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FEATURES OF INNOVATIVE DEVELOPMENT OF INDUSTRIAL ENTERPRISES OF UKRAINE IN WARTIME CONDITIONS

ABSTRACT

The paper reveals the actual aspects of innovative development of industrial enterprises in Ukraine, analyses the state of implementation of innovations in enterprises and the dynamics of research and development costs under wartime conditions. The article considers the issues of adaptation of business entities to the challenges of today, such as increased uncertainty and risks, activities with limited resources and disruption of logistics routes for the supply of raw materials and sales of products. The article reveals the importance of innovation in improving the efficiency of enterprises by enabling the introduction of digitalisation of production processes, expanding the existing options for using alternative energy sources, using modern management approaches, etc. Recommendations are made to strengthen the innovative potential of Ukrainian industrial enterprises to improve their competitiveness in the domestic and international markets.

Key words: innovative development, industrial enterprises, innovation, innovative potential, investment.

JEL Classification: M 11, O 32, O 33.

1. INTRODUCTION

The development of innovation processes in industrial enterprises is a key factor in ensuring the competitiveness of the economy. In the context of martial law in Ukraine, enterprises are facing growing uncertainty, reduced investment, and destruction of supply chains. At the same time, modern challenges stimulate the adaptation of production processes, the introduction of digital technologies and the use of alternative energy sources. The study of the innovative development issue in difficult economic conditions is relevant, as it contributes to the formation of effective strategies for the recovery and development of the industrial sector.

2. STATE OF KNOWLEDGE

Scientific research shows that innovative industrial development is a key factor in economic growth (Say, 2024). In particular, Ukraine demonstrates positive dynamics in the Global Innovation Index, despite the impact of military operations (Global Innovation Index, 2023). Some authors emphasise the importance of digitalisation of production processes as a tool for increasing efficiency (Andros, 2019). Other researchers emphasise the need to attract investment in R&D, which will contribute to the sustainable development of industrial enterprises (Yelisieiev, 2017). However, there is still a lack of a comprehensive analysis of the impact of martial law on innovation processes in industry, which needs additional research.

3. MATERIAL AND METHOD

The study uses an analysis of statistical data on the innovation activities of Ukrainian industrial enterprises for 2022–2024, including data from the State Statistics Service of Ukraine, the Global Innovation Index, and relevant international organisations. The methodological basis is economic and statistical analysis, which allows to assess the dynamics of research and development (R&D) expenditures, as well as the level of innovation. The method of comparative analysis is used to identify trends in the innovation policy of Ukraine in comparison with other countries. The scope of application of the obtained results is strategic planning of innovative development of enterprises and formulation of recommendations on the policy of state support for the innovation activity.

4. RESULTS AND DISCUSSIONS

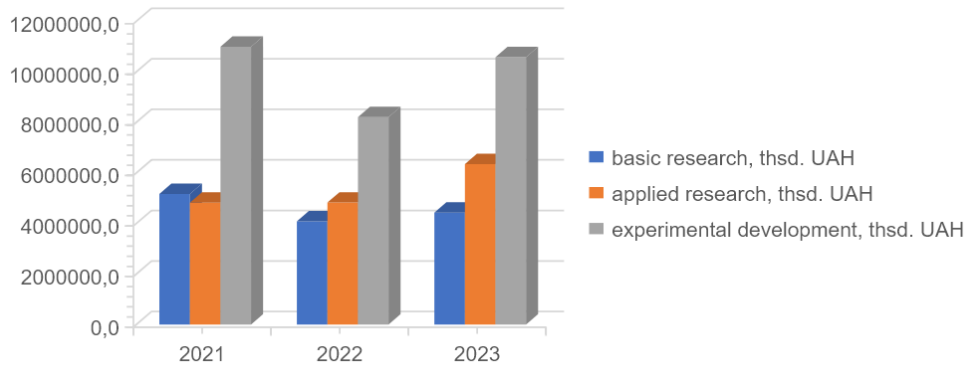
The article reveals topical aspects of innovative development of industrial enterprises in Ukraine, analyses the state of implementation of innovations in enterprises and the dynamics of research and development costs in wartime. The article considers the issues of adaptation of business entities to the challenges of today, such as increased uncertainty and risks, activities in conditions of limited resources and disruption of logistics routes for the supply of raw materials and sales of products. The article reveals the importance of innovations in improving the efficiency of enterprises by enabling the introduction of innovative development.

Industrial enterprises provide the basis for the development of the country's economy, support human capital and are one of the main sources of innovation processes. On the other hand, innovative development helps Ukrainian enterprises

to maintain a competitive position in the market and withstand internal and external threats, including wartime, in the period 2022–2024. The realities of domestic industrial enterprises require adaptation to new business conditions and the search for effective ways of development, including innovation.

The Ukrainian economy has significant innovation potential and is successfully integrating into global innovation processes. Thus, according to the Global Innovation Index for 2021, Ukraine ranked 49th among 132 economies, which shows a positive trend compared to previous years, with the highest indicators of human capital quality and one of the lowest indicators of infrastructure and institutional development. In 2023, Ukraine ranked 55th among 132 economies in the world according to the same rating, rising two places compared to 2022 and becoming one of the top 3 most innovative economies among lower-middle-income countries. Once again, the highest scores were given to human capital development, domestic education, and information and communication technologies, while the lowest scores were given to the institutional environment and infrastructure. According to Global Innovation Index 2024, Ukraine ranked 60th in the same ranking, but it should be noted that our country produces more innovative products compared to investments in research and development in relation to GDP.

According to the State Statistics Service of Ukraine, as shown in Figure 1, research and development expenditures in 2022–2023 decreased compared to pre-war levels. Intramural R&D expenditures in 2023 amounted to only 81.6% of the same figure for the previous year. In the year 2023, the total amount of funds invested in R&D exceeded the 2021 figure by 1.8%.



Source: Calculations using data from the State Statistics Service of Ukraine.

Figure 1. Intramural R&D expenditure by R&D type by economic activity in 2021–2023.

In terms of the distribution of R&D expenditures by source of funding, the most important investors remain the public sector organisations (their share increased from 46% in 2021 to 67% in 2022 and fell again to 43% in 2023) and

companies' own funds (their share in the funding structure increased from 10% in 2022 to 28% in 2023). The share of funds from foreign sources and funds from the business sector organisations varies from 20% to 12%.

The number of organisations engaged in research and development experienced a fast decline: in 2022, their total number decreased by 11%, and in 2023 by another 3.5%, according to information actually provided in the reports of enterprises. The decrease was mainly due to the business sector (by 20.4% and 9.1%, respectively) and the public sector (by 29 units in 2022 and another 16 units in 2023).

An analysis of the state of innovation in Ukrainian industrial enterprises in 2022–2024 shows mixed trends:

– investments in innovations decreased due to hostilities and their impact on business results, in particular, resources are being redistributed to cover basic needs and functioning in the economic crisis;
– the difficult conditions and the need to respond to the relevant challenges led to the search for non-standard solutions and the introduction of innovative approaches. At the same time, in order to maintain efficiency and reduce dependence on human resources (which is quite relevant in the context of a full-scale invasion), we can notice a trend towards the introduction of digital technologies and process automation amid a reduction in overall investment.

The development of innovation infrastructure is understandably constrained by the hostilities, but remains an important aspect of supporting innovation through the activities of technology parks, business incubators and technology transfer centres. The latter allow to obtain innovative products by combining human resources, policies and innovative potential on a commercial basis. Currently, there are two centres in Ukraine – the Ukrainian Integrated Technology Transfer System (UTTN) and the National Technology Transfer Network (NTTN). The creation of appropriate conditions for the development of small innovative enterprises and start-ups also contributes to the innovation potential of industrial enterprises. As adequate funding of innovative research and development is the most important factor for further development, investment in innovation should remain a priority to ensure the long-term development of industry, despite the difficult economic environment.

Under martial law, the innovative development of Ukraine's industrial enterprises is of particular importance, as it ensures economic sustainability and contributes to the country's fast recovery. Its characteristic aspects include:

1) increased degradation of innovation ecosystems, reduced innovation activity in high-tech industrial sectors, especially in small and medium-sized enterprises. According to "*State of innovation in Ukraine during the war"*, 42% of enterprises have reduced spending on innovation, and for 31%, innovation is not relevant at all;

2) emphasis on the development of defence technologies – in recent years, the defence industry has intensified in Ukraine, with the production of drones in high-tech start-ups (since the beginning of the full-scale invasion in 2022, more than 200 new munitions companies have emerged, producing a wide range of weapons, especially drones);
3) negative impact on regional development and the need for state support – the innovative development of the regions has weakened, highlighting the systemic problems of technological lag. According to the research by to "*State of innovation in Ukraine during the war"*, 73% of enterprises need special long-term programmes to support the industry, and 41% need fiscal incentives to boost innovation;
4) the requirement for producers to adapt to new business conditions – enterprises have to adapt their innovation development strategies to wartime challenges, especially in the chemical, engineering and metallurgical industries, and re-profile production for defence technologies whenever possible in cooperation with international partners. According to this study, among the surveyed businesses, 77% do not consider innovation to be relevant, while the remaining 23% (large enterprises, exporters of goods and services) consider innovation projects to be promising. The same companies accounted for 19% of the increase in research and development expenditures during martial law, which indicates a positive trend.

The main challenges of industrial enterprises in the context of war also include increased uncertainty, increased risks, limited resources, disruption of logistics links (routes), etc. The development of new anti-crisis strategies requires managing uncertainty and risks by diversifying suppliers to safer regions and markets, including international markets; insuring risks, creating financial reserves and strengthening financial control; introducing flexible production planning (including optimisation of production processes, automation and digitalisation of management), etc.

Operating in a resource-constrained environment requires a transition to energy-saving and alternative energy sources, use of solar and wind energy, and autonomous power sources (generators, battery systems). Cooperation and outsourcing, such as the transfer of certain functions to other companies, will help reduce costs and increase efficiency in the face of resource constraints. In terms of human resources, it is worth introducing flexible work schedules, remote employment, and staff retraining to ensure the versatility of employees.

In terms of sales, it is advisable to expand both traditional local markets (establishing regional offices) and e-commerce platforms (marketplaces, online sales, remote ordering) and enter international markets through cooperation with international companies, switching to rail and road transport instead of sea transport, etc.

The introduction of innovations in industrial enterprises today is inextricably linked to digitalisation. In this context, digitalisation is understood as the use of modern digital technologies to search for, create, process and exchange information, and conduct financial transactions between network participants. The effectiveness of the innovation process directly depends on the organisation of communications between them, as the digitalisation process is accompanied by a combination of physical and digital resources in the production sector. Thus, digitalisation, or the introduction of digital technologies into all aspects of an enterprise's activities, makes it possible to optimise processes, reduce costs and increase productivity, which improves performance.

The prospect of companies switching to alternative energy sources, which reduces dependence on traditional energy resources and promotes environmental sustainability, is unavoidable. This is also in line with the goals of sustainable development and Ukraine's European integration strategy. Expanding the existing possibilities for using alternative energy sources contributes to the increase of the economic effect of their use and the relative functioning autonomy in terms of energy dependence.

5. CONCLUSIONS

Innovative approaches to management (introduction of new forms and methods of business process management) allow enterprises to quickly adapt to market changes and increase the efficiency of their operations. The use of innovative technologies in management includes the introduction of flexible organisational structures, the development of an innovative culture and the use of modern information systems to support management decisions.

Thus, the innovative development of Ukrainian industrial enterprises in wartime is characterised by significant challenges, such as a decline in demand for innovation, a pessimistic scenario for infrastructure development, a reduction in foreign direct investment, etc. Comprehensive government support is required (*e.g.*, long-term sectoral development programmes, appropriate tax policy), adaptation of business strategies, and active involvement in defence and recovery projects to ensure resilience and economic recovery. Businesses that are able to adapt and innovate have a higher chance of successful operation and development in the post-crisis period. Strengthening the innovation activities of business entities and responding quickly to current challenges require a comprehensive approach that includes financial sustainability, technological flexibility, and innovative approaches to production and logistics. The use of new digital technologies, strategic planning and efficient resource management help industrial enterprises remain competitive even in times of crisis.

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