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Formation of Innovative Ecosystems: Relevant Priorities for Dynamic Sustainability of Regional Development

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ABSTRACT
The purpose of the study was to determine the key priorities and mechanisms for stimulating the innovative activity of regional economies adequate to the goals of ensuring their dynamic stability based on the formation of innovative ecosystems focused on the creation and commercialization of innovations. This study is based on the use of the main provisions of economic synergetics and the ecosystem approach, the use of methods of systemic, logical and comparative analysis, scientific generalization and systematization. Author formulates methodological provisions for achieving dynamic stability of regional development in the context of the actualization of the requirements of a new quality of economic growth, as well as the priorities of regional policy based on the idea of developing innovative ecosystems as complex network structures. The matrix of inter-level interactions suggested as an analytical basis can be demanded when structuring mechanisms for supporting and regulating the development of innovative ecosystems. The applied significance of the obtained results is contingent the promising nature of their use in the development and implementation of regional innovation policy.

Keywords: *Regional economy, New quality of growth, Dynamic sustainability, Network paradigm, Innovative ecosystem, Development priorities.*

1. INTRODUCTION

The modern stage of development is characterized by the ever-increasing intellectualization of all types of activities that have a direct impact on the pace of socioeconomic development. The totality of socio-economic relations regarding the most efficient production, distribution and use of available intellectual resources in order to increase social and personal well-being constitutes the essential basis of the economies of countries and regions [1]. At the same time, a significant part of the problems arising during the transition to an innovative type of development is contingent on the complex interaction of new geopolitical, technological and other factors, which are the basis for chief transformations in the structure of productive forces (figure 1).

Innovative updating of the technological basis, modernization of institutions, widespread use of integration methods of conducting economic and management activities, advanced service platforms, network communities with the increasing role of the state in solving priority tasks of innovative development are becoming the main determinants of economic dynamics at both the national and regional levels [2].

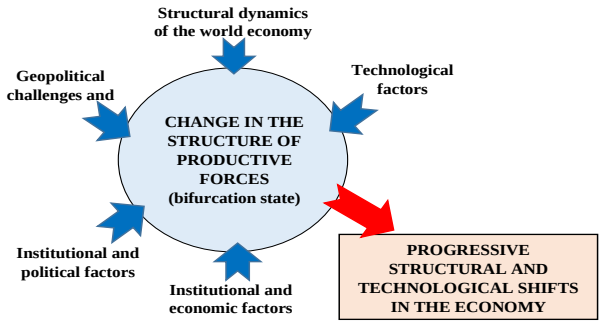

Figure 1 Model of the formation of progressive structural and technological moves in the economy.

This maintains the search for ways of innovative development of regions adequate to the increasing complexity of system-forming relations inherent in the modern type of reproduction taking into account transformational processes and technological shifts that form the basic conditions of the environment for the functioning of economic actors. As a result, the study of the transformation processes of modern economies into networked ecosystems that can provide an organizational basis for their transition to an innovative growth model, becomes one of the most important areas of economic theory and practice.

The aim of the study was to determine the directions for providing the sustainability of the development of regional economies in the context of the ecosystem paradigm of innovative growth. Particular attention was paid to the disclosure of the main priorities of the formation of network innovation structures, methodological provisions for stimulating the innovative activity of regional economies, adequate to the goals of ensuring their dynamic stability.

2. MATERIALS AND METHODS

The methodological basis of the work was the axiomatics of economic synergy as an interdisciplinary research concept, including the study of the specifics of the environment, basic conditions / provisions, key factors that form a new quality of economic growth, as well as structural links between the elements of systems, taking into account the synergistic effects arising in the process of their joint functioning. as well as the ecosystem approach. From the point of view of a synergistic approach, regional systems are considered as complex, open, self-organizing integral forms of the spatial organization of society, functioning in a constantly changing market environment. The presentation of the sustainability of regional development in the categories of synergetics made it possible to outstrip it as a dynamic (adaptive) sustainability achieved as a result of material, information and energy exchange with the environment. Dynamic sustainability is understood as the ability of regional economies to adapt to changes in external conditions of activity through internal transformations. What is more, the transformation of the internal structure acts as the most favorable reaction to the dynamism of their environment, both from the energetic and temporal points of view. Its measure can be the number of possible combinations that the system can potentially generate under certain conditions due to structural transformations.

Considering that the dynamic stability of modern economies is associated with the ability to build up innovation potential based on achieving the continuity of the innovation cycle (synergy of innovation) [3], increasing the efficiency of inter-firm communications [4] and interactions with the external environment [5], the concept of innovative ecosystems (CIE) was chosen as a methodological basis for ensuring the sustainability of the regional development as complex integrated structures capable of generating network effects of joint interactions [6-8] and thereby stimulating innovative growth. CIE are characterized by the ability to self-organize and expand the possibilities for achieving productivity growth by grading the functional, informational and other dissociation of their elements [9, 10], as well as strengthening synergy and symbiosis of joint activities of network partners [11].

During the development of suggestions, author used existing theoretical developments in the field of innovation management, knowledge economy, network economy, the theory of regionalization of economic processes, organizational management, structural and technological dynamics of economic systems. In the course of the research, author used the methods of systemic, logical and comparative analysis, methods of scientific generalization and systematization.

3. RESULTS

In the literature, ensuring the sustainability of the development of modern economies is usually associated with the formation of network structures that unite a wide range of participants in innovation activities based on the principles of ecosystem design [12-17]. For regional economies, the process of transition to innovative development models is associated with a targeted policy of introducing fundamentally new organizational and managerial methods and mechanisms for activating the innovation process, ensuring a balanced structure of the subjects of innovative interaction and regional resources [18].

As a result of the study, we proposed an innovative mechanism for achieving dynamic stability of regional development in the context of the actualization of the requirements of a new quality of economic growth (figure 2).

The priorities for implementing innovations in the regional economy are linked to the formation of

conditions for ecosystem transformation based on the wide use of network structures, and in particular, to:

- the introduction of new methods and technologies in the innovative management of the region (digitalization of the development and implementation of innovative strategies, IT technologies, artificial intelligence, platform solutions);
- the development of horizontally integrated network structures (entrepreneurial ecosystems, development institutions, technology parks, scientific centers, technopolises that provide a technological breakthrough);

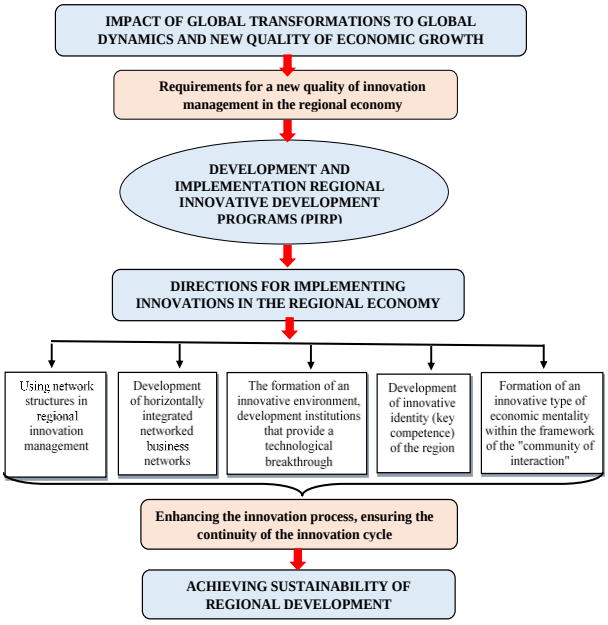

Figure 2 An innovative mechanism for regional development based on the idea of creating network structures.

- creation of a networked innovation environment (horizontal network communications between all participants in the innovation process);
- identifying the innovative identity of the region (defining the key competence of sustainable development of the regional economy);
- forming of an innovative type of economic mentality within the framework of the “community of interaction”.

A special role in enhancing innovation and achieving the continuity of the innovation cycle is assigned to innovation ecosystems focused on ensuring technological development and innovation. The growing popularity of CIE in the business and scientific world, management and politics is evidenced by the explosive nature of the number of publications devoted to the study of this category (figure 3).

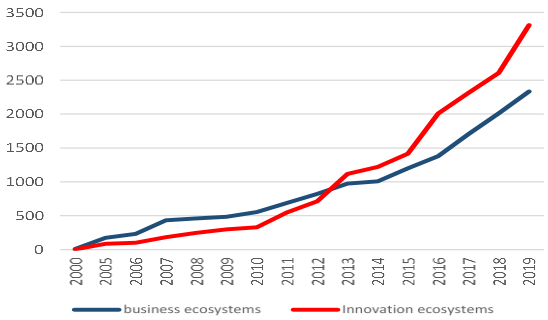

Figure 3 Dynamics of the number of works devoted to the study of entrepreneurial and innovation ecosystems in the Google Scholar database for 2000-2019. Source: Google Scholar.

The interest in the study of the ecosystem paradigm of ensuring the sustainability of development in recent decades is contingent on the desire to rethink the interconnection of economic entities that is emerging in the new economy with each other and with the external environment. The foundations for the development of an ecosystem approach to the study of relationships between business agents were laid by J. Moore, who focused on the ability to manage community collaboration (a wide network of interacting organizations and individuals) as a key condition for the implementation of innovation [12]. Today, despite the fact that the CIE theory is in the stage of intensive formation, according to R. Adner, ecosystems are a stable mechanism for coordinating the activities of economic factors, adequate to the new challenges of socioeconomic dynamics [9]. If CIE evolved spontaneously in the countries/regions leading innovation, not planned by anyone, or as, for example, in the Scandinavian region, which has developed and implemented strategies for the development of innovative industries, then at present it is possible to obtain direct (growth of economic indicators of regional development) and indirect (increase in territorial attractiveness, image of the region) effects from the construction of CIE only dependent on the intensification of efforts/activities of regional management creating conditions for the ecosystem transformation of the economy. We mean the formation of a certain institutional environment, of an adaptive type, aimed at ensuring the dynamic sustainability of development in conditions of high uncertainty and risk, as well as social capital. At the same time, insufficient knowledge of the mechanisms of interaction between the elements of CIE, the ways of formation and their role in reaching a new level of regional development, continues to be one of the issues that require its solution.

Based on their conceptualization as complex synergetic systems, consisting of three complementary elements/sub-ecosystems: science (knowledge is generated based on fundamental research), technology (technological knowledge is generated) and business (valuable business proposals are developed and

implemented), the importance of a comprehensive studies of the structure and specificity of the processes of integration and interaction of CIE elements, which, according Y. Su et al., are their most significant characteristics[19]. In fact, understanding the features of the CIE landscape, formed by the level of development of science, technology and business (STB) and their interaction, contributes to the rationalization of the search for ways of innovative growth, making management decisions to create an infrastructure for the development and development of innovations, and intensive development of the network environment.

It is customary to distinguish the research and commercial components within a certain CIE [19-21]. Thus, according D. Oh D. et al., with achievement of a systemic compromise of their goals and interests, it is possible to form effective informational, organizational and economic interactions that contribute to balancing the relationships between the selected subsystems of CIE. The result of such a constructive dialogue is the achievement of the progressive (sustainable) development of the CIE [20].

As an analytical basis for assessing the nature of the interaction of STB elements of a certain CIE, we note the feasibility of studying two types of relationships, and, in particular: relationships between the levels of science-technology (S-T) and technology-business (T-B).

Moreover, within the framework of interactive network analysis, the S-T connection exists when fundamental knowledge generated by organizations in the scientific field transforms into technological innovations/concepts in the technological ecosystem and vice versa. The T-B connection exists in the case of organizing joint work of companies in a technology ecosystem with companies in business ecosystems to commercialize technologies into innovative products that are in market demand. The matrix for assessing inter-level interactions (figure 4) allows to assess the ratio of the selected types of relationships inherent in a particular CIE.

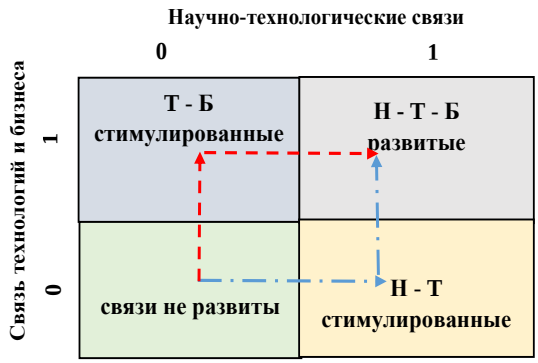

Figure 4 Interaction matrix of key elements of the innovative ecosystem.

It includes such quadrants of inter-level interactions as:

• underdeveloped ones (with no relationship between STB levels);

• developed ones (with balanced STB communications);

• based on S-T communications (existing scientific and technological developments are not used for commercial purposes);

• based on T-B communications (characterized by a significant market orientation, possession of applied knowledge in the absence of fundamental knowledge).

Since CIE do not grow directly from an underdeveloped quadrant, in order to move to a balanced level of STB links, it is necessary to follow the path of stimulating innovative growth through the development of segments based on either S-T links or T-B links (indicated by arrows in the figure).

When choosing an innovative strategy based on the activation of T-B connections, it is customary to talk about an economy with a “catching-up” development regime, which in the future may develop into an innovative one.

The “outstripping” type of development or leadership in innovative activity is characteristic for economies following the path of stimulating S-T direction. In the first case, the emphasis on ensuring innovative growth is associated with the development of imitation innovations, including the use of incentive mechanisms for "open innovations". The second case considers investment in the scientific and technological sector, the development of our own breakthrough innovations.

The presented matrix of inter-level interactions also makes it possible to explore the ways and the corresponding mechanisms of development of emerging new industries that have unique innovative potential in comparison with traditional ones.

4. DISCUSSION

The attractiveness of CIE as structures contributing to ensuring the dynamic stability of regional development is high [20,21]. At the same time, in order to accelerate innovative growth based on the ecosystem transformation of regional economies, it is important to develop an adaptive network environment that allows them to create conditions for the formation and maintenance of complex forms of collaborative interactions between participants in the innovation process.

From the point of view of integration and balance of interrelationships between scientific and technological and business-entrepreneurial subsystems of CIE, the results of this study allow us to clarify possible ways of

innovative development of regional economies based on the specifics of the CIE landscape and regional resources. Moreover, it is possible to switch to an "outstripping" mode of development when stimulating the development of new industries with unique innovative potential in comparison with traditional ones, since the delay in the newly formed CIE is surmountable.

5. CONCLUSION

A significant role in ensuring the dynamic stability of regional development is assigned to the formation of network structures aimed at stimulating innovative growth. The implementation of this goal is possible as a result of the ecosystem restructuring of the regional environment as a necessary condition for expanding cooperation, strengthening synergy and symbiosis of joint activities of network partners as a result of the intensification of information, material and energy exchange between all participants in the innovation process.

The study defines the priorities for the implementation of an innovative mechanism for regional development, based on the idea of forming innovative ecosystems as complex network structures focused on the creation, technological development and commercialization of innovations. The implementation of the proposed measures will contribute to the concentration of efforts on solving the problems of ensuring the dynamic stability of regional economies by expanding their innovative capabilities, and, accordingly, increasing competitiveness in the globalizing world.

The matrix of inter-level interactions presented in the work can become an analytical basis for structuring mechanisms to support and regulate the development of innovative ecosystems.

Opportunities for further research are related to the clarification of the mechanisms of interaction and integration of STB components of innovation ecosystems.

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