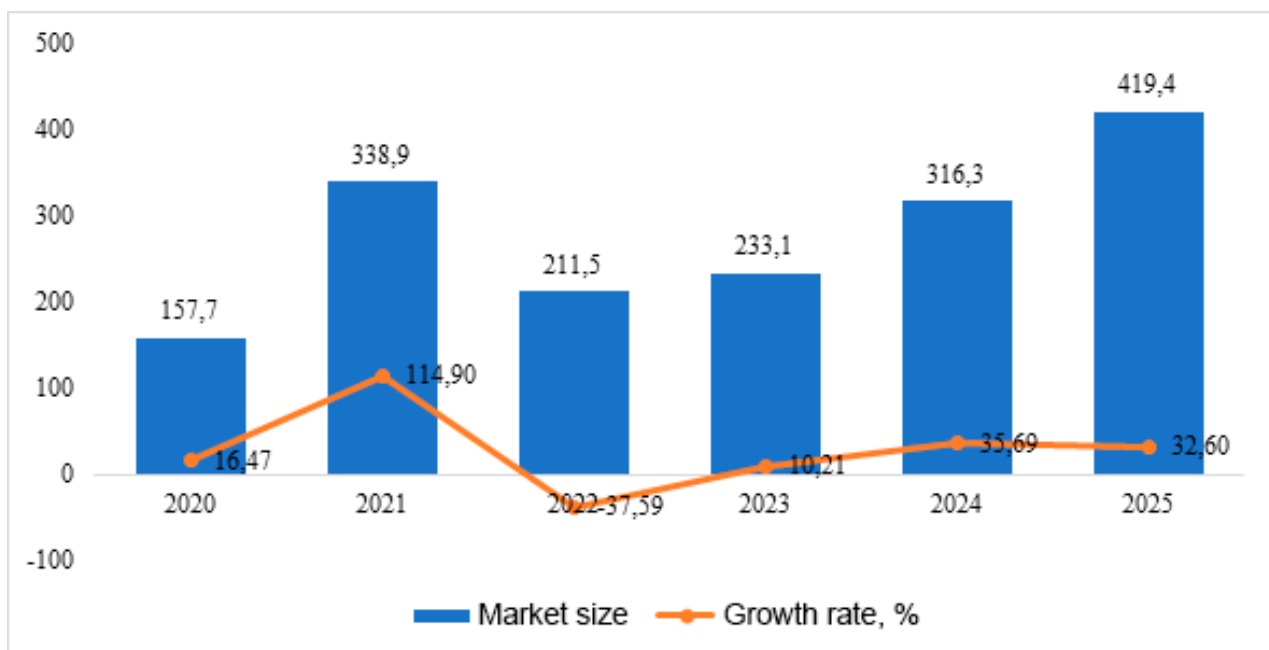


Fig. 5 – Dynamics of the AI market development in Ukraine for 2020–2025, million USD

Source: [12]

service quality, and even assist in creating legal documents. As a result, there is a tangible prospect of partial or complete replacement of employees in certain professions, particularly in content marketing, HR, analytics, logistics, customer support, and administrative services.

It should be noted that, given the labor shortage in Ukraine, automation has become a necessary step to ensure business stability, as the number of vacancies consistently exceeds the number of resumes, directly indicating

a workforce deficit due to mobilization, migration, and reduced labor resources. In this context, AI implementation in Ukraine acts more as a tool to support the economy than as a cause of unemployment, which is further confirmed by the rapid growth of the AI market and its active use by 24% of Ukrainian companies.

Equally important is the observation that under wartime conditions, the trend toward digitalization of business processes has a different character: AI does not displace

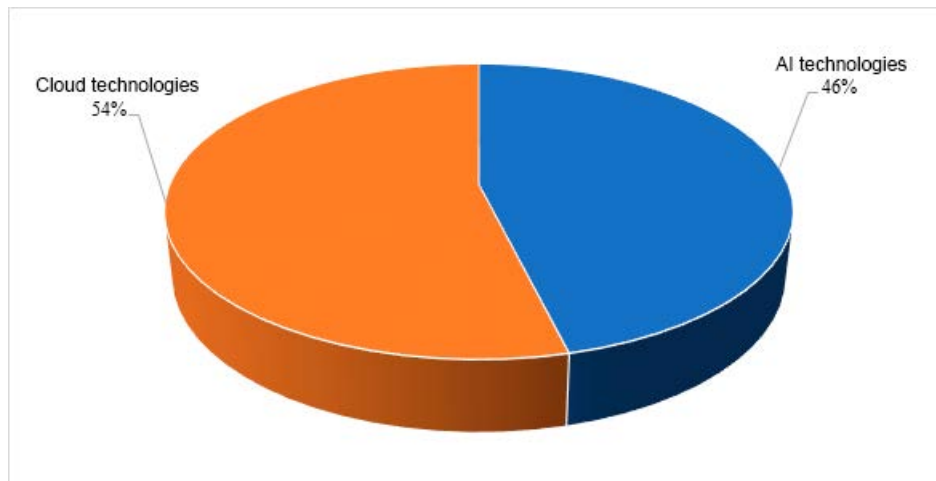


Fig. 6 – Structure of technology use in the activities of Ukrainian companies as of 2025, %

Source: [13]

Table 3 – Characteristics of AI implementation by Ukrainian companies as a prerequisite for employee replacement

Company	AI Usage	Employee Replacement Perspective
Foxtrot LLC	AI automates the creation of product descriptions, generates personalized customer offers, optimizes search, analyzes competitor pricing, and manages chatbots for support.	Reduced need for content creators, analysts, and support managers
OTP Bank PJSC	A language analytics system is used for 100% monitoring of calls, feedback to agents, sales performance analysis, and training of contact center operators.	Optimization of contact center operations and reduced workload for supervisors
MHP PJSC	Implemented an end-to-end AI system for managing incubators and production processes, analytics for optimizing grain balance, as well as fraud detection and supplier support systems.	Partial replacement of production specialists, analysts, and quality control staff
Nova Poshta LLC	AI helps build courier routes considering delivery time, automatically adapts routes in case of changes, and improves accuracy and efficiency of logistics processes.	Reduced need for logistics dispatchers and planners
Netpeak Group	AI-based systems analyze calls in educational institutions and assess candidates on 110 scales during hiring, reducing time spent on analytics and interviews.	Replacement of recruiters, assessors, and HR analysts
International Charitable Foundation “Come Back Alive”	A tender AI assistant automates document verification and preparation for public procurement participation. Another AI processes data for the foundation by reading information from documents.	Reduced workload for legal staff and database operators
EPAM Systems LLC	Generative AI platform StatGPT 2.0 provides access to economic information and analytics through natural language, allowing organizations to work with global data more efficiently.	Auxiliary tool for analysts and researchers

Source: [14]

employees but rather compensates for their absence. In the short- and medium-term, this does not lead to mass technological unemployment, but rather serves as a tool for adaptation to martial law and economic instability.

Conclusions and prospects for further research. Summarizing the article, it should be emphasized that in the context of Ukraine’s digital economy, technological unemployment is not a myth, but neither is it an unequivocal reality. It largely represents an adaptive response of businesses

to the challenges of wartime and workforce shortages. In the long term, under peaceful conditions, automation may indeed pose risks to certain professions. However, with proper state regulation, retraining, and the development of new competencies, AI is capable not so much of destroying jobs as of transforming the labor market. Further research should focus on issues of workforce retraining, state regulation, and the development of policies for adaptation to digital transformation.

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