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AmurCon 2021: International Scientific Conference**INNOVATION CLUSTER AS A TOOL FOR INNOVATIVE  
DEVELOPMENT OF THE RUSSIAN ECONOMY**

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**Abstract**

One of the most pressing problems of the Russian economy is the insufficient realization of the country's potential in the development and implementation of innovations and in the production of innovative products increasing the competitiveness of Russian enterprises in the world market and, as a result, increasing the competitiveness of the Russian economy as a whole. An innovation cluster as the highest form of clustering based on the "triple helix" model as an interaction between the government, business and science, is able to stimulate economic growth and innovative development in Russia, primarily due to the initial focus on the production of an innovative product in parallel with scientific research and highly qualified personnel training. The purpose of this study is to determine the essence of the innovation cluster as a tool for the national economic development: to study cluster's specifics, signs, factors influencing the formation of a cluster and the effectiveness of its functioning, to improve the algorithm for its formation, to identify the opportunities and risks faced by cluster's subjects: the government, region, small and large business, research and educational organizations. The article analyzes the existing algorithms for the formation of an innovative cluster and proposes the author's algorithm: the first and key stage in the formation of an innovative cluster is the designation of the purpose of cluster's creation, and the cluster's structure depends on what is the innovative task is needed to be solved in the field of industry, science or the public sector.

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## 1. Introduction

In the modern economic system, the innovative component of economic activity is the main factor of competitiveness of an economic agent at any level: enterprise, region, national economy. The company creates a competitive product to meet the requirements of the market. Innovative enterprises bring the region economy to a fundamentally new level. Innovative development and the introduction of innovations are the main indicators of the state of the national economy today.

The external environment as a system is characterized by three features which are most important for all economic agents: complexity, uncertainty, constant change at a rapid pace. The complexity is expressed in the variety of direct and indirect connections of economic agents and objects, in their mutual influence. Uncertainty as systemic economic, political and social risks that cannot be probabilistically assessed is an integral part of the development of national economic systems. The rapid pace of change is due, among other things, to rapid scientific and technological development, which is reflected in the shortening of the product life cycle and the constant demand for the development and implementation of innovations by the market system.

The government plan of innovative development of Russia "Strategy 2020" was implemented not completely. One of the main priorities of the innovative development of the national economic system, according to the "Strategy 2020", is the growth of innovative activity of manufacturing enterprises and the introduction of innovations. Thus, by 2024, the share of organizations engaged in innovative activities in the field of technology should grow to 50%. In fact, the share of such industrial enterprises in 2020 is about 10%, as in 2011. The share of domestic high-tech products in the total world exports was supposed to reach 2%. In fact, this figure is less than 1%). Also, the cost of research and development was supposed to be 3% of GDP; at the moment, this figure is slightly more than 1% (Silakova & Grigor'ev, 2021).

"Strategy 2020" and its implementation clearly showed the existence of problems in the functioning of the Russian national innovation system and the need to improve innovation management tools. Clusters are the such tools; their effectiveness has been confirmed by a significant number of studies. Today clustering has reached its most complex form – innovative clusters. This process is relevant at the moment for any national economy.

It should be noted the importance of clusters not only for strengthening the competitiveness of the national economy by creating high-tech products, but also the ability of this tool to effectively solve problems and tasks where government is necessary, in most cases through the introduction of innovations. The government, as well as science and education, are an integral part of innovation clusters; it is especially important for the implementation of innovative projects of national importance.

## 2. Problem Statement

Disadvantages of Russian system of development and implementation of innovations and innovation management are a factor hindering the economic development and growth. The problem is complex and is caused by many reasons, including systemic ones. Clustering can't be called something new for the Russian economy. The prerequisites of the modern cluster approach applied in Russia originated in the Soviet system. A cluster uniting industrial enterprises should be regarded as a tool for

managing the national economy. Innovation clusters can fairly be considered the most complex form of clustering and a potential tool for increasing the efficiency of the Russian innovation system. Improving the cluster approach in the field of innovation can eliminate gaps in the development and implementation of innovations in Russia.

### **3. Research Questions**

The subject of this study is the formation of an innovation cluster as an economic agent capable to stimulate the innovative development of the Russian economy through the production of competitive innovative products.

### **4. Purpose of the Study**

The purpose of the work is to show the importance of the innovation cluster as a tool for the development of the Russian economy in the field of development and implementation of innovations:

- to consider the conditions, factors, goals and objectives of the formation of an innovation cluster as an independent economic agent capable to create innovative competitive products and stimulate the innovative development of the national economy;
- analyze the existing algorithms for the formation of an innovation cluster and offer recommendations for improving the algorithm;
- to identify the risks and opportunities of innovation cluster's subjects: the government at the national and regional levels, small and large businesses, science and education organizations

### **5. Research Methods**

Analysis of existing definitions of a cluster and approaches to the study of the process of cluster's formation, the concept of an innovative cluster and its characteristic features and algorithms for the formation of an innovative cluster.

Synthesis of the author's algorithm for the formation of an innovative cluster based on the considered algorithms; it is proposed to take into account that the creation of innovative products is the goal of forming a cluster, on which the next steps should depend.

Classification of opportunities and risks of carrying out activities within the framework of an innovation cluster by the types of its subjects: government, region, small business, large business, science and education.

### **6. Findings**

#### **6.1. Innovation cluster: purpose, principles and models of formation**

The foundations of the modern theory of clusters were formulated by M. Porter in 1990 in his model of analysis of the territory's comparative competitive advantages. A cluster is a group of geographically concentrated enterprises and organizations involved in related activities and interacting

based on their identity and complementarity. A cluster is a complex dynamic network-type system (ecosystem) with vertical and horizontal connections, the cluster's subjects are legally independent, are partners and interact in the format of interactive cooperation (Smorodinskaya, 2018). Cluster is a geographically localized group, isolated of enterprises in the industry, independent, with internal competition, cooperation, a single center and a single system of services. Thus, the cluster has four basic characteristics: it's a group of enterprises, the enterprises are geographically localized, interconnected and innovation (Lapygin & Tulinova, 2020).

The main advantage of the cluster and at the same time the main goal of its creation is the growth of opportunities for its participants to create an innovative product, and as a result, the development of the regional and national innovation systems. In the modern world, product innovation is often the main condition for competitiveness, therefore, clustering should lead to the creation of a product that will do enterprises highly competitive in regional and global markets (Babkin et al., 2020b). The goal is achieved through the accumulation and rapid exchange of knowledge, stimulation of innovation, pooling of resources, cost reduction, territorial proximity of subjects, multiplicative and synergetic effects. All of the above forms the potential of the cluster (Druzhinin & Alekseeva, 2020; Lapygin & Tulinova, 2020; Strizhenko & Rogozin, 2016). There is both competition and cooperation between the subjects of the cluster, and it contributes to faster innovation. The competitive positions of cluster's subjects are significantly strengthened. Cluster connections highlight weak links in the chain of creating an innovative product, and the cluster's capabilities make it possible to attract investors and businesses more effectively to solve the identified problems; it contributes to the development of small and medium businesses in the regions, strategic development of the region, import substitution (Babkin et al., 2020a; Jasheva, 2016).

The conditions for the formation of clusters include:

- geographical proximity of potential cluster subjects;
- close relationship between the subjects;
- mutual benefit from horizontal ties;
- combination of cooperation with competition;
- cost reduction due to the integration and innovative component of products;
- growth of added value in the cluster product (Lapygin & Tulinova, 2020)

In modern conditions, in order to increase competitiveness, technological interaction between cluster's members should be interdependent. Such connection becomes a catalyst for the system's innovative development, accelerates its pace. At the same time, the stronger the technological interdependence, the more sensitive the cluster will be to changes in the external environment. (Strizhenko & Rogozin, 2016) Therefore, a flexible cluster development strategy and constant technological adaptation are needed.

Based on the study of modern sources on the topic of clustering, two approaches to the study of the cluster formation can be distinguished: industry and innovative. The industry approach is to form clusters based on the cooperation of existing industry complexes. The innovative approach is based on the innovative component of the joint activity of the cluster participants as the main condition for clustering. The question arises: how appropriate is it today to separate the concepts of "cluster" and "innovation

cluster"? The main goal of clustering is to increase competitiveness; this process already implies, in most cases, an innovative product. When such a cluster structure as the association of subjects geographically around a scientific and educational center characterized by partnerships with institutional and state structures is described, of course, we are talking about an innovation cluster based on the "triple helix", a model of effective interaction between the state, business and universities (research and educational organizations).

Cluster resources: material, financial and informational (Karpov et al., 2017).

The formation of clusters is influenced by such groups of factors as scientific and technological, institutional, geographical, global and legislative (Babkin et al., 2020c). It is also possible to distinguish industrial, regional and federal factors (Lapygin & Tulinova, 2020).

Three interrelated factors are essential for the effective formation, development and functioning of innovation clusters:

1. the quality of the economic environment of the region in which the cluster is formed;
2. cluster organization and management model;
3. efficiency of coordination within the cluster (Smorodinskaya, 2018)

The following "national" cluster models are distinguished.

Italian: association of a large number of small firms into various associations in order to increase the competitiveness of these firms. Low technological level of products.

Japanese: the cluster is formed around a leading company with large-scale production and with many integrated suppliers at various stages of the production cycle. High technological level of products.

North American (USA, Canada): characterized by strong competition between cluster enterprises and is possible if the production process within the cluster doesn't imply a close relationship between the cluster's subjects. Due to competition and mass production, a low cost of the product is achieved.

Indo-Chinese: the government plays a key role in the cluster. Foreign investments are attracted, new technologies are being developed, high-tech products are being produced and companies are entering the world market.

Finnish: high level of innovation due to interaction with research and educational organizations. This model is characterized by a high degree of business's internationalization (Strizhenko & Rogozin, 2016; Zhilnikov, 2013).

As signs that the formed innovation cluster will meet the goals and objectives of its creation, it should be noted:

1. the presence of three elements of "spiral" in the cluster's structure: government, business, education;
2. territorial concentration of subjects (the distance between subjects is not more than 200 km);
3. the presence of a unified, well-coordinated team, information openness, mutual trust;
4. the presence of an innovative ecosystem, a business environment that supports startups and is based on best practices of the "Rainforest" type (Silicon Valley business environment);
5. the number of subjects in both specialized and related industries is 100-150 (the so-called "critical mass");

6. horizontal network connections between subjects should be characterized by increasing density and intensity;

7. balance between specialization and diversity;

8. balance between cooperation and competition (Smorodinskaya, 2018)

## **6.2. Algorithm for the formation of an innovation cluster**

Let's consider the basic algorithm for creating a cluster (Lapygin & Tulinova, 2020). The cluster is represented as a project consisting of the following stages.

1. The initiative of stakeholders, the creation of a project team, the involvement of experts and consultants.

2. SWOT-analysis of the proposed cluster, determination of its mission, vision, goals, conducting foresight sessions.

3. Development strategy and a cluster project creating.

4. Identification of cluster's participants, events, documentating of the new structure.

The regional cluster formation model is implemented in six consecutive steps (Zhilnikov, 2013):

1. Definition of industries and complexes of the region's specialization.

2. Analysis of the territorial location of potential cluster's subjects.

3. Determination of the presence and closeness of relationships between subjects.

4. Analysis of infrastructure and availability of unified service centers for servicing cluster's subjects.

5. Identification of innovative activity of the future cluster.

6. Assignment of the "cluster" status to the new association.

In this model, the ability of a cluster to create innovative products is determined at the final stage of its formation.

The algorithm for forming an innovation cluster directly begins with an analysis of the innovation potential and innovation infrastructure of the region. Then promising directions for the development of innovative activities in the region are determined. The third step of the algorithm is the analysis of the influence of external and internal factors on the formation of an innovation cluster. At the fourth stage, criteria for evaluating the effectiveness of combining subjects into an innovation cluster are being developed. At the fifth and sixth stages, the concept of development and the model of the innovation cluster are formed. The seventh stage is making a decision about which tools will be used to implement the cluster model. The final, eighth step of the algorithm is the development and testing of cluster formation and management tools, and these tools must use the innovative potential of the created cluster most efficiently. The ninth stage is also designated; it is possible adjustments from the fourth stage (cluster's efficiency criteria) to the eighth (development and testing of innovative cluster's management tools) (Stepanova, 2014).

If the purpose of creating a cluster is the innovative development of the region, then it is fair to start forming a cluster by determining the priorities of region's innovative development.

1. Selection of priorities for the territory's innovative development (involvement of experts).

2. Determining the composition of participants in the innovation process.
3. Formation of the preliminary passport of the cluster.
4. Risk assessment.
5. Formation of the cluster's management and procedures for cluster's paperwork.
6. Increased integration and improved coordination of business processes in the region (Tronina, 2020).

The sixth and final stage of the formation of an innovation cluster can be considered as a positive consequence of this process for the region.

A significant advantage of the presented cluster formation algorithms as a tool for managing the economic system and innovative projects is the reliance on the existing resource base of the region and the established relationships between potential cluster participants. In parallel, there is an assessment of the innovative potential of the future structure and the influence of environmental factors on it. But it is important to note that, since the main goal of creating an innovation cluster is an innovative competitive product, it would be advisable to focus the algorithm initially on the innovation for what the cluster is being created. Thus, the authors propose the following algorithm for the formation of an innovation cluster.

1. Designation of the purpose of creating an innovation cluster.
2. Identification of potential cluster's participants – enterprises, organizations, government and educational structures, taking into account:
  - a) innovation potential;
  - b) priorities of innovative development of the region;
  - c) the closeness of relationships;
  - d) availability of innovative infrastructure;
  - e) territorial proximity.
3. Conducting a SWOT-analysis of the cluster being formed.
4. Creating of a cluster's development strategy.
5. Definition of the cluster's management structure.
6. Procedures for cluster's paperwork

### **6.3. Opportunities and risks of participation in the innovation cluster**

An innovation cluster is impossible without the participation of the government and scientific and educational organizations. The structure of the innovation cluster is based on the "triple helix" model – the harmonious interaction of the government, business and science, the key elements of the innovation system of any country. "Business" means enterprises and organizations focused on the development and production of innovative products. "Science" is not only scientific research, but also universities, where also science is developed, innovations are created and high qualified personnel that meets the requirements of the modern innovative environment is trained.

Let's consider what opportunities and risks participation in an innovation cluster contains for its subjects: the state, the region, small and large businesses, science and education.

**Table 1.** Opportunities and risks of participation in the innovation cluster\*

Participant	Opportunities	Risks
Government	<ol style="list-style-type: none"> <li>1. Creation of a flexible cluster-network organization that allows self-adaptation to the continuous change of technologies and sharply increased uncertainty.</li> <li>2. Stimulating innovation in small and medium-sized enterprises.</li> <li>3. Development of inter-cluster cooperation in order to form new innovative sectors of the economy.</li> <li>4. Cost reduction through the introduction of a cluster model of self-organization of regions.</li> <li>5. Development of cross-border intercluster relations.</li> <li>6. Improving the efficiency of spending public funds through integrated project subsidies.</li> </ol>	<ol style="list-style-type: none"> <li>1. Fragmentation of the economy at the interregional, interindustrial and inter-firm levels.</li> <li>2. Monopolization of markets.</li> <li>3. Inaccurate assessment of the effectiveness of the cluster policy of the regions.</li> <li>4. The formation of clusters exclusively for obtaining federal support.</li> </ol>
Region	<ol style="list-style-type: none"> <li>1. Attracting new companies to the region and developing new sectors of the economy.</li> <li>2. Inflow of direct and indirect investments.</li> <li>3. Increase of tax revenues to the budget.</li> <li>4. Reduction of transaction costs.</li> <li>5. Formation of regional value chains.</li> <li>6. Using the potential of associations in which the emergence of a “triple helix” is possible.</li> <li>7. Positioning.</li> <li>8. Promotion of cluster’s products in domestic and foreign markets.</li> </ol>	<ol style="list-style-type: none"> <li>1. Weak partner networks and lack of skills in developing horizontal ties.</li> <li>2. Reliance on regional budgets and benefits of special territories.</li> <li>3. Temporary participation of subjects in the cluster only to attract budget funds.</li> <li>4. Federal support only for fast-growing clusters-leaders.</li> </ol>
Small business	<ol style="list-style-type: none"> <li>1. Promotion of small companies to national and global markets.</li> <li>2. Receiving tax deductions and benefits.</li> <li>3. Establishment of network interaction with innovative companies and scientific and technological centers.</li> </ol>	<ol style="list-style-type: none"> <li>1. Focus on large business.</li> <li>2. The influence of large companies in making decisions about the cluster development strategy.</li> <li>3. Lack of intermediate investment demand.</li> <li>4. Limitation of financing for specific projects.</li> <li>5. Prioritization of economic sectors for promotion (the cluster’s idea focuses on the high-tech sector).</li> </ol>
Large business	<ol style="list-style-type: none"> <li>1. Attracting small innovative enterprises as contractors.</li> <li>2. Receiving tax deductions and benefits.</li> <li>3. Access to highly qualified researchers on outsourcing within the framework of project activities.</li> </ol>	<ol style="list-style-type: none"> <li>1. Lack of potential of final consumer demand.</li> <li>2. The need to sponsor cluster activities.</li> </ol>
Science and Education	<ol style="list-style-type: none"> <li>1. Obtaining funding for research.</li> <li>2. Creation of joint educational</li> </ol>	<ol style="list-style-type: none"> <li>1. The possibility of leakage of the results of intellectual activity.</li> </ol>



<p>programs with industrial partners,                  practical orientation of education.</p> <p>3. Approbation of scientific                  developments.</p> <p>4. Commercialization of the results of                  scientific activity</p>	<p>2. Lack of material incentives for the                  development of innovative activities                  for the university's staff.</p> <p>3. Implementation of the idea of the                  "triple helix" nominally.</p>
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\*compiled by the authors based on sources: How... (2016), Rumjanceva et al. (2021), Smorodinskaya (2018).

As can be seen from Table 1, the creation, participation and development of the innovation cluster model is multidirectional. Regional and federal authorities demonstrate great involvement in the implementation of cluster policy for a number of objective reasons, and this can explain the directive principle of cluster formation. Scientific and educational organizations have a high motivation to participate with minor risks, while for businesses, especially small ones, participation in clusters has a less unambiguous effect. For most Russian companies, an acute problem remains the shortage of their own and attraction of external investment funds and the limit of consumer demand. At the same time, the refusal to interact according to the "triple helix" model will not allow business and scientific and educational centers to achieve competitive advantages in the national and global markets, and the government to take a leading position in the global economy. In order to cope with the existing and continuously emerging challenges, it is necessary to take into account the risks that each subject of the cluster ecosystem may face, and develop a response strategy, develop a personalized incentive system to involve new organizations and maintain interest in the innovation and production activities of cluster's participants in the long term.

The basic principles of the policy regarding the formation of clusters and their management were fixed in Russia at the legislative level in 2008, when the "Methodological recommendations for the implementation of cluster policy in the subjects of the Russian Federation" were formulated (approved by the Ministry of Economic Development of the Russian Federation No. 20615-ak/d19 on December 26, 2008). In part, these principles were a continuation of the Soviet principles of managing territorial production complexes, but at the same time they met the requirements of modern economic systems. (Druzhinin & Alekseeva, 2020) Over the past decade, 117 industrial clusters have been created in Russia with a total number of employees of approximately 1.5 million people. In 2012 and 2014, there was an increase in the number of clusters being created, followed by a decline due to adverse environmental factors, including sanctions from the United States and European countries. In 2020, the average number of participants in one cluster in Russia is slightly more than 30 subjects with an average number of 12377 people. The distribution of cluster structures across Russia is uneven. The leaders in the number of clusters are the Central, Privolzhskij and North-Western Federal Districts (Lapygin & Tulinova, 2020).

The government, on the one hand, contributes to improving the stability of the functioning of cluster's members, on the other hand, as a bureaucratic system hinders the development of clusters.

## 7. Conclusion

The modern national economic system depends in its development on the factors of scientific and technological progress more than ever. It is possible to overcome this dependence by becoming one of the leaders in the development and implementation of innovations; it will significantly accelerate the pace of economic growth, increasing the competitiveness of manufactured products, enterprises, industries, and the economy as a whole. If we analyze the indicators of Russia's innovative development, we can conclude that the Russian innovation system is not sufficiently developed, in spite of a powerful innovation potential. Innovation clusters, for the creation of which Russia has significant resources, are a tool that can strongly stimulate innovation activity in the country through, first of all, harmonious interaction of industrial enterprises, government agencies, research organizations and universities. Three elements: business, government, science form the well-known "triple helix" model, which is the basis of the structure of the innovation cluster.

The formation of innovation clusters should take place not according to the industry, but according to the innovation principle. Of course, it is important to take into account the resource potential of the participants, their territorial proximity and the closeness of horizontal and vertical relationships when forming a cluster. But at the forefront should be an innovative task that needs to be solved by clustering. Then, based on the designated goal of creating an innovation cluster, the composition of the cluster's subjects is formed, not only based on their capabilities in principle, but also on the capabilities to solve the designated task in the field of innovation, and all characteristics should be taken into account, especially the innovative potential and priorities of innovative development of the region. Then it is necessary to conduct a SWOT-analysis of the future cluster, form a strategy for its development and determine its management structure. The result should be an increase in the competitiveness of cluster's participants through the implementation of innovative activities and a synergistic effect in the form of creating a new competitive product or solving a regional problem by innovative technologies.

Participation in an innovation cluster brings both new opportunities and risks for its subjects, which must be taken into account when forming a cluster development strategy that in turn should be flexible and adapt to changes in the external environment. It is also advisable to create a personalized incentive system to attract promising organizations to the innovation cluster. And, of course, it is impossible to ignore the "downside" of the government's participation in the formation of an effective innovation cluster: the bureaucratic system that can slow down its development.

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