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DETERMINATION OF THE IMPACT OF INNOVATIVE DEVELOPMENT INSTRUMENTS ON THE POST-WAR RECOVERY OF THE ECONOMY OF UKRAINE

Wars, by their very nature, lead to a decline in economic activity, and a significant decline in living standards. One of the most powerful tools for economic recovery is an innovative approach to economic development. The object of research is the process of incorporating the tools of innovative development of the economy and its development for the restoration of the economy of Ukraine during the war period. The problems of feeding the use of innovative tools in the period of war are revealed. It is primed that the tools of innovative development will play a viralized role in the new economy, which has become known to the significant shocks of the hour of the war.

When writing the article, the method of theoretical generalization, scientific abstraction was used to systematize innovative tools; financial, economic, statistical, comparative analysis – to study the direct losses of infrastructure destruction as a result of the Russian-Ukrainian war, the rate of change in exports, imports of goods, the level of inflation and migration processes; systematization, structural analysis, generalization – to form an integrated approach to post-war economic recovery.

It is proposed to use state policy instruments in the process of post-war recovery to stimulate innovative projects through tax benefits and the creation of a favorable business environment. It has been proven that innovation is a tool for important international cooperation, which will contribute to the rapid exchange of technologies and knowledge, which is especially important for countries recovering from war. Proposals have been made for an integrated approach to the economic, social and environmental recovery of Ukraine on the basis of innovative development. Measures aimed creating institutional conditions for innovative development of the Ukrainian economy are proposed.

Keywords: innovation activity, investment climate, economic growth, post-war reconstruction, innovation policy, russian aggression.

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1. Introduction

In the modern world, wars and conflicts that cause significant damage to economic infrastructure pose a serious threat to the sustainable development of countries. The post-war recovery period is often accompanied by numerous challenges, such as the destruction of production facilities, a decrease in the level of labor skills, as well as the outflow of capital and investments. In this context, innovation appears not only as an important component of economic growth, but also as a necessary tool for the recovery of economies that have suffered destruction.

Despite this, there are a number of problems that complicate the implementation of innovations in post-war economies. First, insufficient state support for innovation initiatives and the absence of a clear policy in the field of technological development can lead to a low level of investment in scientific research. Second, unregulated markets and a lack of modern technologies often prevent enterprises from adapting to new conditions. Third, a low level of education and insufficient qualifications of personnel can become significant barriers to the implementation of innovation projects.

Thus, the problem is to identify and analyze those factors that can become driving forces for innovative development in the conditions of post-war recovery. It is necessary to develop recommendations for

effective state policy that will promote investment and the development of innovative technologies, as well as identify mechanisms for integrating new solutions into production and social life. Only by solving these problems will countries be able to achieve sustainable economic growth and social progress in the face of new challenges of globalization.

The problematic issues of innovative activity were studied by domestic and foreign scientists, who believe that the recovery of the Ukrainian economy, ensuring its competitiveness and economic growth largely depend on the use of innovative factors [1].

Interesting are the studies based on the current state of innovation activity and forecasting its results in order to restore the innovative development of enterprises [2].

During the Russian-Ukrainian war, research on the impact of globalization challenges on the development of the Ukrainian economy is relevant. It is determined that it is the model of Ukraine's innovation strategy that will allow it to restore its potential [3]. An in-depth analysis of the key problems that hinder the movement towards sustainable innovative development was carried out not only by scientists [4, 5], but also by practitioners [6]. The study substantiates the expediency of state support for the innovation sphere. It has been proved that the use of innovation mechanisms is aimed at stimulating innovation activity

in Ukraine, since they affect the growth of the pace of introduction of new technologies, increasing the efficiency of activities, increasing the quality of products and, accordingly, the competitiveness of both enterprises and economies of the world [7, 8].

Scientists have established that when forming a model of innovation activity, it is advisable to use tools for further innovative development [9]. For the use of innovative tools, scientists have analyzed the identification of problems that hinder the transition to sustainable innovative development, including political instability, lack of regulatory and legislative framework, weak innovation base [10].

Science should act as a guide to the recovery and innovative development of Ukraine after the war. Therefore, scientists have proposed ways of innovative development in the post-war period [11]. However, the questions of what tools will be used to form the vector of innovative economic development remain unresolved.

An important relevance for the post-war recovery of the Ukrainian economy is the awareness of the expediency of implementing innovative activities as the basis for development and promising social changes. Such social changes will ensure the appropriate level of the country's defense capability, a rapid process of infrastructure restoration and will be a powerful factor of economic growth [12].

Foreign scientists focus on the need for environmental innovations of enterprises and internal research work, which will ensure a high level of innovative inclination [13, 14]. It is environmental innovations that will ensure the use of green technologies of enterprises by optimizing the structure of human capital and easing financial constraints [13]. An interesting scientific approach is based on the key factors of the overall competitiveness of economic regions [15] and national economies based on the introduction of information and communication technologies in innovation systems [16]. It is also important to focus on the expediency of strategic planning of innovative development of territories, taking into account the tools of strategic planning on the basis of innovative development [17, 18].

But the issues regarding the economic growth of the Ukrainian economy, taking into account the stimulation of innovative activity in the post-war period, remain unresolved. So, domestic scientists proposed to eliminate the main disparities in development and shortcomings associated with investments in innovative development on the basis of a number of reforms that contributed to the stabilization of the banking system, the financial sector. Such proposals are aimed at increasing the efficiency of the infrastructure of capital and goods markets, the resumption of lending activities of banks and non-bank financial institutions. Scientists focus on Expediency the expansion of non-cash payments, of the list of remote financial transactions, the protection of the rights of consumers of financial services and the strengthening of Competition [19].

Scientists focus on the expediency of expanding the volume of non-cash payments, expanding the list of remote financial transactions, protecting the rights of consumers of financial services and increasing competition.

Established that it is the innovative development of economic and financial processes that allows to ensure the sustainability of the formation of a strategy to ensure a high level of competitiveness of the Ukrainian economy in the period of post-war recovery [20].

Scientific studies have shown that post-war countries often need government intervention to create a favorable environment for innovation. This can include investment in scientific research, infrastructure development, and entrepreneurship. Government support for startups, the creation of technology parks, and the development of digital solutions can all create a strong foundation for economic growth.

One of the main challenges for post-war economies is to create a sustainable development model that will ensure long-term stability and competitiveness. Innovations play a crucial role in this process, as they allow the economy to adapt to new realities by introducing more efficient and environmentally friendly technologies. The transition to "green" energy, the digitalization of business processes, the introduction of artificial intel-

ligence – all these innovations can become the basis for stable economic growth in the post-war period. Therefore, the topic is relevant and timely.

The aim of research is to determine how the introduction of new technologies and modern management practices can contribute to productivity growth and the restoration of economic infrastructure. Therefore, the topic of scientific research is relevant and timely.

2. Materials and Methods

Scientific research has shown that the tools of innovative development include infrastructure, incentives for innovation activity, capital and goods markets, banks and non-bank financial institutions, knowledge and experience, state support for innovation initiatives, international trade, innovative technologies, intellectual property, and the system of tax benefits. Therefore, let's consider it appropriate to determine the impact of innovative development instruments on the post-war economic recovery Ukraine.

When writing the article, the method of theoretical generalization, scientific abstraction was used to systematize innovative tools; financial, economic, statistical, comparative analysis – to study the direct losses of infrastructure destruction as a result of the Russian-Ukrainian war, the rate of change in exports, imports of goods, the level of inflation and migration processes; systematization, structural analysis, generalization – to form an integrated approach to post-war economic recovery.

To study the theoretical foundations of innovation activity, legislative and regulatory acts, official documents of various state and government bodies regulating economic relations on the territory of Ukraine were studied. In order to analyze the dynamics and trends in the use of tools for innovative development of the economy, official documents of the State Statistics Service and official statistical materials were used. In order to summarize theoretical knowledge and practical approbation of the use of innovative development tools, they got acquainted with the materials of scientific conferences and seminars; resources of the global information system Internet; scientific works of Ukrainian and foreign researchers in the field of economic theory and practice. Economic calculations are made using modern methods and computer technologies for processing statistical materials.

3. Results and Discussion

Russia's full-scale war against Ukraine has dealt a devastating blow to the Ukrainian economy. In order to effectively plan for recovery and development, it is necessary to analyze in detail the scale of the damage and the consequences of the war for different sectors of the economy.

Among the main consequences of the war for the Ukrainian economy, it is worth noting:

1. *Physical destruction of infrastructure*: the total amount of direct damage to residential and non-residential real estate, other infrastructure, vehicles and inventories as of the beginning of 2024 exceeded 157 billion USD (Table 1).

Table 1

Direct damage from infrastructure destruction as a result of the Russian-Ukrainian war by property type, 01.01.2024

Property type	Estimated direct losses, billion USD	Fraction, %
1	2	3
Residential buildings	58.9	37.5
Infrastructure	36.8	23.4
Enterprise assets, industry	13.1	8.3
Agriculture and land resources	10.3	6.5
Energy	9	5.7
Education	6.8	4.3

Continuation of Table 1

1	2	3
Forest fund	4.5	2.9
Housing and utilities	4.5	2.9
Transportation	3.1	2
Healthcare	3.1	2
Culture, tourism, sports	3.1	2
Trade	2.6	1.6
Administrative buildings	0.5	0.3
Digital infrastructure	0.5	0.3
Social sphere	0.2	0.1
Financial sector	0.04	0.01
Together	157.2	100

Note: the table is based on data from Kyiv School of Economics [21]

2. *Loss of agricultural land:* the occupiers mine fields, destroy agricultural machinery and storage facilities. This leads to crop losses and a decrease in agricultural exports.

3. *Decrease in production and exports:* Due to the destruction of production facilities, logistical problems and energy shortages, the production of industrial products and agricultural products has significantly decreased. This led to a decrease in exports and a deterioration in the trade balance. For example, in 2022, exports of goods amounted to 44,148.8 million USD, or 64.9 % compared to 2021, imports – 55,273.5 million USD, or 75.9%. The negative balance amounted to 11,124.7 million USD (Fig. 1, 2).

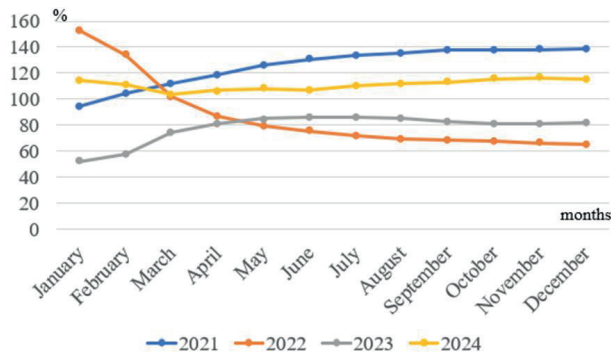


Fig. 1. Growth (decrease) rates of exports of goods during 2021–2024 (in % to the corresponding period of the previous year) [22, 23]

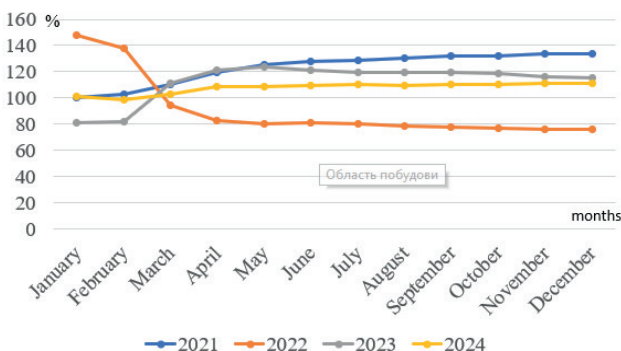


Fig. 2. Growth (decrease) rates of imports of goods during 2021–2024 (in % to the corresponding period of the previous year) [22, 23]

4. *Rising unemployment:* the war led to mass layoffs of workers, especially in temporarily occupied territories and regions affected by hostilities.

5. *Decline in consumer spending:* falling household incomes and rising prices for goods and services have led to a decline in consumer spending.

6. *Inflation:* The war caused significant increases in the prices of energy, food, and other essential goods (Fig. 3).

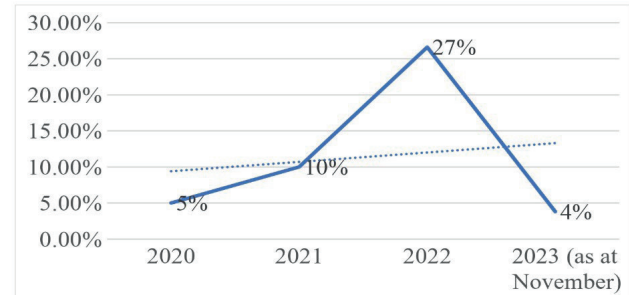


Fig. 3. Dynamics of the inflation rate in Ukraine during 2020–2023 [24]

7. *Mass migration:* Millions of Ukrainians were forced to flee their homes due to fighting. This led to demographic changes and loss of human capital.

However, despite all the trials that have befallen the Ukrainian people, we believe in our victory. And today it is necessary to think about what Ukraine will be like after the war. Innovation will certainly be one of the key tools for the restoration and development of our Motherland. Use of innovative tools allowing not only to rebuild what was destroyed, but also to create a new, prosperous economy.

Innovation offers a wide range of advantages that allow to overcome the consequences of the war and ensure sustainable economic growth:

- creating new markets;
- productivity improvement;
- increasing competitiveness;
- creation of new jobs;
- improving the quality of life;
- increasing export potential [25].

Rebuilding Ukraine requires a comprehensive approach that encompasses not only economic but also social and environmental aspects. Therefore, innovations must be aimed at solving a wide range of problems. They must also take into account the local characteristics and potential of each region. To effectively rebuild Ukraine after the war, it is necessary to clearly identify which types of innovations can contribute to achieving specific goals:

1. For the rapid restoration of infrastructure, construction innovations would be quite appropriate. For example, something like modular structures – developments of Japan, which is known as a country constantly facing earthquakes and other natural disasters. The Japanese actively use modular structures for the rapid construction of housing and public buildings. Such structures can be manufactured in a factory and quickly assembled on site, which allows to reduce construction times and reduce costs;

2. Innovations in agriculture will be necessary, given the proportion of mined and destroyed croplands. For example, the implementation of precision farming systems, the use of drones for field monitoring, and the development of biotechnology to create climate-resistant crop varieties will be relevant;

3. Innovation in the energy sector is a necessary step to ensure energy security, economic growth and environmental sustainability of Ukraine. Denmark is one of the world leaders in renewable energy, especially wind power. This Scandinavian country has been able to transform the energy sector, reducing its dependence on fossil fuels and becoming an example for other countries. Danish companies have developed large offshore wind farms that can produce large amounts

of electricity and are economical [26]. The development of wind power will allow Ukraine to reduce its dependence on imported gas and oil.

Innovation is the driving force behind economic growth and development of any country. However, the development of innovative technologies and their implementation in the economy is a complex and risky process that often requires significant investments of time and resources. That is why the state plays a key role in stimulating innovation activity.

The possibility of state support is one of the key elements in the development of innovation. Many companies, especially in the early stages of their existence, do not have sufficient resources to implement advanced technologies or implement innovative ideas. In addition, innovation activities are often accompanied by a high level of risk, and private investors are not always ready to invest large amounts of money in such projects due to the uncertainty of their future success. In this context, the state can act as a catalyst, providing companies with financial support, providing favorable regulatory conditions, creating infrastructure for the development of innovations and contributing to attracting international experience and investment.

Reducing the administrative burden on business is also one of the key factors stimulating economic growth and innovation. Transferring administrative services to the online mode is one of the most important steps for this. This will not only reduce bureaucracy, but also increase business trust in the state.

Protection of intellectual property in Ukraine is an integral part of the development of an innovative economy. Its effectiveness directly affects the attractiveness of the country for investment, stimulates the development of new technologies and contributes to economic growth. The state plays a key role in ensuring such protection. It creates the necessary legal framework, ensures the functioning of institutions dealing with intellectual property issues, conducts information campaigns and cooperates with international organizations.

The following tasks are particularly relevant for Ukraine:

- improving legislation in accordance with international standards;
- simplification of rights registration procedures;
- increased liability for violations;
- creation of specialized courts and development of electronic services.

It is also important to raise public and business awareness of the importance of protecting intellectual property.

Venture capital support is a crucial element that contributes to the development of the innovation ecosystem in Ukraine. It involves a set of measures aimed at stimulating investments in startups and young technology companies. To effectively support venture capital in Ukraine, it is necessary to take a set of measures aimed at creating a favorable investment climate and stimulating innovations. This involves both direct support for startups and the creation of systemic conditions for their development.

First, it is important to create an effective system of state support. This may include the creation of special venture financing funds, providing tax benefits to investors, developing state guarantee programs to reduce investment risks. It is also worth considering the possibility of creating public-private partnerships to attract additional investments in the venture sector.

Second, it is necessary to develop infrastructure to support startups. This involves the creation of a network of business incubators and accelerators that will provide startups with mentorship, office space, and access to experts. It is also important to develop a network of business angels and venture funds that can invest in Ukrainian startups at the early stages of development.

Thirdly, it is important to develop education and science. Creating powerful scientific base and training highly qualified personnel is the key to the successful development of an innovative economy.

A striking example of successful venture capital support is the United States strategy. The United States has been a world leader in venture capital financing for many decades. This success is largely due to a system of state support that creates a favorable environment for innovation and the growth of startups.

One of the most important tools is the system of tax benefits for investors in venture funds. A common phenomenon in the United States is tax credits for research and development (R&D tax credits). These credits allow companies to deduct part of their research and development costs from their tax liability. This encourages companies to invest in innovation and cooperate with universities and scientific institutions. Venture fund investors can also deduct capital losses from other income, which reduces their overall tax burden [27, 28].

The proposed measures are of practical importance. Given the importance of post-war recovery, it is possible to believe that an integrated approach to the introduction of innovations as a tool for post-war recovery will cover not only economic, but also social and environmental spheres. The transition to new technological solutions in the field of energy, transport, information technology and the agricultural sector in the post-war period will significantly increase production efficiency, reduce dependence on imports and create high-paying jobs.

The use of an integrated approach to the economic, social and environmental recovery of Ukraine on the basis of innovative development has limitations in the study. To introduce innovative tools, it is necessary to invest in research and development, the latest technologies, as well as the modernization of production processes, which can become the basis for rapid economic recovery and strengthening the competitive position of the state in the international arena. Therefore, it is advisable to conduct further scientific research in the direction of investments in innovative development.

Taking into account the globalization of world processes and the realities of the Russian-Ukrainian war, let's consider it appropriate to focus on the above-mentioned tools of innovative development and make a forecast of their impact on trends in changes in export-import activities in Ukraine (Fig. 4, Fig. 5).

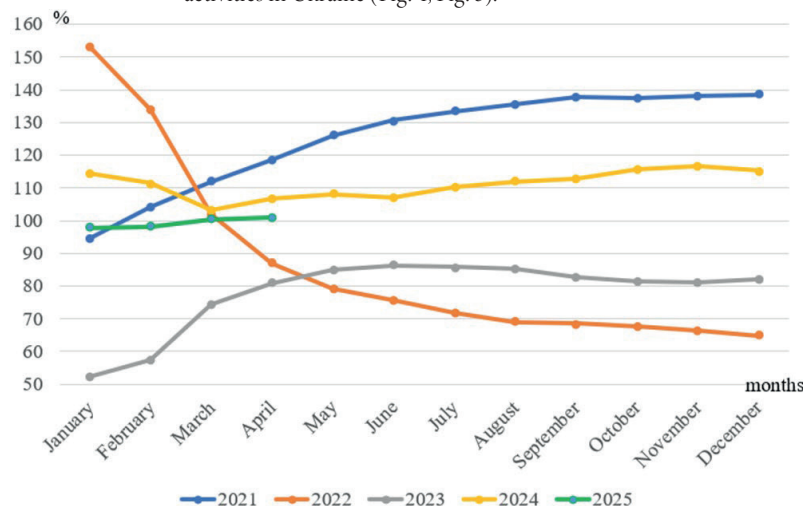


Fig. 4. Forecast growth (decrease) rates of exports of goods for January-April 2025 (in % to the corresponding period of the previous year) [22, 23]

Using the methods of correlation-regression analysis based on the presented statistical data for 2021–2024, regression models were built, forecasted data on exports and imports of Ukraine for January–April 2025 and the growth (decrease) rates of exports and imports of marketable products were calculated (Fig. 4, Fig. 5).

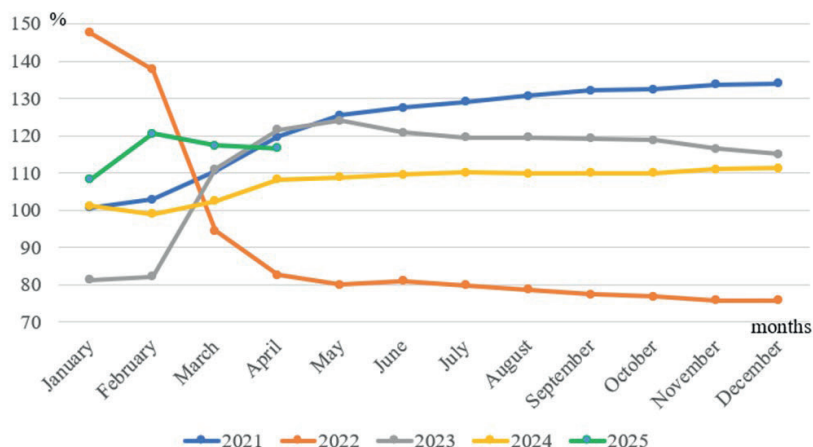


Fig. 5. Forecast growth (decrease) rates of imports of goods for January-April 2025 (in % to the corresponding period of the previous year) [22, 23]

The forecast indicators of export-import activities show a positive dynamics of export activity compared to 2022, 2023. But the negative impact of the destruction of production infrastructure, the shortage of highly qualified personnel will lead to a decrease in the growth rate of export activities. And only the use of innovation potential will ensure the growth of export activity in the following periods of 2025.

The forecast indicators of import activity reflect the growth of imports in January-March 2025 compared to the same period in 2024 and only in April 2025. Next, it is possible to observe a decrease compared to April 2024.

Therefore, the introduction of innovative development tools will ensure, in the strategic perspective, a positive foreign economic balance, as evidenced by the forecast (Fig. 4, Fig. 5). Such shifts will have a positive impact on the level of national security of Ukraine.

4. Conclusions

Studies have shown that direct losses during the Russian-Ukrainian war from: destruction of infrastructure amounted to 36.8 billion USD or 23.4 %, residential buildings – 58.9 billion USD or 37.5 %. Losses are also very significant for industrial enterprises, asset losses amounted to 13.1 billion USD 8.3 %. The losses of the agro-industrial complex and land resources are quite significant – 10.3 billion USD or 6.5 %, energy – 9 billion USD or 5.7 %, education – 6.8 billion USD or 4.3 %.

Therefore, in the Russian-Ukrainian war, Russia uses all the tools to destroy the innovative development of the Ukrainian economy. Determining the impact of these tools allows to take them into account in the post-war reconstruction of the Ukrainian economy. The introduction of innovative development tools, the impact of which is studied in the scientific article, allows not only to take into account their impact, but also to develop measures to use incentives to intensify innovative development.

Scientific research has shown that 2022–2023 were difficult for the economy of Ukraine. There is an explanation for this situation, since a very terrible bloody war for Ukraine has begun and is underway. Therefore, scientific research and statistics show that only the intensification of innovation activity and the introduction of innovative development mechanisms in 2024 allowed Ukraine to take its rightful place among the European developed countries of the world. There are many problems and factors that affect innovative development, so let's consider it appropriate to summarize the scientific research.

In the context of the Russian-Ukrainian war, Ukraine's economy is in dire need of a national security strategy. State management of national security is carried out under strict resource constraints. Therefore, it is possible to believe that the proposed comprehensive approach

to the recovery of the economy of Ukraine on the basis of the use of innovative tools will allow taking into account the characteristics and potential of the regions of the state in order to achieve specific goals and implement the tasks set.

Therefore, innovation, as a driving force of economic growth after the war, acquires particular urgency and significance. It is not just a tool for recovery, but a strategic course for building a new, more sustainable and competitive economy. The war became a catalyst for accelerating technological transformations, which requires the state, business and society as a whole to actively adapt to new realities.

Innovations in the post-war period should be aimed at solving urgent problems, such as restoring infrastructure, developing new industries, ensuring energy security and improving the quality of life of the population. They should be based on scientific research, technological developments and creative ideas.

The state, for its part, should create a favorable environment for innovation, ensuring stability, predictability and transparency of the rules of the game. This involves the introduction of tax breaks for innovative companies, simplifying business registration procedures, developing infrastructure for scientific research and development, as well as supporting university science.

Business should take an active role in the innovation process. Companies should invest in research and development, cooperate with scientific institutions and universities, and introduce new technologies into production. Society as a whole should support innovation. This means raising the level of education, forming a culture of entrepreneurship and readiness for change.

Innovations are not only technological innovations, but also new approaches to business organization, personnel management, and interaction with customers. They allow to create new products and services, enter new markets, and increase the competitiveness of the Ukrainian economy.

Undoubtedly, the implementation of innovations is a long and complex process that requires significant investments and efforts. However, this is the only way to sustainable economic growth and increase the well-being of Ukrainians.

Conflict of interest

The authors declare that they have no conflict of interest in relation to this study, including financial, personal, authorship or other, which could affect the study and its results presented in this article.

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Data availability

The manuscript has no associated data.

Use of artificial intelligence

The authors confirm that they did not use artificial intelligence technologies when creating the presented work.

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