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CREATION OF INNOVATION AND INDUSTRIAL PARKS – THE BASIS OF ECONOMIC DEVELOPMENT OF INDUSTRIAL REGIONS

СТВОРЕННЯ ІННОВАЦІЙНО-ІНДУСТРІАЛЬНИХ ПАРКІВ – ОСНОВА ЕКОНОМІЧНОГО РОЗВИТКУ ПРОМИСЛОВИХ РЕГІОНІВ

The article reveals the relevance of the problem of creating and organizing the activities of innovation and industrial parks as a mechanism for the economic development of industrial regions, activating the investment activity of the state with the aim of its economic growth. The world experience of creating and operating industrial parks is considered. The importance of industrial parks in modern economic conditions is highlighted. The prerequisites and main directions of creating industrial parks in Ukraine are revealed. Possible financing conditions and directions of state support for industrial parks are analyzed. Specific examples of their creation in individual regions of Ukraine are considered, the advantages and disadvantages of special investment regimes are determined. Proposals are provided, the implementation of which will contribute to increasing the efficiency of the functioning of industrial parks and ensuring their positive impact on the development of the economy of industrial regions and the national economy.

It is shown that it is regional innovation and industrial parks with cluster-industry organization of production complexes in key sectors of the economy that can become energizers of the recovery and growth of the Ukrainian economy. The creation of such technological clusters requires a comprehensive approach, including strengthening ties between scientific institutions, industrial enterprises, business and government bodies.

To ensure the innovative development of the Dnieper region and intensify the practical implementation of scientific inventions in the form of industrial samples, it is proposed to create a High-Tech Park on the basis of the Dnipro State Technical University - "Dnipro Scientific and Industrial Park of Applied Research and Innovation Projects "KREMIN" with a special tax and legal regime that ensures the creation of favorable conditions for the successful development of business in the relevant sectors of the economy. According to the results of the analysis, it was established that for

the effective socio-economic development of the regions and the country, one of the main mechanisms for the accelerated recovery of the Ukrainian economy should be an effective state program for the development of regional innovation and industrial parks with an industry cluster organization, taking into account the specifics of specific territories.

Key words: *innovation parks, cluster approach, industrial cluster, industrial regions.*

У статті розкрито актуальність проблеми створення й організації діяльності інноваційно-індустріальних парків в якості механізму економічного розвитку промислових регіонів, активізації інвестиційної діяльності держави з метою її економічного зростання. Розглянуто світовий досвід створення й функціонування індустріальних парків. Висвітлено значення індустріальних парків у сучасних умовах господарювання. Розкрито передумови та основні напрямки створення індустріальних парків в Україні. Проаналізовано можливі умови фінансування та напрямки державної підтримки індустріальних парків. Розглянуто конкретні приклади їх створення в окремих регіонах України, визначено переваги й недоліки спеціальних режимів інвестування. Надані пропозиції, реалізація яких сприятиме підвищенню ефективності функціонування індустріальних парків та забезпечення їх позитивного впливу на розвиток економіки промислових регіонів та національної економіки.

Показано, що саме регіональні інноваційно-індустріальні парки з кластерно-галузевою організацією виробничих комплексів у ключових секторах економіки можуть стати енерджайзерами відновлення і зростання української економіки. Створення таких технологічних кластерів вимагає комплексного підходу включаючи зміцнення зв'язків між науковими установами, промисловими підприємствами, бізнесом та органами влади.

Для забезпечення інноваційного розвитку Придніпровського регіону та інтенсифікації практичного впровадження наукових винаходів у вигляді промислових зразків запропоновано створити на базі Дніпровського державного технічного університету Парк високих технологій – "Придніпровський науково-індустріальний парк прикладних досліджень та інноваційних проектів "КРЕМІНЬ" зі спеціальним податково-правовим режимом, який забезпечує створення сприятливих умов для успішного розвитку бізнесу у відповідних галузях економіки. За результатами аналізу встановлено, що для ефективного соціально-економічного розвитку регіонів і країни в цілому одним із основних механізмів прискореного підйому економіки України має стати дієва державна програма розвитку регіональних інноваційно-індустріальних парків із галузевою кластерною організацією з урахуванням специфіки конкретних територій.

Ключові слова: *інноваційні парки, кластерний підхід, промисловий кластер, промислові регіони.*

JEL Classification*: L16, M11, O14*

Problem statemen. One of the urgent problems of the Ukrainian economy is the search for effective solutions for its modernization and restoration to ensure the sustainable development of the country. A systematic analysis of possible ways to restore industrial potential and increase the competitiveness of the domestic economy shows that one of the effective tools for solving these problems is the cluster form of organization of production industries [1]. In the conditions of constantly growing globalization and competition, the creation of industry clusters in Ukraine can become an effective mechanism for the restoration and innovative development of the country's economy [2]. In this regard, determining promising directions and conditions for the formation of industry innovation and industrial parks and improving methods for modeling and optimizing the cluster organization of regional industry is an urgently applied problem.

Analysis of recent research and publications. At the current stage of economic development of several countries around the world, one of the effective factors of its success is the creation of innovation and industrial parks with clusters of territorial and production complexes in key sectors of the economy. Therefore, several scientific publications are devoted to the problems of analyzing world experience and studying the conditions for the functioning of such formations to restore and ensure

sustainable development of the domestic economy.

Thus, the dynamics of the development of the concept of "industrial agglomeration" and the construction of a network of industrial parks on its basis in European countries are given in the work [3]. The advantages of the functioning of industrial parks for regional industrial and economic development are established. The results of the analysis of the functioning of innovation parks (industrial, technological and scientific), as well as the prospects for their further development in Ukraine and the world are highlighted in the work [4]. The main financial and legal aspects of innovation activity characteristic of scientific and technological parks in Ukraine are analyzed.

The work [5] is devoted to the problems of generalizing world experience in the development of industrial parks in Great Britain, Germany, Turkey, the USA, and China and identifying the advantages of their operation for the economy of Ukraine. It has been established that an industrial park unites enterprises of various fields of activity to produce innovative, environmentally friendly, highly profitable, competitive products both on the domestic and world markets. It has been revealed that in most countries the motivator for the creation of industrial parks is state programs of assistance and provision of tax preferences.

The features of the development of the innovation environment of the national economy of South Korea and China are considered in the work [6]. It is shown that in these countries' innovation parks are one of the effective mechanisms for attracting investments and ensure the production of the majority of export products.

The prerequisites and main stages of the creation of industrial parks in Ukraine are given in the work [7]. The leading and competitive features of industrial parks, conditions and benefits of investment for each project participant are determined. The legislative framework, possible financing conditions and areas of state support for industrial parks are analyzed. Specific examples of their creation in individual regions of Ukraine are considered, and the advantages and disadvantages of special investment regimes are identified.

The issues of the priority of the program strategy for the creation of industrial parks in different regions of Ukraine as a prerequisite for balanced development and the state policy of the effectiveness of benefits and preferences are considered in the work [8]. It is noted that the creation of industrial parks is one of the effective factors for the development of territorial communities.

The experience of stimulating the development of industrial parks in the border regions of Poland is considered in the work [9]. It is noted that when receiving state investments, the economic development of the region of the park's activity and active cooperation with the national research base should be ensured. The importance of industrial parks for the strategic development of territories is emphasized in the work [10]. Based on the Polish experience, the main features of the creation of industrial parks to ensure the sustainable development of territories, in particular rural ones, are highlighted. A model of the functioning of the Lublin Science and Technology Park is presented.

In [11], based on the analysis of the state of development of industrial and technological parks in Poland, the Czech Republic and other countries, it is noted that the creation of such parks is an effective mechanism for the development of organizational networks with the participation of industrial enterprises. It was determined that the leaders in the application of such an approach in Ukraine are Kyiv and Lviv regions.

Substantiation of the directions of further development of economic clusters and the conditions for implementing a cluster approach in the economy of Ukraine for the revival of production, destroyed infrastructure, logistics networks, the national energy system, as well as the development of human capital and regional innovation ecosystems are given in [12]. Using the example of the Zaporizhzhia cluster "IAM", the main features of a modern economic cluster are determined.

In works [13, 14] it is shown that industrial parks are one of the most effective mechanisms for attracting investments and restoring the economic potential of Ukraine. In work [15], it is stated that the development of industrial regions is the basis for the restoration and competitiveness of the domestic economy.

Based on the analysis of the conducted research on the topic of industrial parks, it should be noted that several aspects of the practical implementation of projects for the development of industrial parks and their transformation into scientific and innovative ones require further development.

Formulation of the study purpose. The purpose of this study is to analyze modern approaches to using the infrastructure of industrial parks as an effective mechanism for restoring economic activity, attracting investments for the sustainable development of regions, and identifying promising areas for the functioning of industrial industry clusters.

Presentation of basic research material. Currently, Ukraine finds itself in an extraordinary situation, where existing risks and threats stimulate the introduction of innovative approaches for the accelerated restoration of scientific, industrial and economic potential. The implementation of such a qualitative transition is possible based on the use of proven mechanisms for overcoming similar crisis situations from the experience of developed countries. Thus, the post-war recovery and ensuring accelerated rates of long-term economic growth of Japan and West Germany occurred due to:

– creation of new high-tech enterprises instead of pre-war ones;

– introduction of innovative technologies at enterprises, which allowed to produce highly competitive products;

– development and production of new consumer products;

– state policy of promoting the development of private entrepreneurship;

– state stimulation of high-tech industries through bonuses for companies that export products with high added value, in particular, machine-building, rather than raw materials.

It should be noted that an important role in the recovery of the economies of these countries was played by an international project of financial support for the economies of these countries, known as the “Marshall Plan” [16]. At the same time, the significance of the implementation of the “Marshall Plan” for the recovery of the economy largely consisted in determining the priority areas of industrial development.

The cluster form of industrial organization is also successfully used in modern Germany. The country has more than 200 industrial parks - from the automotive industry to the high-tech sector [4]. The most famous examples of successful cluster associations in Germany:

– the “Automotive Cluster” cluster of car manufacturers, whose task is to create a European center for high-tech products of the automotive industry;

– the “Silicon Saxony” cluster of manufacturers of micro- and nanoelectronics, software, “smart” systems and chip manufacturers in Saxony;

– the “BioEconomy” cluster in the field of bioeconomy and plant sources in Saxony-Anhalt.

Of particular importance is the study of China's experience in applying the mechanisms of free economic zones and industrial clusters, which have launched the transformation processes of the Chinese economy. The term cluster was first introduced in mathematics and means a physically close location within the borders of one region of logically related objects. Accordingly, an industry cluster is an associated territorial-industry association of technologically interconnected business entities and service systems: financial, scientific and technical, production, information and social infrastructure of the region. During 1990-2015, 54 special zones for the development of high-tech industries were created in China, in which 28,388 firms with 3.49 million employees and a sales level of 1 trillion yuan/year operated. The Ministry of Science and Technology and regional authorities were responsible for the creation and development of clusters in these zones. This approach has played a major role in China's GDP growth, job creation, and investment attraction. These entities account for a third of China's high-tech exports. They employ more than half of China's high-tech firms, developers, and research institutions. According to the concept of the China Institute of Industrial Economics, one of the main directions of modern economic development is the transformation of industrial clusters into innovative ones [6].

Analysis of current trends in economic development shows that the cluster approach is an effective mechanism for developing an innovative competitive economy. Therefore, it is regional innovation and industrial clusters of sectoral territorial and production complexes in key sectors of the economy that can become energizers of the recovery and growth of the Ukrainian economy. The

creation of such technological clusters requires an integrated approach, including strengthening ties between scientific institutions, industrial enterprises, business and government bodies. For innovative economic development of industrial regions, it is first necessary to formulate the principles of creating modern effective research centers focused on applied research. One of the most effective examples is the Stanford Industrial Park created based on Stanford University, which became the framework for the Californian technological cluster, known as "Silicon Valley" [4]. Encouraging teachers and students to commercialize the results of their research and increase their value through the introduction of competitive implementation mechanisms was essential to the success of this project.

In modern conditions, one of the effective indicators of the level of economic development of countries in the world is the global competitiveness index. Thus, according to the IMD report "The IMD World Competitiveness Yearbook. 2024", Singapore was once again recognized as the world leader in competitiveness, once again bypassing the long-standing leaders, the United States of America (12th place in the ranking) and Hong Kong (5th place). The country managed to become a world leader in competitiveness thanks to high economic indicators, which were formed due to the volume of international trade, primarily high-tech exports and mastered investments, developed technological infrastructure, including telecommunications, which provides high-speed Internet access, stable indicators in the education system and the availability of a highly qualified workforce, the effectiveness of methods for creating new enterprises, etc. Thanks to its strong economy, labor market, and healthcare and education systems, Switzerland ranked 2nd, while Denmark ranked 3rd due to the steady growth of its economy, which is shaped by strong international trade, while its scientific infrastructure, healthcare and education systems demonstrate sustainable results. In addition, the country has shown very good results in international investment and productivity, ranking first in Europe in business efficiency [17].

Based on current trends in the development of innovation and industrial parks, it is necessary to pay attention to the importance of forming a cluster organization of industrial production at the regional level. Therefore, to ensure the innovative development of the Dnieper region and intensify the practical implementation of scientific inventions in the form of industrial samples, it is proposed to create a High-Tech Park based on the Dnipro State Technical University – "Dnipro Scientific and Industrial Park of Applied Research and Innovation Projects "KREMIN". A special tax and legal regime are being introduced for the subjects of the scientific and industrial park, in which favorable conditions for the successful development of business in the relevant sectors of the economy operate. The High-Tech Scientific and Industrial Park has the right to provide tax benefits for participants on a systematic basis. Residents of the High-Tech Park are exempt from all corporate taxes, including value added tax, income tax, and customs duties. Individual income tax for employees of resident companies of the park should be a fixed rate of 10%. This approach will allow to fully utilize the educational, scientific research, professional and infrastructure potential of the Dnieper region. The results of the conducted scientific research should be published in scientific publications indexed in domestic scient metric databases.

Of great importance for the effective economic development of the region is the creation and stimulation within the high-tech park of clusters for the development of innovative strategic industries, such as: energy sources and energy-saving technologies; nanotechnology, microelectronics and information equipment; information systems and technologies; mechanical engineering and instrument-making; production of electronics and electrical engineering; industrial and transport machinery and engineering equipment; high-quality medical equipment; aircraft construction, rocketry and space industry; automotive industry, shipbuilding and production of railway transport vehicles; metallurgy: production of cast iron and steel; equipment and technologies for processing raw materials of ferrous and non-ferrous metals; production of metal products; production of stainless steel products; new materials, chemicals and biotechnology; oil extraction and oil refining industry; production of electrical appliances and household electrical appliances; production of plastic products; light industry, production of clothing and footwear.

Within the framework of industry-specific regional innovation and industrial clusters, manufacturers, suppliers, financial organizations, which are closely interconnected and provide the production process, as well as logistics enterprises, are concentrated. It should be noted that the

efficiency of the implementation of flow processes of interaction of the participants of the cluster structure is ensured by the transport and logistics cluster, which can have an independent form of cluster organization and be integrated into the structure of the High-Tech Park. As a result, the industrial cluster becomes an effective mechanism for creating and producing high-quality innovative products with high added value and a sufficient level of safety margin. In the future, it is planned to determine specialization for the above industries in the form of: production of nuclear fuel cycle elements for the development of nuclear energy; modernization of energy facilities; titanium, lithium and aluminum production; production of machine tools and power tools; production of agricultural machinery; cars, motorcycles and electric scooters; production of building materials; petrochemicals; paper production; pharmaceuticals; production of household appliances (washing machines, air conditioners, hoods, irons, vacuum cleaners, umbrellas, thermoses, dishes); bearings, automotive components; production of various types of metal doors and fittings, etc.

The creation of the proposed innovation park will allow the park residents to use all types of resources more productively and rationally and will provide opportunities to:

− create new production facilities using innovative technologies, a high level of competitiveness and strengthen the processes of specialization and division of labor;

− expand the volume of exchange of ideas between the park's participating firms and use the innovative potential of a larger number of employees in various fields;

− increase the number of jobs and solve the problem of unemployment;

− improve the development of all industries that will operate within the cluster;

− increase budget revenues;

− ensure the training of specialists in educational institutions who are needed in the region;

− attract additional investments and improve the economic climate;

− develop engineering, transport and logistics infrastructure;

− increase the number of production sectors;

− actively develop the region's industry;

− increase export potential.

From the perspective of the theory of systems analysis, an industry cluster is a complex multi-component system, the complexity of mathematical modeling of which depends on the number of interacting elements: enterprises, organizations and economic entities and the number of functional relationships between them. It is proposed to carry out research and optimization of the functioning of such a system based on an integral macroeconomic model of an industry production cluster. For this, it is assumed that an industry cluster is a dynamic system whose state at time t is determined by the vector $x(t)$. The state of the system changes in accordance with the action of control parameters $u(t)$, which are called system control. Under such conditions, the mathematical model of the functioning of an industry cluster can be represented by the following system of differential equations:

$$d\bar{x}/dt = f(\bar{x}(t), \bar{u}(t), t), \quad (1)$$

where $x(t)$ is the current state of the industry production cluster; $x(t) \in X$, X is the set of permissible system states; $u(t)$ is the control function, $u(t) \in U$, U is the set of permissible values of control parameters; f is the vector function of the development (dynamics) of the system state taking into account the interaction of cluster elements.

In system (1), control is determined by the condition of effective functioning of the cluster according to the criterion of maximizing the efficiency of the industry production process for a certain period $[t_1, t_2]$, which is given by the optimization functional in the form:

$$E = \int_{t_1}^{t_2} \Phi(\bar{x}(t), \bar{u}(t), t)dt \rightarrow \max, \quad (2)$$

where $[t_1, t_2]$ is the specified time of the start and end of the production process; $\Phi(\bar{x}(t)$ is the functional for determining the efficiency of the industry production system for the current values of its parameters; $u(t)$ is the parameters of optimal control of achieving the goals of the production process.

It should be noted that the consideration of special regimes of customs and tax benefits, socio-economic development and others for each of the cluster participants in the dynamics of the system development is ensured by the possibility of setting its own control trajectories and setting additional

conditions for taking into account the state of the competitive environment. The proposed approach allows optimizing the functioning of industry clusters of production processes and determining the prospects for their development.

The economic efficiency of the functioning of the industry cluster of the industrial region is clearly demonstrated by the possibility of implementing various sales options for metal products. Thus, the sale of one ton of rolled metal gives an income of about $1,200, and the manufacture of hairdressing scissors from the same volume of metal allows you to get a corresponding income of about $200 thousand, that is, metal processing using medium-complexity technologies allows you to increase the income from its sale by more than 160 times. It should be noted that when using modern high-tech metal processing processes, this indicator can be significantly improved.

To increase the efficiency of their activities, cluster participants can organize joint research and development work to find innovative solutions, minimizing the time to market for new products and technologies. The interaction of all cluster participants allows obtaining certain advantages due to the emergence of a synergistic effect of the combined efforts of such an entity:

– optimization of the use of infrastructure and necessary resources;

– coordination of innovation, production and marketing strategies of cluster participants;

– increasing the competitiveness of industrial products;

– ensuring comprehensive security of supply chains;

– development of scientific and technological infrastructure;

– activation of educational, research and innovation activities;

– creation of mechanisms for coordinating the interests of government, business, science and educational institutions.

It should be noted that the creation of industrial clusters in the regions is supported by structures involved in the organization of industrial high-tech structures:

– Association of Industrial Automation Enterprises of Ukraine (APIU) - the founder of the Industry 4.0 movement and the National Strategy 4.0 project with an emphasis on cluster development;

– Ukrainian Cluster Development Agency CLUST-UA;

– Public Organization "High-tech Office Ukraine" - coordinator of the development of IAM clusters in Ukraine.

Conclusions. As a result of the analysis, it was found that one of the effective mechanisms for increasing the country's competitiveness and developing industrial regions is the creation of innovation and industrial parks. Logistics and industrial infrastructure based on innovation and industrial parks can become one of the main components of a guarantee of stability for Ukrainian business, the introduction of innovations and investments in the development of territories. For the successful implementation of relevant mechanisms for the restoration of socio-economic development of the Dnieper region and the intensification of the practical implementation of scientific inventions in the form of industrial samples, it is proposed to create a High Technology Park based on the Dnieper State Technical University - “Dnieper Scientific and Industrial Park of Applied Research and Innovation Projects “KREMIN”. At the same time, the program for supporting regional innovation and industrial parks should become nationwide, which will ensure a steady increase in the production of high-tech products and prospects for attracting investments and releasing competitive products to world markets.

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