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CONCEPTUAL PRINCIPLES FOR THE FORMATION OF INNOVATION MECHANISMS FOR PUBLIC REGULATION OF REGIONAL DEVELOPMENT AND INDUSTRIAL SAFETY

The article explores the conceptual foundations of the formation of mechanisms for innovation of public regulation of regional development in the context of ensuring industrial security. It is substantiated that modern challenges - digitalization, military threats, global supply chains, technogenic risks - necessitate a rethinking of traditional approaches to regional policy and security management. The key theoretical concepts of public administration, innovation policy and industrial security are analyzed, on the basis of which an integrated model of innovative public regulation is formulated. The directions of transformation of institutional, legal, organizational and digital mechanisms of regional development are determined, taking into account the requirements of sustainability and security.

Keywords: *public administration system, public regulation mechanisms, industrial policy, sustainable development, regional development, regions, critical infrastructure, tools, digitalization, digital transformation.*

Problem setting. The current stage of socio-economic development of regions is characterized by a high level of turbulence, which is due to a combination of global, national

and local factors. These include the digital transformation of the economy, the growth of technogenic and environmental risks, the destabilization of production chains, military threats and the need for post-crisis recovery. Under such conditions, public regulation of regional development acquires a new quality, since it must ensure not only economic growth, but also industrial security as a component of national and regional stability. The innovative nature of public regulation is becoming a determining factor in the effectiveness of regional policy [2; 5]. Traditional administrative mechanisms are increasingly unable to adequately respond to complex risks arising in the industrial sector. This necessitates the formation of new conceptual principles of public regulation, focused on the integration of innovative approaches, network governance, digital tools and principles of sustainable development.

Recent research and publications analysis. Organizational, legal, financial, economic and other aspects of ensuring the development of regions are the subject of consideration by R. Benedix, P. Blau, Ye. Borodin, K. Bradley, Z. Burik, S. Valton, J. Commons, R. Coase, N. Kolisnichenko, A. Korol, S. Lipset, R. Lukisha, V. Lunyak, T. Mamatova, A. Markusen, O. Matveieva, W. Mitchell, I. Moskalets, I. Petrik, A. Pomaza-Ponomarenko, G. Richardson, S. Romanyuk, G. Harris, G. Starushenko, T. Shestakovska, and others [2; 5; 10; 11–12; 13]. At the same time, there is a need to study complex mechanisms of state regulation in the field of regional development from the perspective of determining the connection between this development and the level of industrial safety in the state.

Paper objective. The purpose of the article is to substantiate the conceptual principles of forming mechanisms for innovation in public regulation of regional development, taking into account the requirements of industrial safety.

Paper main body. The theoretical understanding of public regulation of regional development is based on a combination of concepts of public administration, regional economics and security studies. Classical models of regulation, based on hierarchical management and directive influence, are gradually transforming towards multi-level and network governance, where horizontal interactions between state, business and public actors play a key role.

Innovative public regulation involves the use of new management tools, including data-driven policies, digital platforms, regulatory sandboxes, public-private partnership

mechanisms and social innovations. In the regional dimension, such tools allow adapting development policies to the specifics of territories, their level of industrialization and security risks.

Industrial safety in this context is considered as a multidimensional category, covering technical, environmental, social and management aspects. It is related not only to minimizing accidents and man-made disasters, but also to ensuring the continuity of production processes, protecting labor resources, and the stability of infrastructure.

The formation of innovation mechanisms for public regulation of regional development requires a clear conceptualization of their structure and functional purpose. In general, such mechanisms can be represented as a set of institutional, legal, organizational, economic and information and digital components, the interaction of which is aimed at achieving the strategic goals of regional development and industrial safety.

The institutional component involves adapting the system of public authorities to the conditions of innovative development, including the creation of specialized regional development agencies, industrial safety centers and innovation hubs. It is also important to strengthen coordination between the central and regional levels of government.

The legal mechanism consists in forming a flexible regulatory environment capable of stimulating innovation in industry and ensuring an appropriate level of safety. This includes the introduction of risk-based regulation, improving safety standards and harmonizing national legislation with European standards.

Innovation in the field of industrial safety is manifested primarily in the use of digital technologies, as well as the development and use of innovations and risk management mechanisms. Among these technologies, one can single out the Industrial Internet of Things (IIoT), big data analytics, artificial intelligence and predictive modeling, which allow for timely detection of potential threats and minimize their consequences [2; 10; 11].

In the regional context, it is important to create integrated industrial safety management platforms at the regional level, which combine data from enterprises, state authorities and response services. Such platforms contribute to increasing transparency, efficiency of management decisions and involving the public in monitoring security processes.

Innovative public regulation of regional development should be integrated into the

strategic planning system. Regional development strategies should take into account not only economic indicators, but also indicators of industrial safety and sustainability. This allows for the formation of long-term development scenarios focused on the balance between growth and safety.

The participation of stakeholders in the process of forming and implementing regional policy is of particular importance. Innovative regulatory mechanisms contribute to the development of partnerships between authorities, business and scientific institutions, which is a prerequisite for the introduction of advanced technologies and increasing the competitiveness of regions.

As a result of the systematization of the discourse on the issues of forming and implementing the state policy of innovative development of regions, the following research platforms are distinguished, which determine the essence and content of the following concepts: innovation; innovative development; innovation model; state policy; state industrial policy.

During the study, it was found that experts distinguish two approaches to defining innovations: static and dynamic. For application in public administration practice and in this study, the static approach is the most suitable. It is characterized by specificity and focus on results. A key role in the innovative development of the economy is played by such aspects as competition and the organization of socio-economic relations. This differentiation contributes to the expansion of the understanding of the state policy of innovative development of the economy.

Conceptualization of the innovation mechanism of public regulation of the economy involves the development of a clear system of approaches and methods that ensure the stimulation of innovative activity in the country. The main goal of this mechanism is to create conditions under which innovations become a key factor in economic growth and increasing the competitiveness of the national economy. The first thing that requires attention when conceptualizing such a mechanism is the identification of priority areas of innovative development. The state must determine which industries or technologies will be supported to achieve the maximum economic effect. These can be, for example, information technologies, biotechnology, or renewable energy production.

The second important aspect is the development of state support instruments for innovation, which may include financing of research and development, tax breaks, grants for startups, as well as the creation of infrastructure for innovation (for example, technology parks). It is important that these measures are targeted and result-oriented. The third is the legislative support for innovation activities. The state should create a legal framework that regulates relations in the field of intellectual property, protection of trade secrets, and investments in the latest technologies. This also includes the development of norms that facilitate venture financing and risky investments. The fourth is international cooperation in the field of innovation. State policy should take into account the potential for attracting foreign investment, participation in international scientific and technological projects, as well as the import and export of innovative products and technologies.

Fifth – internal organization of the innovation process. This includes the formation of effective mechanisms for coordinating the actions of all participants in the innovation process, from scientific institutions and universities to the private sector and government agencies. Such coordination is aimed at creating a single innovation ecosystem that promotes the rapid implementation of innovations. All these aspects together form a comprehensive approach to the implementation of the state policy of innovation development of regions, ensuring sustainable growth and modernization of the economy.

Despite the availability of a sufficient number of scientific specialized sources, theoretical studies on the mechanisms for implementing the state policy of innovative development of regions from the standpoint of ensuring industrial safety have not received a full scientific analysis. For example, L. Prykhodchenko points out the need to include in the mechanisms for implementing the innovative policy of economic development a target component as "the primary element of the structure of the mechanism intended for exhaustive specification of the general goal" [9].

Innovation plays a crucial role in social life, as it is the main driver of social, economic and technological progress. The essence of innovation is the introduction of new or significantly improved products, processes, services or technologies that go beyond the traditional use of resources and knowledge.

Economic development. Innovation is the key to increasing productivity, ensuring

lower production costs and improving the quality of products. This contributes to the competitiveness of national economies in the global market.

Companies that invest in research and development can develop innovative products that open up new markets and create new industries.

Social impact. Innovation has a significant impact on social life, as it can improve the quality of life through new medical technologies, educational tools and solutions to environmental problems. For example, the development of vaccines and therapeutics directly affects the health and longevity of the population.

Technological progress. Innovation drives technological progress, enabling the development of new methods, tools, and techniques that can revolutionize industries. From digital technologies to renewable energy, innovation is changing the way we produce, consume, and interact in society.

Improving governance and infrastructure. Innovative approaches to infrastructure management and development contribute to more efficient use of resources, reduced waste and increased overall system efficiency. This can include everything from smart cities to new forms of urban planning and energy management. Ensuring sustainable development. Innovation plays a central role in sustainable development, as it enables the development of new solutions that reduce environmental impact and contribute to greater environmental, social and economic sustainability. Innovation is thus a fundamental element for progress in all areas of social life, opening up new opportunities for regional development.

We consider public regulation of innovative development of regions as a complex system of measures and strategies aimed at creating an institutional, resource and motivational environment to support and promote innovative activity. We share the views of researchers who consider state policy in the field of regional innovative development as a key component of the general strategy of the state for organizing, regulating and directing the innovation process in society.

This policy aims to ensure sustainable innovative development of the national economy, increase its competitiveness and promote progressive structural changes. It is based on the systematic and coordinated activities of state bodies at different levels and in different sectors of the economy. The main directions of this policy are defined in legislation and strategic

documents aimed at forming appropriate institutional, scientific, technical and economic foundations for stimulating innovation processes.

This policy is actively supported by the state through the implementation of various measures and mechanisms that involve the attraction of the necessary resources, both public and private, to stimulate innovation at all levels and in all sectors of the economy [3].

There are deep systemic connections between the state innovation policy of economic development and other aspects of public life, such as investment, institutional, scientific and technical, educational, industrial and structural policies.

These connections are also evident in economic disciplines, in particular in the innovative economy and technological change. However, the state policy of innovative regional development has its own independence and a significant impact on these policies and the national economy as a whole, shaping their orientation towards innovation. The state policy of innovative regional development is a strategic direction of government activity aimed at stimulating innovative activity, which aims to increase the competitiveness of the national economy, create new jobs, and improve the quality of life of citizens. Let us consider the key components and approaches in the formation of such a policy.

The main directions of the state policy for the innovative development of regions:

1. Support for scientific research and development. This includes financing of fundamental and applied scientific research, development of new technologies, as well as support for university and private research initiatives.

2. Creation of innovative infrastructure. Development of technoparks, business incubators, science towns that provide the necessary base for the development of startups and technology transfer.

3. Financing and incentives. Includes the provision of tax breaks, subsidies, grants for innovative projects and startups. This may also include support for venture financing and loan guarantees for innovative companies.

4. Regulatory policy. Simplification of administrative procedures for new products, regulation of intellectual property, ensuring the protection of trade secrets and patents.

5. International cooperation. Participation in international scientific and technological programs, promotion of the export of innovative products, attraction of foreign investments

in domestic innovations. 6. Educational policy. Training of qualified personnel through educational programs focused on science, technology, engineering and mathematics (STEM), as well as creating conditions for training and development of talents in the field of innovation.

When implementing a state policy for the innovative development of regions, certain challenges may arise, namely:

1. Coordination between different participants. The need for effective interaction between the government, the private sector, scientific institutions and higher education institutions.

2. Financial constraints. Limited budgets can restrain the amount of funding for innovation and research.

3. Regulatory barriers. Difficulties in regulating new technologies and products that are changing rapidly [5; 12; 13].

An effective state policy for innovative development requires a flexible approach, the ability to adapt to new technological and economic conditions, and the active participation of all stakeholders in the process of innovation activity. These measures are carried out through the implementation of the state policy for the innovative development of regions (Table 1).

Table 1

Features of the formation of mechanisms for implementing state policy for innovative development of regions depending on the type of innovation policy

№	Type of innovation policy in the region	Formation mechanisms
1	Catch-up politics	1. Increasing investment in scientific research and development (SRD). 2. Creation of technology transfer centers. 3. Support for the development of small and medium-sized innovative enterprises.
2	Non-catch-up politics	1. Creating an environment for technology transfer not from one's own country, but from developed countries. 2. Providing tax and other benefits for foreign investors who introduce new technologies. 3. Supporting domestic enterprises that purchase licenses for new technologies.
3	Leadership politics	1. Focusing on the development of our own innovative technologies. 2. Support for fundamental scientific research. 3. Creation of scientific and technological parks and clusters.

Source: compiled based on [2; 3–4; 12; 13]

In this context, the issue of determining the appropriate mechanisms for implementing innovation policy in the field of regional innovation development of Ukraine becomes relevant: institutional and legal, organizational and structural, economic, communicative and informational. These mechanisms depend on the model of innovation development of a particular region chosen by the state (Table 2). Considering the main types of innovation processes, such as interactive, network and informational, researchers in modern political and economic realities consider it appropriate to combine them into a linear and interactive model for the development of innovation policy. The main goal of such a combination is to reduce the gap in the development of different regions of the country.

Table 2

Comparative review of mechanisms for public regulation of regional development depending on the chosen model of innovative development

№	Model of innovative regional development	Public regulation mechanisms
1	Linear model	1. Aimed at stimulating scientific research and development work. * Support for basic research. 2. Creation of scientific and technological parks. 3 Financing of innovative projects.
2	Catch-up politics	1. Purchase of licenses and know-how from developed countries. 2. Joint ventures with foreign companies. 3. Attracting foreign direct investment.
3	Innovative model	1. Creating a favorable environment for innovation. 2. Stimulating the private sector to invest in innovation. 3. Developing human capital. 4. Supporting small and medium-sized businesses.

Source: compiled based on [1; 5; 8; 12; 13]

Therefore, when choosing a system of mechanisms for implementing the policy of innovative development of the economy, it is important to take into account the current state of innovative activity, its potential, as well as the chosen model of development of the innovative sphere by the authorities. Based on this analysis, it is necessary to determine the desired model of innovative development of the region.

In Ukraine, the problem lies in the lack of a clear national strategy for the development of innovations in the regions and in the system of mechanisms for their implementation at the local level. Innovative changes in the development of regions should be based on appropriate strategies and create a favorable innovation environment. Current legislation does not provide a clear definition of the principles of regional innovation policy and does not detail the structure of the regional innovation system. The main components of

this system, such as the institutional structure of the innovative economy, priorities in scientific, technical and innovative development, program financing of scientific, technical and innovative projects, support for innovative entrepreneurship and technology transfer, remain unsystematized and uncoordinated. Ukraine needs supraregional institutions to integrate regional innovation initiatives into larger structures and leaders who are focused on innovation at different levels of government. According to scientific research, regional innovation systems that encompass state management of innovation activities are classified as meso-level, which are part of macro-level innovation systems and arise as a result of the integration of micro-level innovation systems. These systems integrate mechanisms at the macro, meso, and micro levels [2].

The objects of public regulation of innovative development of regions are means of increasing and optimizing the innovative potential of a region or country, including initiatives for the development of innovative processes in the regional economy. These objects include innovative projects, programs, objects of intellectual property rights and others, as well as resources that contribute to these processes. The spheres of implementation of such innovative processes include the scientific and technological, production and consumption spheres. As for the state policy of innovative development of regions, it is based on a hierarchical approach and is correlated with the power-vertical system of state management of social and regional development, in particular its economic component. This policy is aimed at creating conditions for the creation of new innovative structures. However, such an approach may be ineffective on a long-term basis.

Our view is that in order to achieve long-term and positive results, it is necessary to reconsider the sectoral structure of the economy in the region and promote interaction between self-organized structures and state institutions. This can be achieved through the introduction of a mixed matrix management structure [4]. The heterarchical management principle, in the context of public administration, acts as a complementary principle to the traditional hierarchical approach, expanding its application and contrasting it with absolute chaos. Heterarchy, which means "loose hierarchy", is associated with the synergistic discourse and the principle of self-organization. This approach ensures the flexibility of the management system in the horizontal direction, promotes the harmonious development of

new market segments within the framework of existing formal and informal institutions, stimulates competition and contributes to increasing the competitiveness of economic entities and the country as a whole.

Modern theories of innovative regional development offer different approaches to understanding and stimulating dynamic growth and competitiveness of regions: innovation clusters (M. Porter, J. Held) emphasize the importance of concentration of resources and knowledge in certain industries to stimulate innovation, endogenous technological progress (P. Romer, F. Aghion, P. Howitt) focuses on internal factors, such as education and research, as key drivers of dynamic growth, innovation networks (D. Becattini, G. Hakenson, R. Kemegni,) emphasize the importance of cooperation and interaction between different actors to stimulate innovation, regional innovation systems (F. Cook, J. Howells) consider the region as a complex system where institutions, policies and culture affect the innovation potential, dynamic convergence (R. Barro, H. Sala-i-Martin) argues that regions with less developed economies have the potential for faster growth through innovation [13].

These theories have practical significance for regional policy, offering

tools and recommendations for stimulating innovative development:

– a country's competitive advantages are formed and maintained by activating socio-economic initiatives at the regional level [8];

– regional characteristics, such as the availability of a highly skilled labor force, access to infrastructure, the presence of universities and research centers, and the availability of financial and entrepreneurial support, can significantly affect the ability of regions to generate innovations and stimulate economic growth. For example, regions with a large number of technological enterprises, research institutions, and universities may have an advantage in the development and implementation of new technologies.

Also important is support from local authorities and the business community, which can contribute to the creation of a favorable environment for the development of innovations.

In this regard, policies aimed at stimulating innovative development at the regional level can be of great importance for the overall economic growth of the country. Such measures may include:

- the creation of innovation centers, providing financial support to startups and

technology companies, as well as promoting cooperation between business, higher educational institutions and state authorities;

– the complexity of problems related to regional development is increasing, including uneven distribution of resources, macroeconomic instability and other aspects [6];

– the process of regional decentralization continues [1].

It should be noted that the analysis of the above concepts is important in the context of the interaction of state policy mechanisms for innovative development of the economies of the European Union member states and supranational regional innovative economic development policies, especially taking into account Ukraine's aspiration for integration into the EU [7].

Conclusions. In Ukraine, there is a significant amount of information about the state policy of innovative development at the regional level, as well as the theoretical, methodological and practical aspects of forming an innovative model of development of industrial regions. Four key components are identified for creating an effective economy in the region, including the development of an innovative regional system that collaborates between companies, scientific institutions, research centers, universities, idea banks, and other institutions. Recently, the issue of finding factors that determine the effectiveness of state policy for innovative development of regions has been intensified. These factors affect the results of state influence on the innovative development of the economy in the country in general and in the regions in particular, and the formation of the national innovation system of the region. This system contributes to the support and development of innovative activities, stimulates innovation processes in order to ensure sustainable development and the effective use of available resources, such as scientific and educational, labor and innovation potential, in order to achieve economic, social and environmental efficiency of innovations in the region.

As a result of the study, it is substantiated that the formation of mechanisms of innovation of public regulation of regional development and industrial safety is a key condition for ensuring sustainable development in the face of modern challenges. Innovative regulation allows integrating economic and security goals, increasing the effectiveness of public policy at the regional level. It is determined that the conceptual principles of such regulation should

be based on an interdisciplinary approach, the use of digital tools, the development of institutional capacity and the implementation of risk-oriented management models. Further scientific research should be directed to an empirical assessment of the effectiveness of innovative mechanisms of public regulation in specific regions of Ukraine.

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