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TERRITORIAL INNOVATION CLUSTERS:
WORLD LANDMARKS / UKRAINIAN REALITIES

Abstract. The article investigates the formation of innovation clusters at the regional level, considering the practical world experience. Based on the analysis of current trends in the development of the national economy as a whole and its individual components in the form of regions, the need to use the processes of combining production with scientific institutions and government organizations has been proved. The analysis of theoretical approaches to the use of the economic category «cluster» showed a certain similarity of opinions of experts, but also allowed to identify a variety of approaches, based on which the author's definition of the cluster is proposed.

The analysis of cluster classificaiia allowed to outline the classification features and identify possible types of innovation clusters. Research of features and differences of clusters from other territorial and administrative associations allowed to define their advantages and to find out lacks. Scientific approaches to the features, advantages, and prospects of formation of innovation clusters, the main driving force of which for the socio-economic systems of the regions is dynamism, adaptability, and synergy, are analyzed. The preconditions for the formation of innovation clusters at the regional level are systematized.

Analysis of the experience of developed countries in the practice of clustering of the economy allowed to identify three geographically determined centers of development of innovation clusters and historically formed models of their formation. A detailed analysis of the latter allowed to determine their main characteristics, their typical features and to indicate examples of use in certain countries. Quantitative characteristics of existing innovation clusters in advanced countries by industry specificity are studied.

Based on the analysis of the existing Development Strategies of individual regions of the country, a description of the state of formation and development of cluster models in certain sectors of the national economy is given. The existing obstacles to the active innovative development of the

country's regions have been identified, and the application of the Italian model, which has minimal obstacles to implementation, has been recommended as conclusions.

*Keywords***:** cluster, innovation, development, regions, synergetic effect, cluster models.

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ТЕРИТОРІАЛЬНІ ІННОВАЦІЙНІ КЛАСТЕРИ: СВІТОВІ ОРІЄНТИРИ / УКРАЇНСЬКІ РЕАЛІЇ

Анотація. Досліджуються питання формування інноваційних кластерів на регіональному рівні з урахуванням практичного світового досвіду. На основі аналізу сучасних тенденцій розвитку національного господарства країн та окремих його складових у формі регіонів доведено необхідність застосування процесів поєднання виробництва з науковими установами і державними організаціями. Здійснений аналіз теоретичних підходів до використання економічної категорії «кластер» продемонстрував певну подібність думок фахівців, сприяв визначенню різноманіть підходів, на основі яких запропоновано авторське визначення кластера.

Проведений аналіз класифікації кластерів дозволив окреслити класифікаційні ознаки та ідентифікувати можливі типи інноваційних кластерів. Дослідження особливостей і відмінностей кластерів від інших територіальних й адміністративних об'єднань дали змогу визначити їхні переваги і з'ясувати недоліки. Проаналізовано наукові підходи до особливостей, переваг і перспектив формування інноваційних кластерів, головною рушійною силою яких для соціально-економічних систем регіонів є динамічність, адаптивність і синергія. Систематизовано передумови формування інноваційних кластерів на рівні регіону.

Аналіз досвіду розвинутих країн світу з практики кластеризації економіки дозволив виділити три географічно обумовлені центри розвитку інноваційних кластерів та історично сформовані моделі їх формування. Докладний аналіз останніх дав змогу визначити їхні

основні характеристики, типові риси, охарактеризувати особливості використання в певних країнах світу. Досліджено кількісні характеристики наявних інноваційних кластерів у високорозвинутих країнах за галузевою специфікою.

На підставі аналізу наявних стратегій розвитку певних областей країни надано характеристику стану формування і розвитку кластерних моделей у певних галузях національного господарства. Визначено наявні перешкоди активному інноваційному розвиткові регіонів країни, як висновки рекомендовано застосування італійської моделі, що характеризується мінімальними перешкодами до впровадження.

Ключові слова: кластер, інновація, розвиток, регіони, синергетичний ефект, кластерні моделі.

Формул: 0; рис.: 1; табл.: 2; бібл.: 23.

Introduction. Modern conditions of effective functioning and progressive development of national economy in most every country in the world require implementation and dissemination of processes of use of innovations in all spheres of life. Nowadays the role of innovative activity of economic entities and requirements to the level of development of innovative infrastructure is rapidly growing. Innovation infrastructure is considered as a system of public administration, conducts simultaneously with the regulation and integration also generation of processes of creation and use of scientific knowledge and technologies, introduction of new products, services, new methods of organization and management of economic activity.

The realization of the above-mentioned task is possible if authorities, business structures, research institutions, educational organizations and other socio-economic structures are united into certain groups on the basis of the cluster approach. The use of clusters in the formation of certain territorial sectoral associations of economic entities is able to provide fast rates of economic development. Cluster associations are the guarantee of formation of strong scientific-industrial complex and socio-economic and social development of territories. Due to the formation of territorial innovation clusters, it is easier and easier for regions to adapt to the changing conditions of the external environment and overcome its negative impacts and are able to generate many synergistic effects in various areas of activity.

Modern developed countries widely use innovation cluster policy as a component of national development strategies in order to increase national competitiveness and innovation potential of the national economy. The infrastructure of territorial innovation development in Ukraine is at the initial stage of formation, there are only certain types of innovation structures, such as technoparks, business incubators, scientific and technical centers, and funds.

So, the direction of strategic vector of development of Ukraine in the European direction emphasizes the expediency of formation of innovative infrastructure of territories on the basis of clustering of subjects of activity and emphasizes the relevance of the study topic.

Study analysis and problem statement. The research of innovative clusters is actively engaged in the representatives of the world scientific community. General questions of clustering, features of formation of cluster models are studied by such leading foreign and domestic scientists as M. Porter [1], M. Voynarenko [2], A. Varyanichenko [3], I. Kosach [4], S. Sokolenko [5]; studies of cluster influence on regional development and cluster functioning in modern conditions — A. Varyanichenko [3], L. Levkovskaya [6], A. Kuzmin [7]; the impact of clusters on the economy was studied by M. Enright [8], UNIDO [9], K. Kitels, G. Lindquist, E. Selwell [10]. However, the issues of formation of territorial innovation clusters in the conditions of modern Ukrainian realities on the basis of world experience remain insufficiently investigated. This determines the relevance and necessity of the study and forms its purpose, determines the methodology and research methods.

Unresolved aspects of the problem. Despite the emergence of national, regional, and municipal clusters in various sectors of production in developed countries over the past decades, however, the development of clusters in Ukraine remains quite insignificant.

Given the sufficient natural-resource, production, research and personnel potential, the national economy of the country almost does not use the advantages of innovation and cluster development to ensure its competitiveness. It seems appropriate to conduct a detailed study of theoretical and methodological approaches and practices of using cluster models for domestic regional formations.

The **aim of the article** is a thorough analysis of the theoretical and methodological foundations for the formation of an innovative form of development of territorial infrastructure based on clusters in the conditions of Ukrainian realities.

Study Methodology and Methods. As a theoretical and methodological basis of the study used the statement and developments of domestic and foreign scientists concerning the problems of the cluster approach and analysis, as well as personal assessments of the author. Analytical and abstractly logical methods of research, as well as methods of system analysis and synthesis for theoretical analysis of the essence and content of innovation clusters were used. For the analysis of existing approaches to the definition of economic essence of the category «cluster» and prerequisites for the formation of innovation clusters in the regions we used structural-logical methods.

Study results. Ensuring sustainable innovative development of national economy and economy of any country in conditions of changing present is possible to achieve with the use of progressive scientific and methodological approaches in process management both at national and regional levels. According to the positions of specialists in the sphere of management, it is reasonable to solve the problem of absence or imperfection of mechanisms of management of strategic innovative development of existing economic systems by way of optimal combination of possibilities and efforts of proper educational and scientific institutions, industrial and market structures, state authorities interested in the results of their functioning. Such associations among scientists are defined as clusters or otherwise points (poles) of growth. Processes of implementation of the cluster approach in economically developed countries of the world began to be actively applied in 70—80 years of the last century, when at liberalization of trade and transnationalization of world production was formed new economic systems, which changed the existing concept of socio-economic development. Under such conditions, countries require integration in global world processes, due to the objective development of large network structures and the rapid growth of the role of human potential as a necessary factor for sustainable growth.

The theoretical principles of the use of clusters for the formation of economic systems of a new formation have certain attributes, namely [11]: the cluster is created on the basis of interaction of human resources, providing the search for common interests and various forms of cooperation among socio-economic subjects; the realization of the cluster potential occurs through the use of advantages of the organizational resource. Vertical and horizontal connections between enterprises and elements of market infrastructure form effective motivational mechanisms among cluster participants; the cluster is an integral part of the regional innovation system. According to [12], cluster analysis highlights certain conditions of cluster emergence as signs of territorial-sectoral association in accordance with its essence, formed in the form of the concept of «5I»: initiative; interest; information; integration; innovation.

The first three components of the concept function as forms of interaction of human resources, the fourth is provided by using the formed organizational resource of the cluster, the last component of the concept is formed in accordance with the general Strategy of innovative development of the association.

Active application of the cluster approach in modern economic research requires analysis of the conceptual apparatus and terminology of clusters. *Table 1* shows the idea of the economic essence of the category «cluster» in the studies of various specialists.

Table 1

Existing approaches to the definition of the economic essence of the category «cluster»

Author	Interpretations, sources
M. Porter	Groups of companies, service providers, firms in related industries and organizations in certain areas, interconnected and geographically concentrated, operating together and simultaneously competing with each other [1]
M. Voynarenko	«Sectoral territorial voluntary association of enterprises, working closely with scientific institutions and local authorities to improve the competitiveness of their own products and the economic growth of the region» [2]
O. Varyanichenko	«Groups of geographically localized interconnected companies, suppliers of equipment, components, specialized services, infrastructure, research institutes, universities and other organizations that complement and strengthen the competitive advantages of individual companies and the cluster as a whole» [3]
I. Kosach	«A territorial association of interrelated enterprises and institutions within the relevant industrial region, which focus their activities on the production of world-class products» [4]
S. Sokolenko	«A group of closely related, geographically interrelated businesses and organizations that cooperate with them, operate together in a particular type of business, and are characterized by common areas of activity to produce world-class products and complement each other» [5]
O. Tishchenko	«Territorially-branch, competitiveness coordination network association of business structures, public organizations and scientific institutions, ensuring a competitive position at the meso, macro and mega levels» [6]
O. Kuzmin	«Geographically localized set of production-active subjects of economic activity with motivated and sustainable cooperative relations» [7]
M. Enright [8]	Cluster of industrial enterprises-firms that are located nearby according to the criteria of territorial accessibility [8]
UNIDO	Industry or geographic concentrations of businesses that produce and sell a range of related or complementary products and are therefore jointly affected by challenges and opportunities [9]
K. Kittels, G. Lindquist, E. Selwell	A group of companies and other institutions in related industries located together in a specific geographic region [10]

Note. Compiled from analysis of sources [1—10].

As the analysis shows (see *Table 1*), there is currently no unambiguous interpretation of the category «cluster» among scientists in the field of management and economics. The above fact makes it difficult to form the theoretical foundations and methodological foundations of cluster theory and their use in practical activities. The understanding of the category «cluster» in the economic literature is characterized by a significant number of approaches to understanding its essence and economic content. Thus, summarizing the above, it is reasonable to characterize the formation of a cluster as a synthesis of cooperation and competition, in a combination of resources creates favorable prerequisites for the development of innovation processes. The interrelation with internal needs of cluster consumers is based on competition, and with external — on cooperation. According to the author [13] it is a set of 7K, namely: concentration, cooperation, competition, communication, coordination, competitiveness, competence. That is, the formation of clusters in economic systems at any level — national, regional, local — should ensure the concentration of production and cooperation of actions of potential cluster participants over the development of innovation processes. Within the formed cluster it is necessary to ensure competition, communication, and coordination of activities. The presence of sufficient competence of cluster participants allows obtaining a synergetic effect for increasing the competitiveness of the socio-economic system. In the scientific literature there are certain classifications of clusters on various attributes. Thus, territorial clusters are divided into macroclusters (formed on the basis of distribution of innovation and resource potential of a certain area among several regions), meso-clusters (formed by concentration of enterprises on a certain attribute) and microclusters (municipal specialized).

National innovation clusters, regional production clusters, and local clusters are distinguished in public administration. According to [13, p. 515] as theoretical models three types of clusters are allocated: «pure agglomeration» (characterized by the general arrangement, however absence of internal communications); «Industrial complex» (participants are connected by internal

market relations, the considerable firm dominates, forms around itself environment) «Social network» (characterized by complex and long-term relations). According to the geographical scale there are localized and dispersed or scattered clusters; according to breadth or scope clusters are divided into broad and narrow; according to growth potential — in the industry context and in the context of competitiveness; according to the coordination mechanism there are clusters with stable market relations, clusters based on short-term coalitions based on long-term relations and hierarchy. Depending on the stage of development, there are working, latent or hidden, potential and politically managed clusters [14, p. 3—13]. The use of the cluster approach to enhance the competitiveness of socio-economic systems at various levels is characterized by their high efficiency and flexibility, as well as their rapid mobility. Compared to other forms of organization and cooperation of economic entities and power structures, clusters have certain advantages and disadvantages. The advantages of using clusters should include [15]: increasing access to various resources; increasing the efficiency of logistics flows between the participants of the cluster formation; reducing transaction costs; increasing the stability and predictability of financial flows; reducing financial and credit risks; qualitative improvement in the innovative development of cluster participants; intensive development of innovative, financial, marketing and other relations between the cluster participants. We see the disadvantages of the cluster approach in the following: the concentration of cluster participants on internal relations and, as a consequence, ignoring the environment outside the cluster; the possibility of reducing the flexibility of cluster participants due to its isolation; complications in assessing the effectiveness of each cluster due to their uniqueness; dependence of the results of the cluster on the effectiveness of each participant. In order to achieve the highest possible level of competitiveness of socio-economic systems at the national, regional, or local level it is advisable to implement the formation and use of innovative clusters. As noted by experts of the European Union (EU), «an innovation cluster is a group of independent companies — innovative start-ups, small, medium and large enterprises, as well as research organizations operating in a particular area and in a particular region and are designed to stimulate innovation activity through intensive interaction, joint use of facilities and exchange of knowledge and competencies, ensuring contribution to technology transfer, networking and information distribution between the subjects of cluster» [15, c. 10]. In [16, p. 8], the author defines innovative clusters as innovative environments created to develop processes of collective learning and social cognitive process, which result in the dissemination of local knowledge, synergy and accelerated cooperation. According to [17, p. 11], as a result of the formation of an innovation cluster, new knowledge and external effects arise as a consequence of their distribution. It is reasonable to highlight the features of innovation cluster, characterizing its advantages in relation to other socio-economic associations [18]: generation and implementation of joint innovation projects; close cooperation of science, education, and production; focus on prompt and effective commercialization of results; processes of mutual learning and communication among cluster participants the need for highly qualified personnel; close inter-industry relations.

Innovation clusters are characterized by certain system characteristics, the identification of which allows to describe it as a competitive and synergetic system, characterized by dynamism and a high level of adaptability. The system characteristics of an innovation cluster include: dynamism, adaptability, integrity, organicity, self-management and self-development or self-perfection [19, p. 148]. Thus, the essential characteristics of an innovation cluster are as follows: an innovation cluster is able to include other various types of clusters in a particular territory, provides for the formation and development of the innovation environment; the result of the functioning of innovation clusters is innovation in various fields of activity, namely, production, organization, social work, management, and the like; all participants of innovation clusters are connected with each other by the innovation development process, therefore, they form a single con To summarize, it is advisable to identify an innovation cluster as a socio-economic system at the regional level, contains industrial and non-industrial enterprises, scientific and social organizations, state and municipal institutions, consumers associated with participation in the innovation process for the purpose of positive progressive development of the region and its society, as well as the synergistic effect of co-functioning. Regional innovation clusters are formed under certain conditions (*Fig.*).
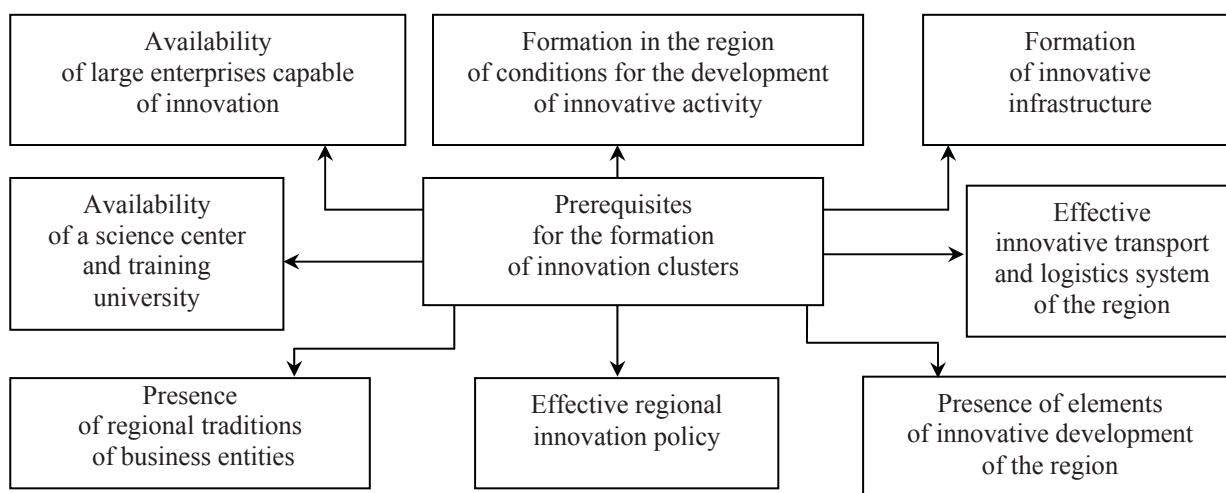
Fig. **Conditions for the formation of regional innovation clusters**
Note: compiled from analysis [19].

In the modern international economic experts on the implementation of the cluster approach, there are three geographically determined centers of development of innovation clusters, characterized by certain specific natural resource potential and traditions formed over a long period of time:
- North American;
- Western European;
- Asian.

Analyzing the experience of leading countries on the practice of forming cluster formations, it is worth noting that clusters are mainly formed at different levels (federal, regional, microlevel) in accordance with the industry specifics of participants (transport, tourism, clothing, etc.) and according to the type of innovation applied (technology parks, business incubators, industrial platforms, biotechnology).

According to the level of education, the most common among the countries of the world are clusters at the regional level, then comes the micro level, and the least of all clusters created at the state level. In the world practice the existing models of clustering are united into three basic models of cluster formation: Italian, Danish and Dutch, the general characteristic, typical features, and examples of use are systematized in *Table 2*.

Table 2

Features of basic models of formation of regional innovation clusters

Model name	General feature	Typical characteristics	Examples of use
Italian	The process of cluster formation occurs by evolution without government intervention	Lack of formalized structure, separate management structure, financial ties, close family ties, strong dependence on the territory, high independence from the government	Shoe cluster of northern Italy; watch cluster of Switzerland; wine cluster of France
Danish	State support for the clustering process	Availability of a network broker with the functions of a coordinator; formation of a phased training program; setting up contacts between permanent members of the cluster; formation of strategies for cluster networks	UK, USA, Canada, Australia, New Zealand
Dutch	Synergistic effect of combining the efforts of manufacturing enterprises with research institutions	Dissemination of access to new technologies, information, and knowledge; activity of government innovation policy; synergistic effect of cooperation between business and science	Holland

Note. Created based on [21].

Porter M. E. notes, which considering features of regulation of activity of innovative cluster formations by the state, it is expedient to allocate two models — dirigiste and liberal. The first model is implemented mainly in the countries where the active participation of the state in the processes of economic regulation (for example, Japan, Sweden, France, Korea, etc.) is noted [19].

Active state intervention of the state of the above countries in the development of innovation clusters occurs during the entire period of their formation and operation, starting with the justification of priorities of strategic and expedient clusters and financing of projects of their formation and ending with the definition of their key success factors to achieve the objectives of activity.

The following model of state regulation of clustering the economy is characteristic of countries with weakened government intervention in business, i.e., Australia, Canada, USA. In the liberal model, clusters get the most natural direction of development as an organic market formation.

The main regulatory bodies on the part of the state are regional and local state institutions, the purpose of which is to elaborate and support the development strategies of the formed clusters. Thus, the state plays an auxiliary role in the functioning of clusters. The analysis of foreign experience in the clustering of economic systems allows to assert that innovation clusters, as a rule, include economic entities with different functional tasks, but all of them are connected by a single high-tech production, actively develops [20; 21].

Summarizing the analyzed practical experience of developed countries on the clustering of socio-economic systems, it is worth noting:

- the increasing complexity of the requirements for the quality and innovativeness of the products or services produced requires the fusion of the efforts of manufacturers, scientists, and authorities in order to create synergies within innovative cluster formations;
- the achievement of high-tech of a significant part of modern production requires the presence of integral communication networks;
- accelerated regional development is currently most effectively obtained through the formation of innovation clusters.

Modern Ukrainian national economy lacks an active introduction of innovative technologies through effective state regulation. Regions, in which it is projected to implement the formation of clusters, should have sufficient capacity to form an innovative model of development. It seems appropriate as a positive experience to use the Indian model of clustering socio-economic systems, while the application of the Finnish or North American model is difficult because of the low level of development of market institutions, underdeveloped competition, and the like.

If we consider the possibility and feasibility of implementing the Italian, Danish or Dutch model to the Ukrainian regions, it should be noted that the first model of clustering can develop among the regions of the country objectively, without assistance or obstacles from the local or central authorities. The use of the Danish or Dutch model or their variants meets a certain bureaucratic resistance. «Realization of the innovative policy in Ukraine may rely upon the experience of the innovative leader — Switzerland in the sphere f decentralization of management and insurance of the creation of competitive advantages of each region through the creation and efficient functioning of the clusters» [22].

The current situation in the implementation of cluster models is characterized by the existence of developed strategies for regional development over the next 10 years, only three areas have not been approved for implementation. Practically only two regions — Transcarpathian and Kyiv regions — in the near future plan to form a regional industry cluster using innovative wood processing technologies, as well as a transport and logistics cluster. In other words, we can assert that the above-mentioned oblasts have formed approaches to the formation of clustering policy and propose the expansion of cross-border projects implementation with the financial support of the EU.

The analysis of regional innovation development strategies of Donetsk, Volyn, Sumy, Lviv, Chernivtsi and Ivano-Frankivsk regions indicates that clusters are not used as development models,

but attention is paid to the processes of network and market infrastructure development, creation of technological and industrial parks [21].

As for the Odessa, Rivne, Zhytomyr, Zaporizhzhia, Chernihiv and Kherson regions, their Strategies are mostly descriptive in nature, define the range of problems and determine the formal, possible ways of their solution.

In the Strategy of development of the Nikolaev and Kharkiv regions there is no use of the term «cluster», but their economic growth is de jure planned on an innovative basis, Kharkiv region plans for the future development of value chains of small and medium agricultural production [21].

It should also be noted that there is little evolutionary application of models of clustering of socio-economic systems of certain border regions based on the experience of adjacent regions of neighboring countries.

«Thus, differentiation of Ukrainian regions by territorial feature, infrastructure development and the level of social and economic development is displayed on chronic imbalances of their local budgets» [23]. It is a shame, but in Ukraine there are certain obstacles to the active development of innovation clustering, namely: the insufficient level of qualification of specialists of public administration at all levels and historically established type of mentality, as well as relatively weak development of information infrastructure. To overcome these obstacles, it is advisable to coordinate clustering with Poland, Slovakia, Hungary, Romania, and Moldova.

Discussion. Since there is no unambiguous interpretation of the category «cluster» among scientists in the field of management and economics, the formation of theoretical foundations and methodological bases of cluster theory and their use in practical activities is now precisely a difficult, systemic task. The use of the cluster approach to enhance the competitiveness of socio-economic systems at various levels will improve their efficiency and flexibility and accelerate the mobility of the latter.

It is reasonable to characterize an innovation cluster as a socio-economic system at the regional level, containing industrial and non-industrial enterprises, scientific and social organizations, state and municipal institutions, consumers associated with participation in the innovation process for the purpose of positive progressive development of the region and its society, as well as the synergistic effect of joint functioning.

Foreign experience of clustering economic systems made it possible to distinguish economic entities with different functional tasks in the composition of innovation clusters, which are connected by a single high-tech production, actively developing.

The conducted analysis allowed to assert that in Ukraine there are sufficient prerequisites for the emergence and formation of territorial clusters on the basis of innovation, but the practical implementation of cluster mechanisms is overloaded with a number of reasons.

The study is of practical importance for the creation of conditions to improve the competitiveness of the regions of the country and the level of their development.

Conclusions. The relevance, necessity, and prospects of the use of cluster models to enhance the processes of innovation development of regions requires further research in the direction under study. It seems appropriate to apply the practical experience of forming innovation clusters of developed countries of the world. The need for implementation of the cluster approach in the practical activities of domestic socio-economic systems at the regional level is proved by the identified problems in the current state of clustering of certain areas of the country.

Prospects for research in this direction is the development of effective mechanisms for clustering areas of the country by industry based on the use of innovative development models.

Література

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