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## HOW DIGITAL TRANSFORMATION OF THE ECONOMY CAN IMPROVE EMPLOYMENT IN UKRAINE<sup>1</sup>

This article aims to explore opportunities for increasing employment levels in Ukraine through the digital transformation of the national economy based on the analysis of the current state of the labor market and the utilization of artificial intelligence (AI) digital technologies. The relevance of this research is associated with the impact of the COVID-19 pandemic and the full-scale invasion of the Russian Federation into Ukraine on the labor market, including the consequences such as destruction, illnesses, population migration, and business closures. The article employs general scientific empirical and theoretical research methods, including observation and description, as well as analysis, synthesis, abstraction, and generalization. The research findings indicate that digital transformation can stimulate the development of the information technology sector, provide new employment opportunities, and contribute to overall economic growth, thereby activating the labor market. In addition, the development of artificial intelligence systems provides new opportunities for the economy. The application of artificial intelligence can contribute to creating new jobs in fields such as big data analytics, robotics, and statistics. The demand for experts with knowledge of artificial intelligence can lead to the development a corresponding market for educational services. However, potential negative consequences exist, such as replacing certain human labor with artificial intelligence systems. Nevertheless, the overall potential impact of implementing artificial intelligence is much greater than the negative effect resulting from the reduction of some human labor. The disappearance of jobs in certain fields is accompanied by the emergence of new fields and, consequently, new types of employment. The practical significance of this study lies in its potential application for managerial decision-making regarding the development of digital transformation in the country, including the formulation of effective policies and strategies for implementing AI systems in the economy.

**Keywords:** digital transformation, employment, labor market, technological progress, innovation, job placement, artificial intelligence (AI).

**Introduction.** Until recently, the impact of the global economic crisis, internal economic instability, imperfect market infrastructure, imbalanced population distribution in certain regions, and migration were the main causes of unemployment in Ukraine. The COVID-19 pandemic became a test of strength for global and national economies, particularly in the employment sector. A series of

lockdowns implemented by many countries worldwide to prevent the spread of the disease among the population and the collapse of national healthcare systems resulted in the closure of businesses and the unemployment of countless workers, resulting in the disappearance of numerous job opportunities.

The complete incursion of the Russian Federation into Ukraine in 2022 profoundly impacted

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the Ukrainian labor market, as it raised concerns about the survival of businesses and their employees due to the destruction of civilian infrastructure and harm inflicted upon the peaceful population. However, the Ukrainian government is striving to establish the normal functioning of the economy by encouraging employers, through economic leverage, to operate in territories that are not occupied and promote remote employment.

A major development in 2022-2023 has been consumers' widespread adoption of artificial intelligence (AI) technologies. AI can be a significant catalyst for the digital transformation of the economy and substantially impact employment. The utilization of digital technologies has the potential to generate fresh employment opportunities and enhance labor productivity, thereby resulting in a growth in job availability. For instance, integrating AI into the production process can help reduce labor costs and improve the quality and quantity of products. This will enable companies to increase their revenues and enhance the competitiveness of their products in the international market.

Furthermore, digital technologies, including artificial intelligence, can help create new jobs in industries related to developing, manufacturing, and servicing digital products and services. Additionally, improving business process efficiency through digital technologies can generate demand for new services and products, increasing job opportunities.

Therefore, such digital transformation of the economy can significantly impact employment in Ukraine, depending on the specific technologies implemented and their level of influence. Nonetheless, the present condition of the country's job market and how digital transformation influence this market continue to be significant areas of inquiry.

**Literature review.** The issues of employment and the labor market have been reflected in the works of a lot of researchers, such as Skrypnyk S. et al. [1]; Pak N. and Kobets K. [2]; Petrova I. [3]; Pavlikha N. et al. [4]; Bilyavska Yu. and Varava V. [5]; Cheryomukhina O. and Chalyuk Yu. [6]; Volkovsky M. and Lyashok N. [7]; Nikulina M. et al. [22]. Studies on the impact of digital transformation of the economy on employment have been conducted by Marguerita Lane and Anne Saint-Martin [12], Thomas Davenport [13], Carina Dantas, et al. [14], and other scholars.

It is important to mention that the number of studies dedicated to changes in the labor market after the war and considering the current trend of economic digitization is gradually increasing. In particular, Pyschulina O. and Markevich

K. concluded in their work [8] that in Ukraine, increasing the employment rate should be a central issue of post-war recovery, reintegration, and return to peaceful conditions; in the post-war period, the economy will require deeper "reconstruction" than in the pre-war period with regards to economic development; the recovery and restructuring process will require the redistribution of the workforce among economic sectors, which will contribute to increasing its productivity.

Recently, researchers worldwide have been actively studying the positive impact of digital transformation and artificial intelligence on employment. Numerous studies indicate that these technologies can create new opportunities for labor market development and enhance production efficiency. For instance, in the work of Heidi Aly [9], it was revealed that artificial intelligence, rapid technological progress, and digital transformation bring tremendous benefits to developing countries. If these countries take advantage of digital transformation, their economy can become more productive, increasing per capita gross national income and employment.

In their works, Michael Webb [10] argues that artificial intelligence positively influences the labor market, ranging from creating new products that increase demand for labor to more effective education delivery, stimulating labor supply. Article [11] demonstrates that the main advantage of employing artificial intelligence in employment is its potential to automate routine and repetitive tasks, freeing up workers for more complex and creative work. This can lead to increased productivity, efficiency, and cost savings. Moreover, artificial intelligence can help create new job opportunities and industries.

Overall, the digitalization of the economy is expected to have a significant positive impact on stabilizing Ukraine's labor market, as experts projected. However, the effects of digital transformations on employment in Ukraine during times of war and in the post-war period remain insufficiently explored.

**The aim of the paper.** The main aim of this paper is to explore opportunities for increasing employment levels in Ukraine through the digital transformation of the national economy by examining the current condition of the job market and the utilization of artificial intelligence digital technologies.

**Results.** It is necessary to explore the shifts that have occurred in Ukraine's employment landscape in recent years and the potential outlook for the future functionality of the domestic labor market, considering the impact of digital transformation.

For Ukraine, the reduction in employment levels in 2020–2021 due to the COVID-19 pandemic resulted in significant economic and social losses. To stabilize the situation, the government should support sectors capable of creating decent and productive jobs, particularly those with remote workforce engagement. However, the full-scale military invasion by the Russian Federation into Ukraine on February 24, 2022, has significantly shifted employment priorities. Numerous individuals have experienced job losses and have been compelled to relocate to more secure western regions of Ukraine or foreign countries. Therefore, without a consistent state policy to overcome the labor market crisis, a substantial number of unemployed individuals can complicate economic stabilization processes even after the establishment of peace. On the other hand, the non-return of individuals who found stable employment abroad during the war threatened the reconstruction of the national economy due to a labor shortage.

The unemployment rate in Ukraine, reaching around 10–11% by 2021, posed a significant economic and social threat to the country. Despite gradually decreasing throughout 2021 due to the development of new economic activities and forms of employment, particularly remote work, it remained a pressing issue. Examining the quarterly fluctuations in the unemployment rate in Ukraine between 2017 and 2021, both before and after the outbreak of the pandemic, demonstrates a decline from the first to the third quarter of 2017, followed by an increase from the third quarter to the first quarter of the subsequent year. This yearly pattern continued until the second quarter of 2020, which can be attributed to the influence of the COVID-19 pandemic on Ukraine. In March 2020, the first case of infection was reported, followed by the introduction of a state of emergency with strict quarantine measures across the country, substantially impacting the job market [15]. The first quarter of 2021 witnessed the exacerbation of this situation due to the height of the COVID-19 pandemic and the imposition of another round of quarantine measures in Ukraine. The mass vaccination of Ukrainians against the coronavirus and the subsequent reduction in COVID-19 cases gradually contributed to stabilizing the labor market. However, the beginning of 2022 brought radical changes. The Russian-Ukrainian war made it hard to make any forecasts or government strategies for employment growth, raising concerns about the survival of the national economy.

Following the commencement of intense hostilities in Ukraine, the COVID-19 pandemic no longer remained the primary factor impacting the

domestic job market. In the first quarter of 2022, approximately a quarter of Ukraine's population significantly migrated to Western regions and abroad. Normal life in the eastern regions was disrupted, while millions of unemployed individuals emerged in the western regions, escalating strain on the labor market at the regional level. According to estimates by the Ministry of Economy of Ukraine, 30–35% of enterprises were already closed within the first month of the war [16]. To prevent widespread unemployment and economic downturn, the Ukrainian government introduced an unprecedented policy of deregulation and business liberalization designed to stimulate the economic vitality of companies and facilitate their relocation to secure regions if required. One of the steps taken included a substantial decrease in the tax burden imposed on employers and individuals working for themselves (Figure 1).

Apart from offering tax incentives to enterprises, the government allocated a significant amount of 1 billion USD in 2022 to provide interest compensation and loan guarantees to support the planting campaign of small and medium-sized agricultural producers [17]. Credit and tax liberalization, according to experts' estimates, resulted in monthly budget deficits of \$5–7 billion USD in the spring of 2022, which the government has been trying to cover through the mobilization of domestic and external financial resources with varying success. At the same time, slowing down the pace of decline in domestic gross domestic product and employment was practically an insurmountable task. This was due to the extensive destruction of numerous infrastructure facilities, rendering the restoration of business operations and trade flows unfeasible; delayed planting campaigns and reduced sowing areas due to field mines and destroyed agricultural machinery and fuel lubricants; migration of workers abroad in search of refuge [18].

The current government policy, along with prioritized funding for the military, is focused on restoring lost and creating new job opportunities rather than sustaining the unemployed. In April 2022, a sum of 1 billion UAH was assigned from the national budget to restore infrastructure damaged by the war in the Kyiv, Chernihiv, Sumy, and Zhytomyr regions, which led to increased employment rates [19]. This approach is more rational as it directs available resources towards rebuilding the economy rather than providing unemployment assistance and related social payments. However, in our view, external investments and digital transformation will be crucial in supporting and revitalizing Ukraine's

<p>For individual entrepreneurs, freelancers, and members of agricultural farms, starting from March 1, 2022, until the termination of the martial law, as well as within one year after the termination of the martial law. Additionally, voluntary payment of the Single Social Contribution is provided for employers who have chosen the simplified tax system, and the allocated funds were designated for supporting self-employed individuals who have hired employees and were called up for military service in the Ukrainian Armed Forces.</p> <p><b>Voluntary payment of SSC</b></p>	<p>For state and communal land, including land and shares located in areas affected by hostilities, temporarily occupied territories, and areas contaminated with explosive objects and/or fortified structures, from March 1, 2022, until December 31 of the following year after the termination of the martial or emergency state.</p> <p><b>Exemption from land tax and land payment</b></p>	<p>Regarding the charitable aid offered by donors during the period of martial law or a state of emergency as regulated by law, in favor of participants in hostilities, employees of organizations involved in ensuring national security and defense, individuals residing in areas where hostilities take place, and/or individuals who have been forcibly displaced from their place of residence.</p> <p><b>Reduction of VAT rate</b></p>
<p>For individual entrepreneurs and legal entities, if the annual amount of calendar income of enterprises does not exceed 10 billion UAH and certain additional conditions are met. The unified tax rate in case of transition for taxpayers of all three groups is 2%, while for taxpayers of the 1st and 2nd groups, tax payment during the period of martial law is voluntary.</p> <p><b>Simplified tax system</b></p>	<p><b>Measures to reduce the tax burden</b></p>	<p>For the import and supply of defense articles, as well as operations related to the import and supply of special personal protective equipment and body armor for volunteer formations of territorial communities formed in accordance with the laws of Ukraine.</p> <p><b>VAT exemption</b></p>
<p>For gasoline, other petroleum products, heavy distillates, liquefied gas, propane, and isobutane.</p> <p><b>Zero rate of excise tax</b></p>	<p>From 20% to 7% during the period of martial law on the import and supply of motor gasoline, heavy distillates, liquefied gas, crude oil, and crude oil products obtained from bituminous rocks (minerals).</p> <p><b>Reduction of aggregate taxable income</b></p>	<p>For objects located in areas of active hostilities or temporarily occupied territories in 2022.</p> <p><b>Exemption from payment of environmental tax</b></p>

**Figure 1. Measures to reduce the tax burden on employers and self-employed workers**

Source: constructed by the authors based on [20]

economy, as they can stimulate economic processes and regional labor markets.

Making forecasts in times of war is challenging due to the high uncertainty regarding future developments. However, even under such critical conditions, one can speak of new opportunities for the national economy that arise after the cessation of hostilities. Rebuilding the country will require significant investments and many new job positions, which will positively impact employment growth, providing efficient management of these investments. The demand structure for labor will undergo significant changes, particularly with an increased need for professionals in construction specialties, architects, designers, and workers in various skilled trades. This will contribute to overcoming crisis phenomena in the labor market and improving the standard of living for the population.

Together with the war, mass diseases, and population injuries will stimulate employment growth in the healthcare sector, including pharmaceuticals and physical and psychological rehabilitation, and encourage the expansion of remote work and the adoption of new digital technologies, among others. At the same time, alongside the pandemic and the war, the most unpredictable changes in the modern labor market and the overall development of humanity can be brought about by technological advancements. These changes will shape a new reality: political, managerial, or economic [21].

Digital transformations of economic models happening today are reshaping the contours of national economies. Worldwide, green jobs are being actively created, aimed at reducing environmental pollution in all its forms, transitioning to renewable energy, increasing the share of resource recycling, and more, including through the implementation of digital technologies. Ukraine is also creating such jobs, for example, in the construction and operation of renewable energy power plants.

It is worth noting that along with digital transformation, artificial intelligence technologies are being implemented, which will have a significant impact on the realm of employment. This is particularly relevant when many people seek jobs, but companies cannot hire all the workers due to financial constraints.

Artificial intelligence can help improve the job search process's efficiency and reduce recruitment and selection costs. When there are many candidates in the job market but not enough suitable vacancies, AI systems can help find more accurate matches between candidates and positions, reducing the number of candidates who are not suitable for a specific job. Additionally,

AI systems can identify trends and forecast labor market developments, enabling more effective job search efforts and reducing the risk of unemployment. Overall, artificial intelligence can play a significant role in ensuring efficient and equitable employment distribution.

The use of artificial intelligence can help increase productivity and efficiency in many industries, increase the number of jobs, and reduce unemployment (Figure 2). For example, the automation of routine processes through artificial intelligence reduces the time required to complete tasks and enhances their quality, which can create a demand for new job opportunities.

Therefore, applying artificial intelligence can positively impact employment, providing benefits for both employers and employees. Furthermore, developing AI-related fields can create new opportunities for workers with specialized knowledge and skills. For example, the field of AI development requires experts with knowledge of mathematics, computer science, and statistics, while robotics necessitates engineers who can design and develop robots.

Artificial intelligence can also contribute to the creation of new jobs in industries where it is already being applied, such as data processing and analytics. The increasing demand for AI-knowledgeable specialists can help open new courses and programs in educational institutions, thereby expanding the pool of professionals in this field.

Thus, applying artificial intelligence to analyzing labor market needs and predicting market changes will assist companies and investors in making informed decisions, which can positively impact the economy and overall societal development.

Researching the interaction between humans and artificial intelligence in the employment process is important in exploring contemporary labor market trends. This allows for a better understanding of how artificial intelligence can foster employment opportunities (Table 1).

Thus, the digital transformation of the economy through the implementation of artificial intelligence in Ukraine can help improve working conditions, create new jobs, and contribute to developing new industries. However, paying attention to potential negative consequences and developing appropriate strategies to prevent them is also necessary. For instance, as artificial intelligence enables the automation of many jobs, it will reduce the number of positions in certain industries where work involves routine tasks. Additionally, artificial intelligence can replace humans in performing complex tasks that require high qualifications, resulting in a decline in the availability of such employment opportunities.

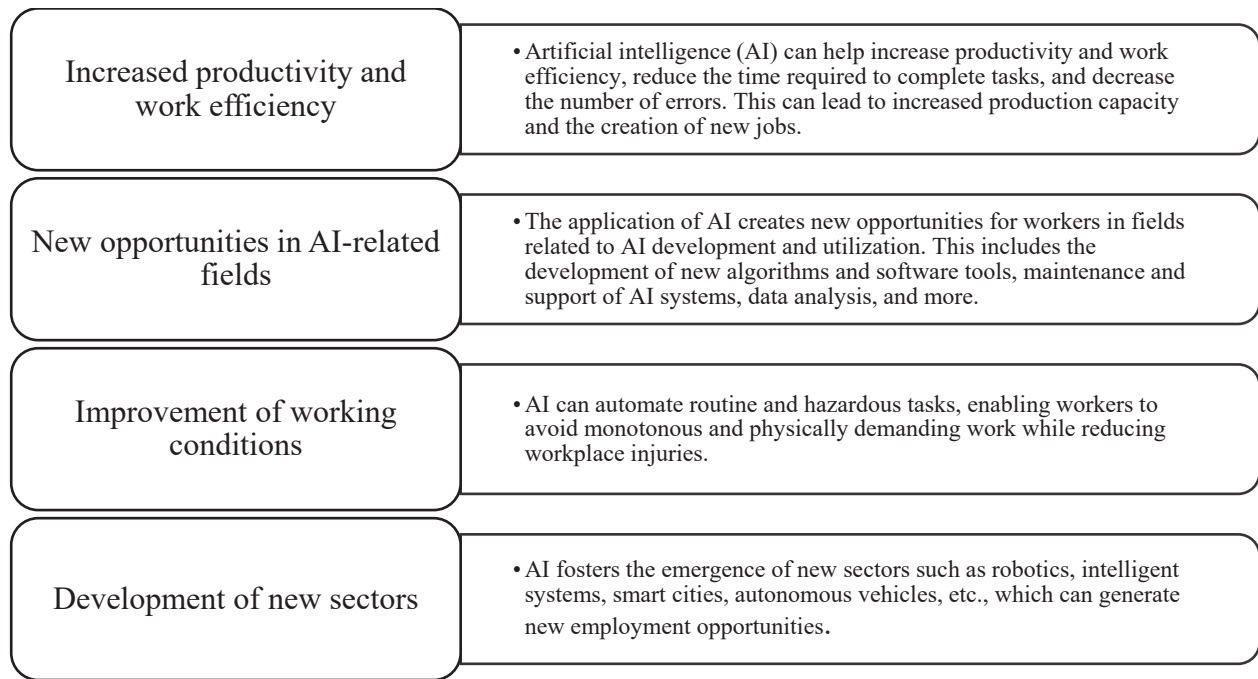


Figure 2. Positive impact of artificial intelligence on employment

Table 1

How Artificial Intelligence can help improve employment

Aspects of interaction between humans and artificial intelligence	How can it help?
Learning and skill development	AI can help in the process of learning and developing employees' skills by analyzing performance data and identifying the individual needs of each employee.
Competition	AI can reshape competition in the labor market by creating new skill requirements for workers and changing the way job searches and employment are conducted.
Automation of routine tasks	AI can perform routine and monotonous tasks, freeing people from unproductive work and allowing more time for creative and strategic activities.
Ethics	AI can raise ethical questions, particularly regarding the privacy protection of candidates and the potential for discrimination based on algorithms.
Increased productivity	AI can enhance workers' productivity by automating routine tasks, optimizing work processes, and providing valuable information for decision-making.
Training	AI can stimulate the need for learning and upskilling among workers, transforming the labor market.
Optimization of recruitment and personnel selection processes.	AI can help select candidates with the most relevant skills and experience by utilizing analytical algorithms and selection technologies.
Collaboration.	AI can assist employees and employers in collaborating more effectively, including improving the candidate selection process, employee training, and development, and predicting labor market changes.
Improvement in decision-making quality.	AI can aid in decision-making by providing access to vast amounts of data and analyzing them using analytical algorithms and machine learning.
Communication.	AI can enhance communication between employees and employers, such as through virtual interviews and communication tools.
Enhancement of customer service quality.	AI can improve customer service quality by responding to inquiries and questions through automated chatbot systems and other technologies.

At the same time, the application of artificial intelligence for analyzing labor market needs and forecasting changes can be a valuable tool for employers and investors seeking to understand which professions and skills are in high demand and which sectors of the economy are growing.

**Conclusions.** The COVID-19 pandemic in 2020–2022 and the full-scale Russian-Ukrainian war in 2022 have been significant tests for the Ukrainian economy and the global economy, thus making significant adjustments to Ukrainian employment trends. To avoid mass unemployment and economic decline, the Ukrainian government has introduced an unparalleled approach of deregulation and promoting business freedom, aimed at stimulating the economic activity of enterprises and their relocation to safe regions when necessary. This includes a significant reduction in tax burden, such as the possibility of transitioning to a simplified tax system, voluntary payment of a single social contribution, reduced value-added tax rate, and so on.

However, even under such critical conditions, we can talk about new opportunities for the Ukrainian economy that arise after the cessation of hostilities, namely: there will be an increased demand for professionals in construction

specialties, architects, designers, representatives of manual professions, and so on; employment in the healthcare sector will develop; the implementation of new resource-efficient, waste-free technologies in construction and the restoration of infrastructure and other facilities is planned based on the principle of "better than before"; the digital transformation of economy leads to the creation of new economic sectors, the eradication of corruption, changes in lifestyle, and the creation of green jobs.

The development of AI-related fields opens new possibilities for the Ukrainian economy. For example, experts in mathematics, computer science, and statistics are needed in the field of AI development, while engineers who can design and develop robots are in demand in the field of robotics. The application of artificial intelligence can help create new jobs in areas where it is already being used, such as data processing and analytics. Additionally, the demand for AI-knowledgeable professionals may lead to the opening of new courses and programs in educational institutions to train them.

Thus, the use of artificial intelligence will contribute to positive progress in the Ukrainian economy and society, creating a new reality in the political, managerial, and economic spheres.

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## **ЯК ЦИФРОВА ТРАНСФОРМАЦІЯ ЕКОНОМІКИ МОЖЕ ПОКРАЩИТИ ЗАЙНЯТІСТЬ В УКРАЇНІ**

У статті досліджується ситуація з ринком зайнятості в Україні за останні роки і перспективи його розвитку під впливом цифрової трансформації економіки. Мета цієї статті полягає в пошуку можливостей підвищення рівня зайнятості в Україні шляхом цифрової трансформації національної економіки на основі аналізу поточного стану ринку праці та використання цифрових технологій штучного інтелекту. Актуальність даного дослідження пов'язана зі впливом пандемії COVID-19 і повномасштабного вторгнення Російської Федерації в Україну на ринок праці, зокрема наслідками у вигляді руйнувань, хвороб і міграції населення та закриття підприємств. За таких умов важливою є державна підтримка створення нових робочих місць і збереження трудових ресурсів. Також необхідне стратегічне планування стабілізації ситуації на ринку праці та розвитку національної економіки. При цьому, впровадження цифрових технологій, зокрема штучного інтелекту, може сприяти створенню нових робочих місць і зменшенню безробіття. У статті використані загальнонаукові емпіричні та теоретичні методи дослідження, зокрема методи спостереження і опису, а також методи аналізу, синтезу, абстрагування та узагальнення. Результати дослідження говорять про те, що цифрова трансформація може стимулювати розвиток інформаційно-технологічного сектору економіки, забезпечувати нові можливості для працевлаштування та сприяти загальному економічному зростанню, що активізує ринок праці. При цьому, розвиток систем штучного інтелекту надає нові можливості для економіки. Застосування штучного інтелекту може сприяти створенню нових робочих місць у таких сферах, як аналітика великих даних, робототехніка, статистика. Попит на фахівців зі знаннями штучного інтелекту може призвести до розвитку відповідного ринку освітніх послуг. Однак, при цьому існують потенційні негативні наслідки, такі як заміна деякої людської праці системами штучного інтелекту. Але загальний потенційний ефект від впровадження штучного інтелекту набагато більший ніж негативний ефект внаслідок скорочення деякої людської праці. Зникнення робочих місць в одних сферах супроводжується появою нових сфер і, відповідно, нових видів робочих місць. Практичне значення дослідження полягає в його можливому застосуванні для прийняття управлінських рішень щодо розвитку цифрової трансформації держави, зокрема розроблення ефективних політик та стратегій впровадження систем штучного інтелекту в економіці.

**Ключові слова:** цифрова трансформація, зайнятість, ринок праці, технологічний прогрес, інновації, працевлаштування, штучний інтелект.