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МОДЕЛЮВАННЯ ВПЛИВУ ЦИФРОВИХ ТЕХНОЛОГІЙ НА ІННОВАЦІЙНИЙ РОЗВИТОК ПІДПРИЄМСТВ В УМОВАХ МОДЕРНІЗАЦІЇ РЕГІОНАЛЬНОГО БІЗНЕС-ЛАНДШАФТУ

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Анотація. У статті розглянуто особливості інноваційного розвитку підприємств в контексті трансформації регіональної інноваційної політики та впливу цифровізації бізнес-оточення. Визначено сутність бізнес-ландшафту регіональної економіки та переваги врахування його впливу в діяльності сучасних підприємств. Розглянуто регіональний вимір інноваційного розвитку на прикладі показників кількості інноваційно активних підприємств та обсягу капітальних інвестицій, визначено основні проблеми активізації інноваційно-інвестиційних процесів. У статті проаналізовано роль інноваційної діяльності промислових підприємств у формуванні ВВП України. Досліджено вплив макроекономічних чинників на інноваційну діяльність промислових підприємств. Наведено результати моделювання впливу цифрових технологій на обсяг реалізованої інноваційної продукції підприємства. Результати моделювання засвідчили, що провідну роль в інноваційному розвитку промислових підприємств відіграють хмарні інновації. Визначено, що основним викликом розвитку інноваційної діяльності є індустріалізація наукомістких технологій, їх комерціалізація та виведення на ринки, що вимагає використання цифрових технологій у всіх сферах виробничих процесів для переходу на принципово новий цифровий формат роботи. Доведено, що у діяльності промислових підприємств це відображається не тільки у просуванні самих цифрових рішень, але й формуванні нової системи факторів та умов, які необхідні для їх успішної реалізації. Аргументовано, що у такому аспекті, виокремлення стратегічних орієнтирів інноваційного розвитку промислових підприємств в умовах модернізації бізнес-ландшафту, є засобом аналізу тенденцій світової економіки, обґрунтування управлінських рішень, процесів планування та прогнозування. Акцентовано увагу на тому, що процеси цифровізації є засобом підвищення ефективності інноваційної діяльності промислових підприємств, результативність яких визначається ефективністю реалізації трансформацій всіх бізнес-процесів та сприяє підвищенню конкурентоспроможності

Ключові слова: інновації, інноваційний розвиток, регіон, регіональна економіка, цифрова економіка, цифровізація, модернізація, бізнес-ландшафт, стратегія, ризики, підприємство, Індустрія 5.0.

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MODELING THE IMPACT OF DIGITAL TECHNOLOGIES ON THE ENTERPRISE INNOVATION DEVELOPMENT IN THE CONTEXT OF REGIONAL BUSINESS LANDSCAPE MODERNIZATION

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Abstract. The article examines the features of the innovative development of enterprises in the context of the transformation of regional innovation policy and the impact of digitalization of the business environment. The essence of the business landscape of the regional economy and the advantages of taking into account its impact in the activities of modern enterprises are determined. The regional dimension of innovative development is considered using the example of indicators of the number of innovatively active enterprises and the volume of capital investments, and the main problems of activating innovation and investment processes are identified. The article analyzes the role of innovation activity of industrial enterprises in the formation of Ukraine's GDP. The impact of macroeconomic factors on the innovation activity of industrial enterprises is studied. The results of modeling the impact of digital technologies on the volume of innovative products sold by the enterprise are presented. The modeling results showed that cloud innovations play a leading role in the innovative development of industrial enterprises. It was determined that the main challenge for the development of innovation activity is the industrialization of knowledge-intensive technologies, their commercialization and market introduction, which requires the use of digital technologies in all areas of production processes to transition to a fundamentally new digital format of work. It is proven that in the activities of industrial enterprises this is reflected not only in the promotion of digital solutions themselves, but also in the formation of a new system of factors and conditions that are necessary for their successful implementation. It is argued that in this aspect, the identification of strategic guidelines for the innovative development of industrial enterprises in the context of the modernization of the business landscape is a means of analyzing trends in the world economy, substantiating management decisions, planning and forecasting processes. Attention is focused on the fact that digitalization processes are a means of increasing the efficiency of innovative activities of industrial enterprises, the effectiveness of which is determined by the efficiency of implementing transformations of all business processes and contributes to increasing competitiveness.

Key words: innovation, innovative development, region, regional economy, digital economy, digitalization, modernization, business landscape, strategy, risks, enterprise, Industry 5.0.

Introduction. State regulatory policy places considerable emphasis on fostering and supporting innovation, despite hostilities and the activities of enterprises in extremely difficult conditions. The development of innovations also involves investments in research and development, the introduction of new technologies and the creation of new products and services. The use of digital technologies is becoming more and more common among Ukrainian enterprises: the Internet of Things, artificial intelligence and automation technologies. Digitalization is one of the directions for the implementation of innovative development, contributing to the optimization of business processes. Every year the number of enterprises and institutions that introduce digital technologies into the management and

production process is increasing. With the rapid advancement of technology, businesses are constantly looking for ways to improve their operations and maintain their competitive position. The integration of digital technologies has become the most important aspect of this process, which has led to the emergence of Industry 5.0. Most often, digitalization is aimed at increasing the efficiency of production processes through automation and robotics. It can help streamline innovation processes by providing a platform for collaboration, communication, and data analysis. For example, digital tools such as virtual reality, 3D printing, and artificial intelligence can be used to test new products and services more efficiently. Data analysis tools can also provide insights into customer needs and preferences, which will help drive new product development. Thus, innovation processes and digitalization are interconnected in industrial enterprises. Businesses that use digital technologies alongside innovative processes are likely to see significant improvements in their operations, leading to increased competitiveness, profitability, and customer satisfaction. It becomes important to choose specific software solutions for a particular enterprise.

Ukrainian scholars have devoted considerable attention to the assessment of the innovative potential of enterprises, the peculiarities of the introduction of innovative activities under martial law, innovative aspects of entrepreneurial activity at the regional level. Such researchers as R. Mann [1], I. Khymych [2], Y. Rohozian [3], I. Bodnar [4] and others work in this direction. The prospects for the introduction of digital technologies, the relationship between digitalization and innovation activities of enterprises, the prerequisites for the development of the digital economy are considered by such scientists as O. Kuzmenko [5], N. Tymoshenko [6], A. Shakhno [7], V. Liashenko [8], N. Kraus [9], M. Tarasiuk [10], N. Pavlishyna [11] and others. However, the instability of the market environment, digital transformations of the business environment of enterprises necessitate the use of new management tools that can ensure the effectiveness of innovative development of enterprises in the region in the context of digitalization of the business landscape and possible changes and challenges.

Research Objective. The article is aimed at modeling the impact of digital technologies on the innovative development of enterprises in the context of modernization of the regional business landscape.

Results. The business landscape of the regional economy reflects the spatio-temporal characteristics of the processes of regional development and the structural orderliness of the regional economic system. It includes the spatial patterns of goods and service flows, resource base, interregional exchange and participation of the region in export-import operations. The regional business landscape forms the determining parameters and trajectories of development of the processes of the regional economy [5-6].

Taking into account the specifics of the business landscape provides enterprises with the following advantages:

- increasing the efficiency of activities – adaptation to changes in the conditions of the business landscape enables enterprises to optimize management functions and time for performing individual tasks, which allows you to ensure a high level of productivity of the organization in the future;
- adaptability of the management process - the enterprise becomes more flexible and able to quickly respond to changes in the external and internal environment;
- risk management – the enterprise has the opportunity to identify problem areas of activity, develop appropriate strategies to eliminate and minimize risks [2, 4].

An effectively functioning regional business landscape should facilitate the harmonious interaction both between enterprises in the region and to optimize the structure and directions of interregional cooperation.

It is advisable to start considering the impact of the business landscape on the features of innovative development with the analysis of innovation and investment processes at the regional level. The regional dimension of innovative development will be studied both from the standpoint of innovation activity and investment activity. Thus, in terms of the number of innovation-active enterprises, the leader in 2024 was the Dnipropetrovsk region (466 enterprises) (Fig. 1). This applies to both enterprises that implemented innovative processes and those that focused on updating or improving products (303 and 220 enterprises, respectively). Kharkiv (390 enterprises), Lviv (377 enterprises) and Kyiv (258 enterprises) regions should also be included in the leaders. The main reason for significant innovation activity, despite the proximity to the territories of hostilities, is the industrial profile of the regions, the availability of an appropriate production and resource base, which makes it possible to implement development projects.

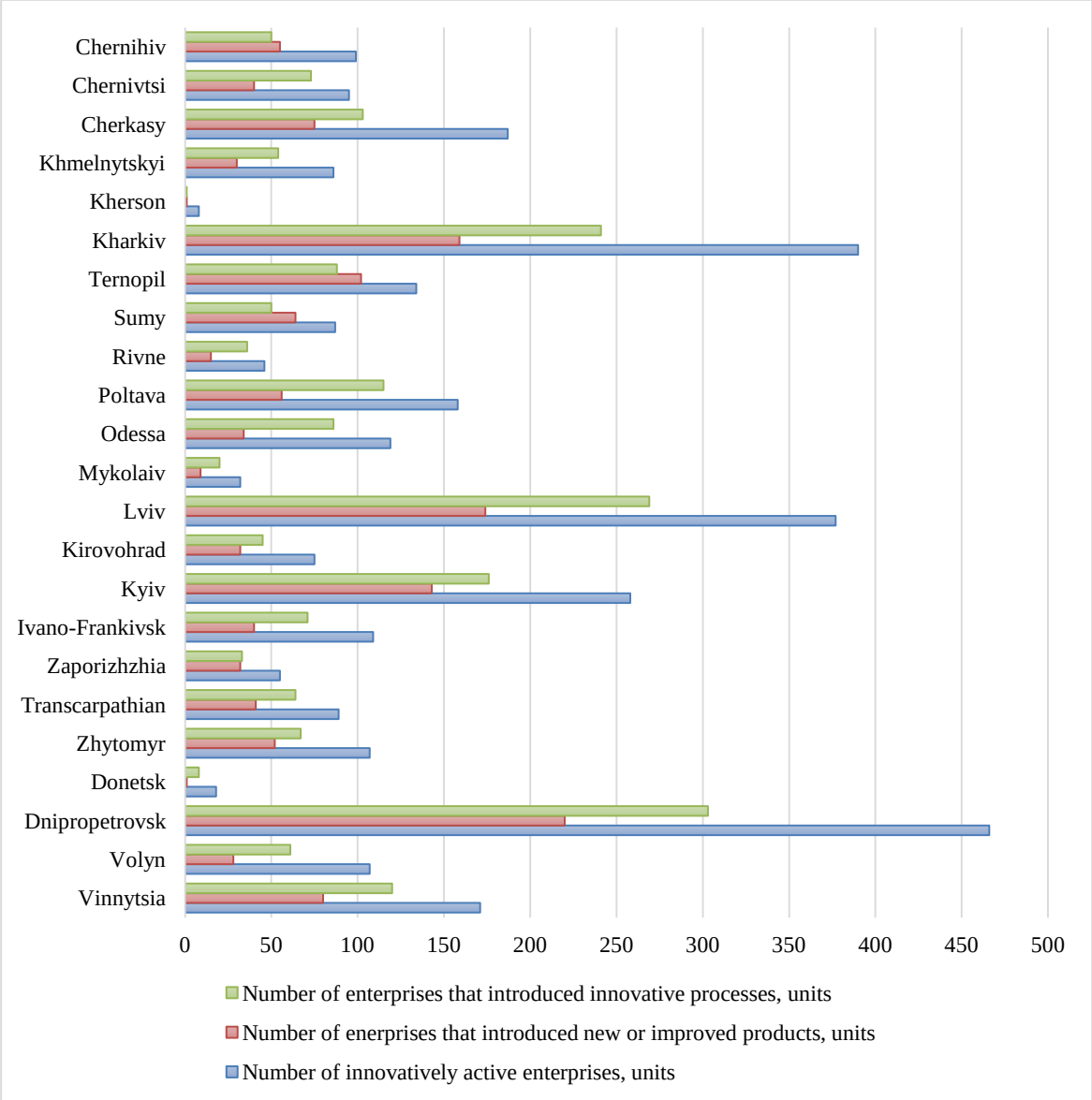

Fig. 1. Number of innovatively active enterprises by region, 2024
Source: [12].

According to the data of the first half of 2025, the largest volume of attracted capital investments belongs to the Dnipropetrovsk region, Kyiv and Lviv regions are in 2nd and 3rd

place, which is explained both by the high concentration of financial capital and the activities of large business structures in the regions (Fig. 2).

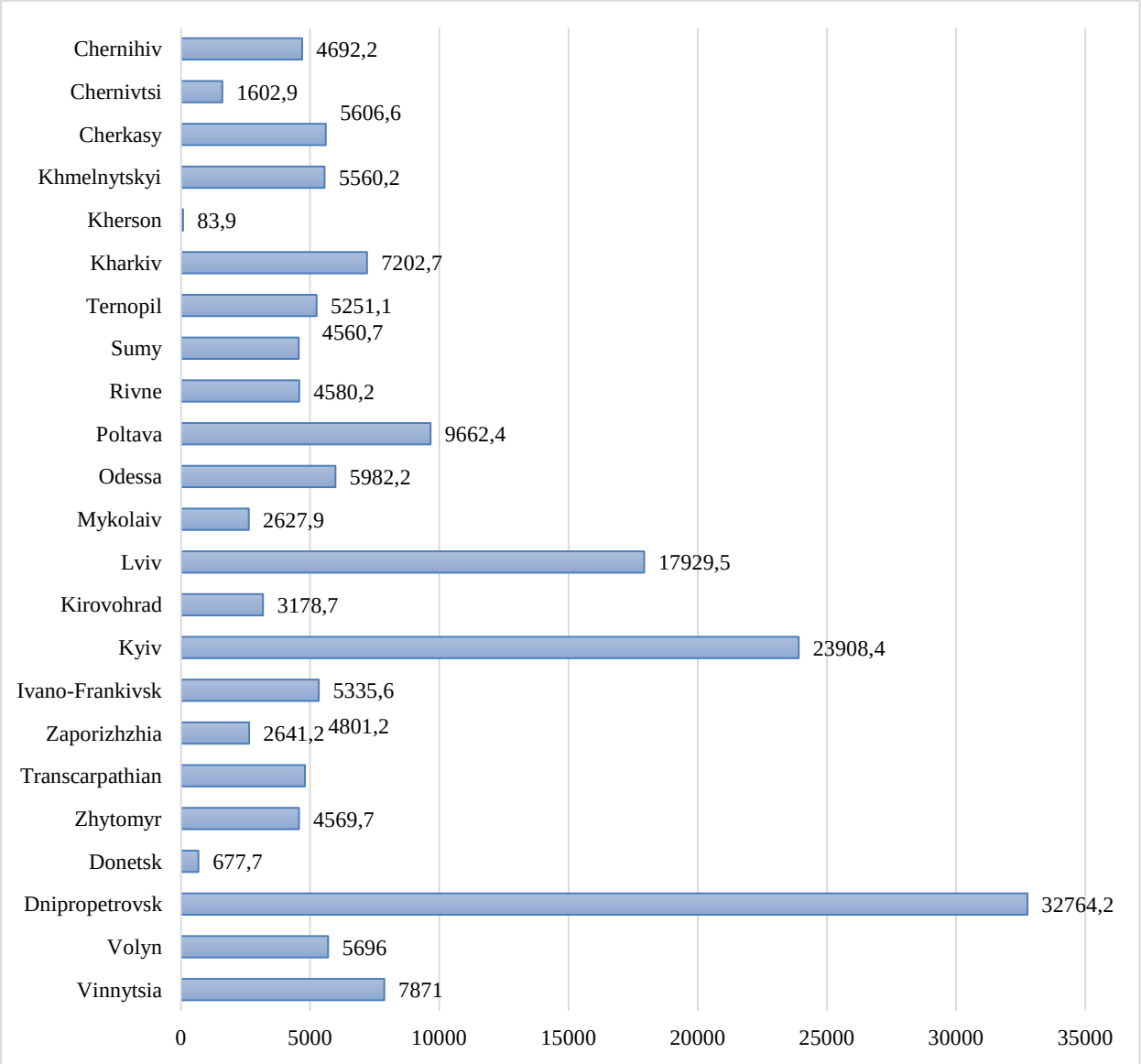

Fig. 2. Volume of capital investments, UAH million, January-June 2025
Source: [12].

The analysis of the structure of capital investment indicates that enterprises' own funds remain the predominant source of financing. The main reasons for the decline in the innovation activity of business entities are related to the threats caused by the military aggression of the Russian Federation and the risks of doing business. However, negative trends are also characterized by a decline in institutional capacity, insufficient level of state support, lack of motivation for scientific research and innovative entrepreneurship. The interconnectedness of the processes of investment and creation of innovations, the lack of resources for conducting scientific research, the imperfection of institutional support for the processes of commercialization of innovations have negatively affected the processes of technological renewal, dissemination of innovative ideas and implementation of innovative projects [7, 10].

Ukraine's industrial sector generates relatively limited revenues from innovative products, with a substantial share derived from imitative rather than genuinely novel products.

This limits margins, profitability and export potential, reinforcing the sector's position as a technological laggard. At the same time, as confirmed by the data of Fig. 3 it is innovation activity that plays a key role in the formation of the country's GDP.

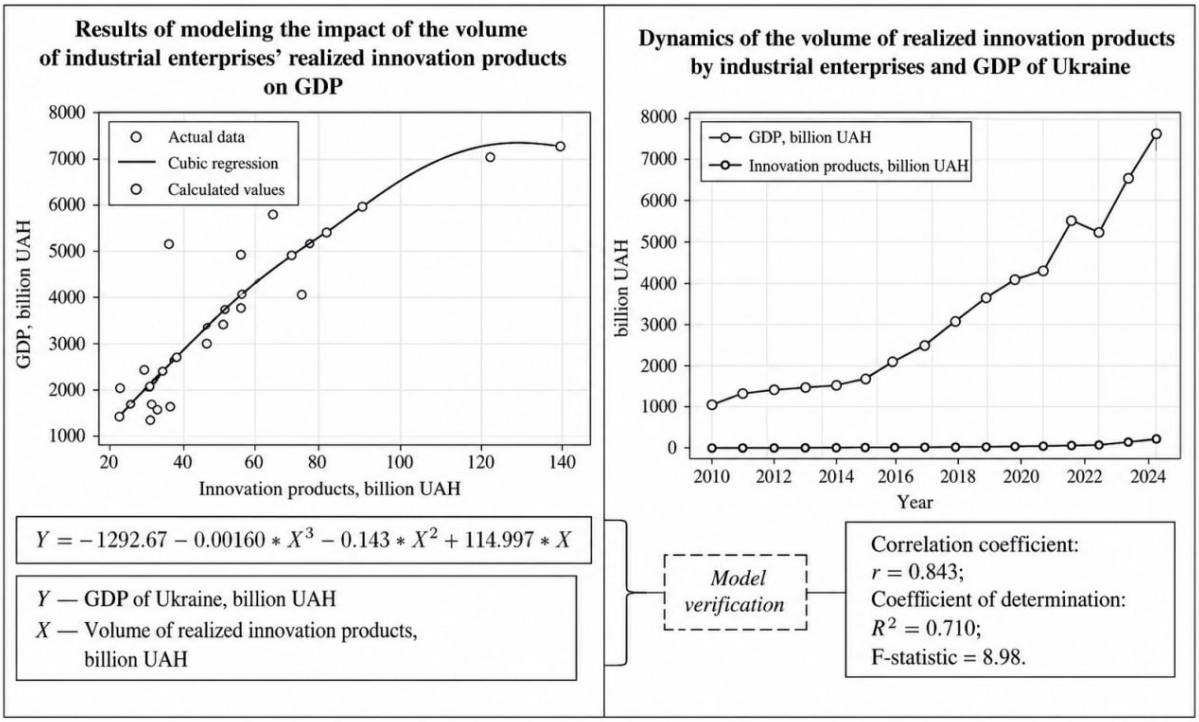

Fig.3. The role of innovation activity of industrial enterprises in the formation of Ukraine's GDP

Source: compiled by the authors based on the data of the State Statistics Service of Ukraine [12] and own calculations.

In turn, the macroeconomic situation affects the innovative development of industrial enterprises. The stability of the economic environment has always made it possible to provide favorable conditions for their activities, which in turn has a positive effect on their ability to invest in new developments, technologies, and equipment. This, in turn, increased the level of competitiveness of business entities and created conditions for the expansion of their economic activity [1, 3, 7].

Figure 4 presents the results of the study of the influence of certain macroeconomic factors on the innovation activity of industrial enterprises.

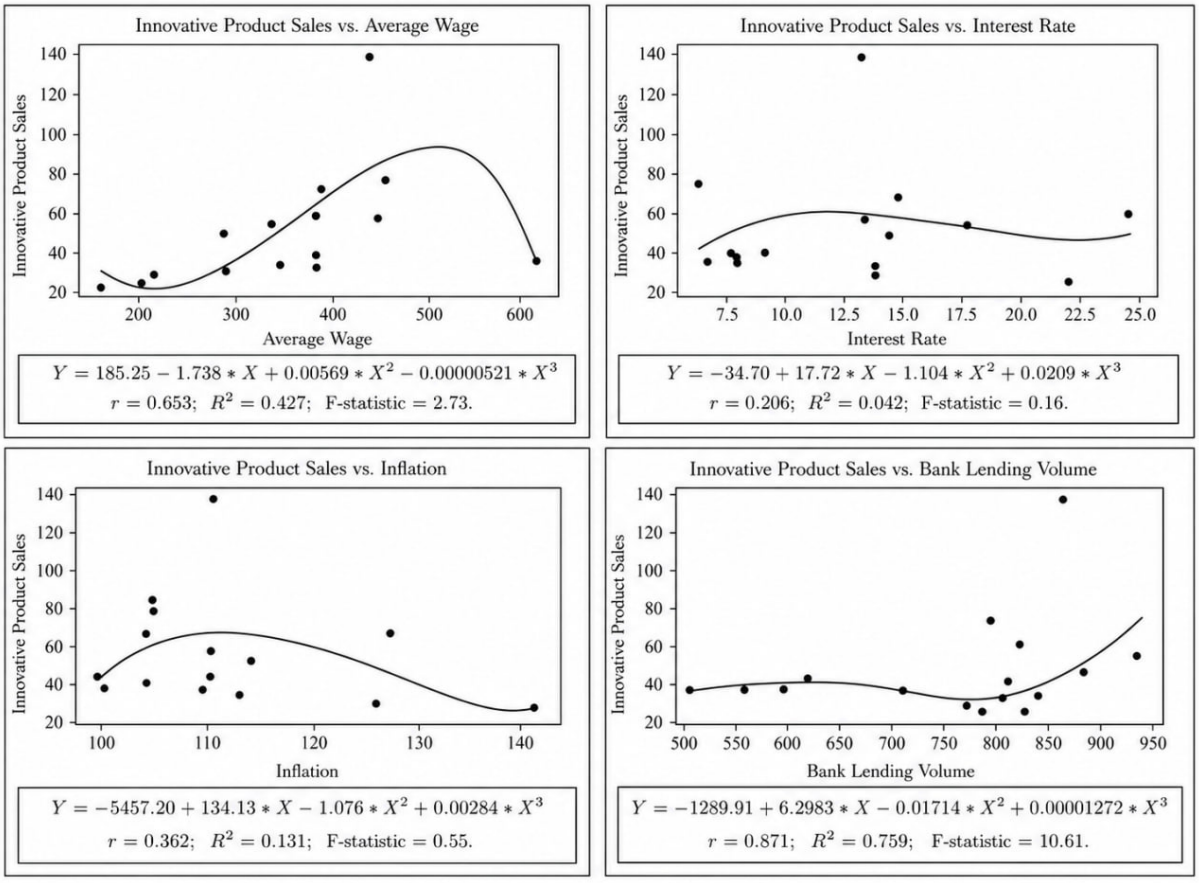

Fig. 4. The influence of macroeconomic factors on the innovative activity of industrial enterprises

Source: compiled by the authors based on the data of the State Statistics Service of Ukraine [12] and their own calculations.

Thus, among all macroeconomic indicators, it is the availability of financial resources, i.e. the availability of credit funds within the national economy, that is an important factor in intensifying the innovation activity of industrial enterprises.

The conducted comprehensive analysis of statistical data allows us to draw a number of systematic conclusions about the current trends in the innovative development of the industrial sector of Ukraine. These trends indicate the presence of deep structural problems, which have been significantly deepened by geopolitical, military and economic crises.

Figure 5 shows the results of modeling the impact of digital technologies on the volume of innovative products sold by the enterprise.

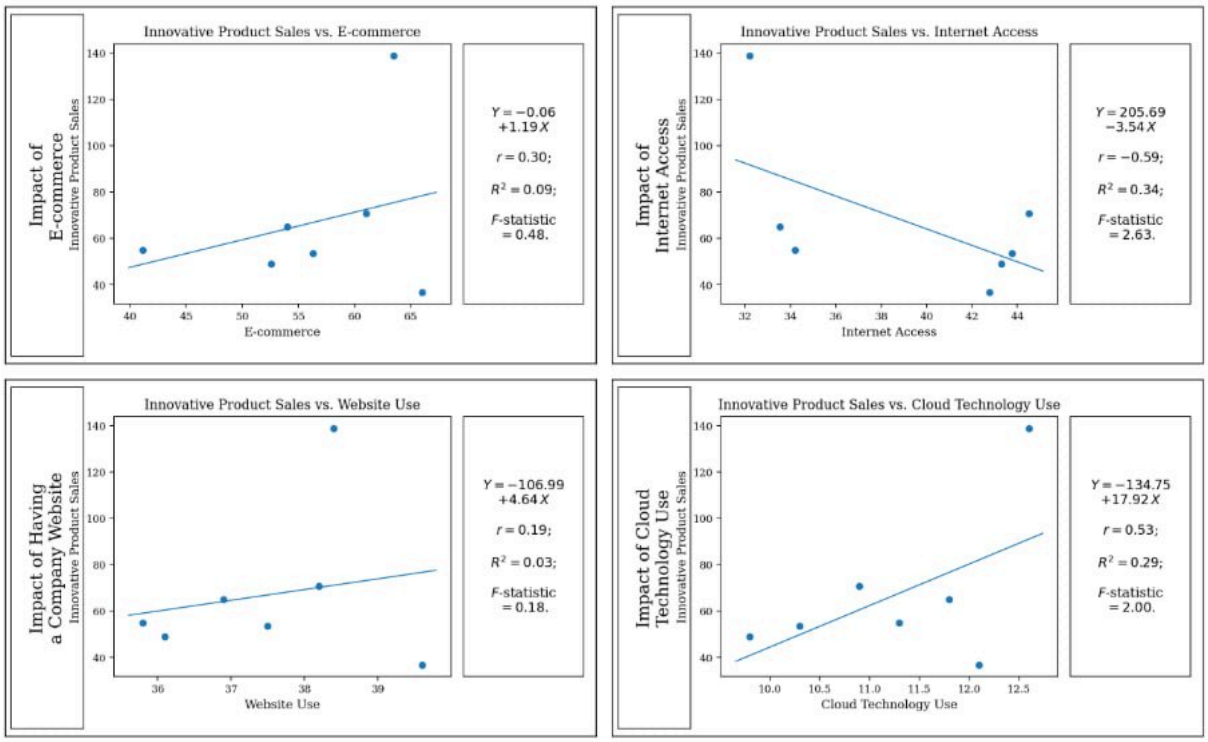

Fig. 5. Results of modeling the impact of digital technologies on the volume of innovative products sold by the enterprise
Source: calculated by the authors.

The main challenge for the development of innovation activity is the industrialization of high-tech technologies, their commercialization and introduction to markets, which requires the use of digital technologies in all areas of production processes for the transition to a fundamentally new digital format of work. In the activities of industrial enterprises, this is reflected not only in the promotion of digital solutions themselves, but also in the formation of a new system of factors and conditions that are necessary for their successful implementation. In this aspect, the identification of strategic guidelines for the innovative development of industrial enterprises under the condition of the digital economy is a means of analyzing trends in the world economy, substantiating managerial decisions, planning and forecasting processes. It should be noted that digitalization processes are a means of increasing the efficiency of innovation activities of industrial enterprises, the effectiveness of which is determined by the efficiency of the implementation of transformations of all business processes and contributes to increasing competitiveness [8, 9, 11].

Conclusions. The modeling results indicate that cloud innovations play a leading role in the innovative development of industrial enterprises. It has been proved that maintaining the competitiveness of industrial enterprises without the introduction of digital technologies is a rather difficult task. Despite the complexity and labor intensity of production processes, it is innovations that contribute to an increase in labor productivity, automation of complex technological processes. Adherence to Industry 5.0 principles requires enterprises to be environmentally friendly, energy efficient and resource-efficient.

For the effective development of strategies and programs, it is necessary to identify problems, risks and prospects for the functioning of industrial enterprises, which will make it possible to minimize negative consequences, thereby increasing the adaptive capacity of the business entity.

It is advisable to note that the introduction of innovative technologies is not possible without strong intellectual and human capital, which provides the foundation for R&D

activities and new innovation projects. Therefore, enterprises need to form their own intellectual and human capital potential for the development of innovation capacity and commercialization of developments.

The difficult situation in industry reduces the overall innovative development of the industry and the state, so the post-war industrial recovery should be based on the principles of sustainable development and Industry 5.0. Improvement of production capacities on an innovative basis should be carried out across industrial entities and with the active support of the state and private investors.

References

1. Mann, R., and D. Hladkii. "Assessment of Innovation Potential in the Regional Development Strategy." *Derzhava ta Rehiony. Seriia: Ekonomika ta Pidpryiemnytstvo*, no. 2(128), 2023, pp. 78–81, https://doi.org/10.32782/1814-1161/2023-2-12.
2. Khymych, I. H. "Features of Innovation Activity in Ukraine under War Conditions." *Halytskyi Ekonomichnyi Visnyk*, vol. 84, no. 5, 2023, pp. 142–150, elartu.tntu.edu.ua/handle/lib/43123. Accessed 17 May 2026.
3. Rohozian, Yu. "Innovative Trajectory of Regional Economic Development as a Strategic Factor of Territory Recovery under War Conditions." *Ekonomika ta Suspilstvo*, no. 47, 2023, doi.org/10.32782/2524-0072/2023-47-12.
4. Bodnar, I. R. "Innovative Aspects of Entrepreneurial Activity in the Context of Globalization." *Visnyk LTEU. Ekonomichni Nauky*, no. 76, 2024, pp. 40–50, https://doi.org/10.32782/2522-1205-2024-76-05.
5. Kuzmenko, O. V., and K. O. Kropyvna. "Prospects for the Introduction and Development of Digitalization in the Innovative Society in Ukraine." *Kyivskyi Chasopys Prava*, no. 1, 2021, doi.org/10.32782/klj/2021.1.6.
6. Tymoshenko, N. Yu., and M. A. Shabanova. "Development of Innovation Activity in the Context of Digitalization." *Ekonomika ta Suspilstvo*, no. 29, 2021, doi.org/10.32782/2524-0072/2021-29-30.
7. Shakhno, A. Yu. "State and Problems of Business Development in the Conditions of Innovative Activity." *Visnyk Kryvorizkoho Natsionalnoho Universytetu*, no. 56, 2023, pp. 143–152, journal-knu.com.ua/web/uploads/pdf/Journal%20of%20Kryvyi%20Rih%20National%20University,%20Vol%2021,%20No%201-143-152,%202023.pdf. Accessed 12 May 2026.
8. Liashenko, V. I. *Digital Modernization of Ukraine's Economy as an Opportunity for Breakthrough Development: Monograph*. NAN Ukrainy, Instytut Ekonomiky Promyslovosti, 2017, iie.org.ua/wp-content/uploads/monografiyi/2017/Lyashenko_Vishnevsky_2018.pdf. Accessed 22 May 2026.
9. Kraus, N. M. "Digital Economy: Trends and Prospects of the Avant-Garde Nature of Development." *Efektyvna Ekonomika*, no. 1, 2018, www.economy.nayka.com.ua/?op=1&z=6047**.** Accessed 22 May 2026
10. Tarasiuk, M. V. "Innovations in the Global Digital Sphere: Assessment of Transformations." *Aktualni Problemy Mizhnarodnykh Vidnosyn*, no. 131, 2017, pp. 94–110.
11. Pavlishyna, N. M., and A. V. Kharin. "Innovations in the Era of Digitalization." *Visnyk KhNTU*, no. 1(84), 2023, pp. 179–187, doi.org/10.35546/kntu2078-4481.2023.1.24.
12. State Statistics Service of Ukraine, www.ukrstat.gov.ua**.** Accessed 12 June 2026.

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