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**INTERACTION OF INNOVATION CLUSTERS, SCIENCE AND  
EDUCATION**

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*Abstract*

The article analyzes the scientific theories of cluster formation in the economy. The concept, structure and order of formation of an innovation, as well as functions, are defined. The concept of an innovation cluster, the order of its formation and interaction with different subjects, the functions of the innovation cluster show the state of the constituent blocks of the cluster. An influence of the innovation cluster on the educational process to improve the competitiveness of subjects of various sectors of the economy is defined. The article demonstrates schematically the essence and the meaning of the functioning of the innovation cluster, which is to obtain the effect of synergy from the connection in one innovation cycle of research, education, innovation and productive activities. The functions of the three blocks of the innovation cluster are educational, scientific-innovative and industrial. The interrelation of the three blocks of the innovation cluster is defined. Research organizations participating in the cluster can attract students studying in educational institutions of the cluster, as well as have potential customers from among the production enterprises of the cluster, which facilitates the process of commercialization of innovations. Finally, manufacturing plants gain an access to top-level personnel and the scientific potential of research organizations. The comprehensiveness of innovation clusters is their advantage in integrating science and education.

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**Keywords:** Education, innovation cluster, economy, competitiveness, production, educational process.



## **1. Introduction**

In the context of accelerating the pace of scientific and technological development and informatization of society, the key role in ensuring the competitiveness of products belongs to the efficiency of research and innovation activities of the enterprise. However, this activity is characterized as highly risky and resource-intensive.

## **2. Problem Statement**

At present, special attention is paid to new mechanisms and forms of cooperation that allow one to consolidate resources and obtain a synergetic effect from the interaction of production, science, education and public administration within a single association.

## **3. Research Questions**

The main research question is what the interaction of innovation clusters, science and education is.

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

The purpose of this article is to analyze the interaction of innovation clusters, science and education.

## **5. Research Methods**

The authors use research methods such as comparison, analysis in the course of the study.

## **6. Findings**

Clusters occupy a special place among modern forms of integration. The cluster is an association of manufacturing companies, research and educational institutions, equipment and service providers working together to solve a common task in order to obtain competitive advantages, create knowledge-intensive and high-tech products (Guidelines for the implementation of cluster policy in the subjects of the Russian Federation, 2008). In other words, it is a group of enterprises and organizations concentrated in a certain territory, operating jointly in one or related industries in terms of long-term business and technological cooperation.

The theory of clusters originates in the XIX century. Thus, Marshall described the relationship between efficiency and geographical localization of production, choosing urban agglomerations and industrialized areas as the object of study (Marshall, 1993) Exactly Marshall proved that the productivity of enterprises and organizations depends on their spatial location and geographical proximity of economic agents (Bykova, 2017). Similar ideas have been expressed by F. Perrou, when speaking of the dominant economy, industries-motors and the poles of growth (Guidelines for the implementation of cluster policy in the subjects of the Russian Federation, 2008).

However, in the modern form the theory of clusters was formed only in the 80s of the XX century. M. Porter is considered as the founder of the theory of clusters. In the course of his research, he proved that large competitive companies tend to concentrate in certain territories. This is because competitive

companies have a positive impact on the surrounding economic entities, which, in turn, create a favorable climate for improving the competitiveness of all participants in the interaction (Migranyan, 2002).

Thus, the basis of the cluster approach consists of two ideas: the dependence of the efficiency activities of the cluster members, firstly, on their geographical concentration, and secondly, on the level of development of interactions, transfer of knowledge and technology inside the cluster. The main indications of the modern economic cluster include: territorial concentration of cluster members; high-quality business and technological interrelationship between cluster members; strong competitive position and high export potential of cluster members; the presence of resource competitive advantages in the cluster-based territories; a single management body that forms the overall policy of the cluster and coordinates the actions of its participants.

Since geographical concentration is one of the most significant signs of a cluster, the concept of a "regional" or "territorial" cluster is quite often used. The regional cluster is a "network structure that includes representatives of the government, business community, civil society organizations in the region, tight-knit around the core of competitive economic activity" (Guidelines for the implementation of cluster policy in the subjects of the Russian Federation, 2008). It is a group of companies concentrated in a certain territory, functioning in one or related industries and supporting their institutions.

The main feature of the regional cluster is a pronounced geographical concentration of its participants in a certain region (Kolb & Kolb, 2005; Barasheva, 2009). This feature distinguishes regional clusters from technology platforms as production associations, scientific and educational organizations across the country.

The most commonly used classification is by the main activity and the purpose of the cluster. In the economic literature, the following types are distinguished: an industrial cluster, a research and production cluster, an educational cluster, an innovation cluster and others. All of them are a form of cooperation of enterprises, research and educational organizations, representatives of the government, the business community and civil society, effectively interacting and increasing the competitiveness of each other and the system as a whole.

Currently, significant attention is paid to the research of educational clusters. Under them is understood as "a set of interrelated institutions of vocational education, united by industry affiliation and partnership with industry plants, as well as a system of teaching in the innovation chain science-technology-business, based mainly on horizontal links within the chain" (Smirnov, 2010). The main objectives of the educational cluster are the organization of an effective process of training demanded specialists of various kinds, raising the prestige of professions, creating conditions for improving the level of education of the population.

This specified task can be implemented only on the basis of the principle of continuous education and horizontal coordination of participants, so in membership the educational cluster necessarily includes institutions of higher, secondary and primary vocational education. Production enterprises and scientific organizations rank second in this case. At first glance, within the educational cluster, the integration of science and education is sufficiently ensured; however, the educational process prevails. Therefore, the process of integration of science and education can be more effective in innovation clusters.

There are different definitions of innovation clusters (Assidy, 2004; Felder & Silverman, 1988; Barasheva, 2009), in particular, the cluster is understood as "a geographically concentrated group of interrelated innovative organizations that complement each other and reinforce the competitive advantages of the cluster as a whole as a result of the synergetic effect. Additional benefits from intra-cluster competition and cooperation arise due to the specifics of the interaction of the cluster core firms with other auxiliary organizations participating in the cluster through vertical and horizontal links" (Disposal of the Government of the Russian Federation of December 8, 2011 № 2227-R). That is, the innovative cluster should imply an integrated set and sustainable functional relationship of research, design and technology, educational, productive, specialized, experimental organizations, as well as organizations of suppliers of equipment, components, parts, materials, service, consulting and other services. They directly perform or service the procedures of innovation cycles and related relations of agreed activity, territorial proximity and functional and technological interconnection at the junction of the main or service functions of the innovation cycle. Innovation clusters combine the signs of scientific, industrial, educational and industrial clusters (Felder & Spurlin, 2005). Therefore, their most important feature is the mandatory participation in the cluster of organizations active in the industrial, educational and research fields. The processes occurring inside the innovation cluster have the consistently parallel character. This means that educational and research organizations are not considered as elements of infrastructure, but as full-fledged members of the cluster, such as production and service enterprises. The purpose of the activity of innovative clusters is to form an effective system of interaction and cooperative of science, education and production to improve the competitiveness of cluster members, the region where it is located, and the national economy as a whole (Garrison & Kanuka, 2004).

The purpose of the functioning of the innovation cluster is to obtain the effect of synergy from the connection in one innovation cycle of research, education, innovation and production activities (Gu & Sumner, 2006).

In addition to the standard functions for managing the overall potential of the cluster and its participants, it is necessary to identify specific functions related to the essence of the innovation cluster. Such special functions can be divided into: scientific and innovative, educational and industrial.

Within the production block, it is possible to allocate exploitation of new types of production and expansion of the range, increase in the technological level of production and modernization of the material and technological base, production of prototypes of equipment.

The research and innovation unit includes the following functions: development of scientific and innovative potential of the cluster, creation of a reserve in promising areas of science and technology, creation of a favorable innovation climate within the cluster, ensuring the dissemination of knowledge and technological transfers improving the efficiency of commercialization of innovations, legal support for the protection of intellectual property, development and implementation of common research projects of cluster members, formation of small innovative enterprises for implementation of innovative projects of cluster members.

Special attention should be paid to the educational unit, which provides for the development of human resources of the cluster, the creation and implementation of innovative educational technologies, the formation of a system of continuous learning. All three blocks of functions are closely interrelated and

complement each other, forming a system of dissemination of knowledge and reproduction of human and intellectual resources. Educational institutions have the opportunity to adjust the methods of training, based on the requirements of other members of the cluster to potential employees, as well as to provide employment of graduates. It is possible to develop special training courses and training programs for skills development, organization of internships and practical training based on scientific organizations and enterprises, which will increase the level of both theoretical and practical knowledge of students. It should be noted that there are wide opportunities to form educational programs on the basis of educational institutions that are part of innovative clusters for the management of innovative activities. A direction is especially relevant for solving the problem of adaptation of the education system to the transition to an innovative way of economic development, set in the strategy of innovative development of the Russian Federation for the period up to 2020: "an important task of the education system will be the orientation of educational programs to teaching the skills necessary for innovation, including analytical and critical, thinking, the desire for new, the ability to practice constant self-learning, readiness for reasonable risk, creativity and entrepreneurship, as well as readiness to work in a highly competitive environment" (Disposal of the Government of the Russian Federation of December 8, 2011, № 2227-R).

## 7. Conclusion

Research organizations participating in the cluster can attract students studying in educational institutions of the cluster, as well as have potential customers from among the production enterprises of the cluster, which facilitates the process of commercialization of innovations. Finally, manufacturing plants gain access to personnel high-level and scientific potential of research organizations. Their advantage is in the comprehensiveness of innovation clusters in integrating areas of science and education.

Thus, the features of innovation clusters specify their significant role in the integration of science and education.

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