

Emerging Markets Queries in Finance and Business

Regional innovation cluster as a center of an innovative person formation

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Abstract

This article is devoted to innovative regional cluster as a center of the formation of an innovative person. The authors describe the current state of regional innovation clusters and a number of necessary conditions for the successful implementation of cluster policy.

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Selection and peer-review under responsibility of the Emerging Markets Queries in Finance and Business local organization

Keywords: innovative person, innovative regional clusters, subsidies, universities, scientific and technological potential;

1. Introduction

Modernization of an economy is determined by the vector of development of regional economic systems. Priority, here, is given to the principle of organizing a territory by clusters. There is a widespread expansion of organizational forms of inter-firm cooperation aimed at building closer links between firms and their suppliers and customers, as well as knowledge institutions engaged in innovation. The main feature of the information society, which is described in detail by Manuel Castells, 2000 is not so much the domination of information as the network logic of its use, which gives the disseminated information special qualities and functions.

Inter-company network structures, acting as generators for the development of regional innovation systems, define a new stage of the genesis of an innovative person in a particular institutional environment, dominated by horizontal network connections.

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The increasing complexity of the interaction of economic agents in the process of building of an innovative regional cluster and amplification of the importance of network cooperation serves as a model for the formation of an innovative person. In practical terms, the need to consider the specifics of the formation of innovative human interaction reveals businesses in a fundamentally new form of organization of the innovation process: an innovative regional cluster. Neo-institutionalism led to the clustering of economic entities, consolidation of resources and core competencies required to investigate mutually beneficial, long-term relationships and focus on long-term cooperation.

Therefore, the transition to a model of an innovative regional cluster and more sustainable development begins with the formation of an innovative person. This challenge will require many nations to conduct reforms that could let go of the familiar concept of "human capital" and to make an innovative person a partner on an equal footing with the other players, especially the science and business.

According to the neoclassical tradition, a necessary condition for the cluster definition is identification of stable interactions between economic agents. We are talking about the work of A. Marshall entitled "Principles of economics", which shows that industrial regions that host several companies engaged in related activities, are characterized by high levels of economic development.

In the 2000s, the concept of an innovative regional cluster penetrated economies of developed countries (from Scandinavia to Japan) as a basis of the development of an innovative person. It also started to appear in decisions of the Baltic Development Forum and strategic documents of the EU as a new approach to the processes of integration and creation of a single knowledge market.

The growing popularity of an innovative regional cluster in different parts of the world is due, in our opinion, to the fact that it provides a new mechanism to achieve innovative development based on a four-subject interaction model that develops the concept of "triple helix" of Etzkowitz and Leydersdorf, 2008 in the direction of expansion of subject composition, complexity of inter-subject interactions and evaluation of the interests of an innovative person.

Studying of research clusters experiences shows that the initial diagnostics of an innovation economy should be based on several different methodological approaches. We will need to work out a new theory and methodology of an innovative regional cluster, based on which a new mechanism for the formation of an innovative person will be created. These issues are discussed in many publications, but the process of modernization confirms the need for a new approach to the matters of formation of an innovative person and to theoretical justification of methods and forms of his innovative work while taking into consideration characteristics of an innovative regional cluster and its institutional structure. The tendencies of formation of an innovative person in an innovative regional cluster have not yet been explored. It determines the importance of this research.

2. Formation of an innovative person in the process of transition of economic systems to the cluster-network model

Innovative development of a territory according to a cluster-network approach should become a basis for a new model of an innovative person. Innovative regional clusters provide regions with an ability to remain strategically stable in the midst of innovation cycles and ensure the formation of an innovative person, determined by significant structural transformations of the economy, cyclical inter-sector interaction of the subjects of innovation activities, and institutional conditions of domestic economic development.

The process of innovation development of a regional cluster requires three key steps:

1. analysis of a regional cluster's innovation potential;
2. development of an innovative strategy for human development;
3. implementation and development of a regional cluster's potential using an innovative strategy for human development as a mechanism for management of regional development.

In this research we check three main hypotheses:

- Changes of the methodological principles, patterns, forms, methods and criteria for an innovative person in a regional innovation cluster in relation to the process of modernization of the economy and the nature of the relationship between business entities;
- to develop concepts of economic theory of an innovative person as a special subject of economic relations, forming a new innovation system;
- to develop a concept of innovative persons typology together with the justification of the author's approach to its classification.

Methodological research principles of an innovative regional cluster in terms of institutional and neoclassical economic theory can determine its nature as a unique entity which uses its economic resources for the production of innovative products. An innovative economy creates new conditions and effects of cluster formation. A need arises to revise the classical model of human capital according to the change to innovative regional organization of the innovation process.

An innovative man possesses universal abilities to increase the efficiency of all resources at all stages of a production cycle, providing innovative regional clusters with a possibility of stable, balanced and socially oriented extended intensive reproduction.

An innovative regional cluster acts as an epicenter of innovation and a "pole of development", where the conditions for the emergence of the sources of innovation in the economic, technological, social and governance areas are created. The positive results of a "pole of development" give a multiplied impetus to the development of an innovative man. In turn, an innovative man is an impetus to the development of a national innovation system. And this fact is recognized and shared by many researchers.

Active use of an innovative man implies participating in the process of his formation and an effective use of all levels of his formation through close co-operation of the state and its institutions of education, science and marketing agents for innovative learning, innovative mass education of the population and creation of conditions for the implementation of innovative solutions in practice through their commercialization.

The transition to an innovative regional clusters concept significantly changes the environment of formation of an innovative person who operates in a complex system of relatively stable institutional rules and changes the rules, focusing not only on maximizing profits, but also on increasing the added value and realization of his intellectual potential. E. Fraser in his work put together a chain of added value for the U.S. clusters based on his evaluations of industries in terms of employment.

The main competitive advantage of an innovative regional cluster is unique and organizational innovation capabilities of an innovative man formed in the course of interaction of agents in the cluster. A new stage of innovative activity following regional cluster organization approach is transformation of supply chains into a cluster system of added value generation. Now we can no longer talk about the goals, but about the systems of added value generation.

In such systems partnership of innovative people strengthens the innovative strategy of regional innovation clusters which is most clearly visible as an increase in the intensity of interactions of individual sectors of knowledge economy, in particular, development of cross-sector interactions and design of institutes in the framework of the "double helix" (government-to-business, government-to- science (education), business-to- science (education)). Innovation is the key to the formation of a tripartite model of the development of an innovative man. The "triple helix" model is organized in accordance with the principles of intersection of three sets of innovative economic relations – a concept developed by H. Etzkowitz and L. Lyaydersdarf, 2008 in relation to the expansion of subject composition and complexity of inter-subject interactions in a regional cluster. Our research showed that the development of an innovative regional cluster should be carried out on through coordination of interests of four subject groups involved in the innovative development of a man, that are responsible for the generation of new knowledge:

1. "Generation and dissemination of knowledge";

2. generation and use of knowledge;
3. creation of an innovative climate;
4. "public interest"

The degree of the development of an innovative regional cluster provides the freedom to create, transfer and disseminate knowledge. It creates an innovative environment for creative individuals who are interested in new knowledge, that have the potential to add value and new jobs through production and exploitation of intellectual property. As noted by T. Stewart, 2010 intelligence becomes the means of production, when the free-flowing mental energy is organized for business i.e. it is given a clear form and can be used to create something that can not be created while it remains in a disordered state.

A cluster streamlines innovative activities in the region and focuses on maximizing all the added value while taking into account the effects of the conjugation.

In Russia, the clusters began to form in 2000, the total number of which today is 72, and at a formative stage are 74. For comparison, in the U.S. there are more than 240 regional clusters plus another 50 clusters formed solely due to their proximity to natural resources.

The Russian government is interested and actively involved in the development of innovative clusters. Thus, an order of the Prime Minister dated August 28, 2012 #DM-A8-5060 initiated the development of programs to support innovative regional clusters, under which 25 clusters were selected.

25 selected clusters were divided into two groups, depending on their innovative and productive capacity. The first group included clusters, the development programs of which were supposed to be supported through grants from the federal budget of a subject of the Russian Federation on the territory of which they are based.

The second group included regional cluster the development programs of which required further development, and that's why the first phase of their programs implementation was not expected to be supported through intergovernmental grants.

We distinguish the following clusters groups based on the industry specification: nuclear technology, aerospace engineering, new materials engineering, mechanical engineering, instrument-making, information and communication technologies, chemicals and petrochemicals, pharmaceuticals, biotechnology and medical industries.

According to the data the total funding to 25 selected clusters in 2012-2017 will amount to about \$ 1.5 trillion rubles. However, the direct financing of clusters from the federal budget is a small part of the clusters budget, as the concept of a cluster implies that the participating companies are the primary stakeholders, and therefore, cluster operations shall be primarily financed by private business.

Federal budget is expected to contribute 480 billion rubles (33% of the total amount). Thus about 213 billion rubles must be provided from regional and local budgets, accounting for 14% of the total funds for the program. 53% of the total funding, that is 780 billion rubles, is expected to be obtained from extra-budgetary sources.

The largest share of extra-budgetary sources will be spent on the "New Materials" cluster development programs (70%), and the lowest - on the "Aerospace engineering, shipbuilding" cluster development programs (38%), which also accounts for the largest funds injection from the federal budget.

The scientific and technological potential of clusters is largely determined by the amount of investment in its participants R&D. The selected clusters are characterized by a high level of R&D investment. Thus, in 25 selected clusters the total R & D expenditure over the past five years (2007-2011) amounted to 1,110 billion rubles or 222 billion rubles annually. R & D expenditure carried out by the clusters participants are a significant proportion (43%) of the total relevant costs on the economy, which in the period 2007-2011 was estimated by the Russian Ministry of Economic Development to be 2,552 billion rubles. For the period of 2012-2014 expenditures in the amount of 968.8 billion rubles or 323 billion rubles/year an average have been planned.

Thus, the development programs of these clusters provide a significant increase in spending on research and development: by 145% in relation to an average annual R & D expenditure for the period 2012-2014 if compared to the same index in 2007-2011. For all groups of clusters a ratio of average annual R & D expenditure for each of the periods is planned to constitute more than 100%. Leading the increase in R & D costs are two cluster groups: "Nuclear and Radiation Technology" and "Pharmaceutical, biotechnology and medical industry", where the indicator is expected to reach more than 200%.

At the same time, Russia is behind leading world economies by the proportion of its GDP spent on R&D. Moreover, there is a downward trend in the share of domestic expenditure on research and development.

Insufficient funding of R&D leads to Russia's share of high-tech products being more than 20 times smaller compared to Switzerland, 14 times compared to the United States, 11 times to Japan, and even 2.5 times compared to India.

Implementation of program activities with the help of subsidies includes development of various infrastructures designed to increase productivity, improve living conditions, modernize culture and sport facilities, and innovation through training and skills development.

Table 1. The amount of expected subsidies in 2013-2017, in millions of rubles.

Infrastructures	The amount of expected subsidies
R&D projects & activities	13 195
Development of Culture and sport facilities	949
Development of infrastructure for education	5 446
Development of innovation infrastructure	11 971
Development of housing infrastructure	4 090
Development of engineering infrastructure	7 977
Development of infrastructure for the energy industry	2 236
Development of transportation infrastructure	12 689

Implementation of the development programs of innovative regional clusters is expected to lead to an increase in private investment in production, development and promotion of new products to 2,218.7 billion rubles in 2009-2016 with an increase of an annual average volume up to 147%; an increase in total revenues of cluster participants from non-oil products sales to 5,672.8 billion rubles in 2011-2016, with an increase of 105%. Adapting to these parameters, the cluster-network organization of a region is moving to a new way of "coordination of communications without hierarchies» Hasimi, 2007. Members of a regional economic cooperation network are constantly exchanging knowledge, benefit from mutual use of each other's assets, coordinate their decisions and change their cultural code while acquiring a network logic of behavior on the formation of an innovative man, Tapscott and Williaws, 2007.

3. Innovative regional clusters as a mechanism for the formation of an innovative man

Innovative regional clusters is a network mechanism for coordinating actions on the formation of an innovative man. Its main advantage, reflecting the benefit of all regional clusters, is its ability to achieve an integral effect of the continuous development of an innovative man.

One of the main priorities for the programs of development of innovative regional clusters programs is creation of high-performing workplaces. Drawing on the results of a survey of 3528 companies operating in a cluster environment, the author followed the positive trend of development of human resources. Thus, 64% of

companies indicated that clusters allow them to hire more highly qualified workers. Slightly fewer companies (62%) reported regular communication of information within their clusters. Six out of ten companies (61%) find that their cluster contributes to the development of the entrepreneurial spirit. Almost as many (59%) noted that partnership relationships within specific projects are typical of their cluster.

Most companies (57%) report exchange of experiences within the cluster, while 55% of companies talk about exchange of information on technologies. 41% of companies mention reduced time to market among positive achievements of their cluster. 43% of companies say that their clusters provide access to research infrastructure, while 46% of companies say that the cluster provides all participants with important elements of infrastructure: buildings, research laboratories, and so on.

As for the total number of jobs in 2011 in enterprises and organizations participating in clusters with wages exceeding 100% the average rate in the respective regions was 179,617. In 2016, this number will increase to 331,692 units or by 84.7%.

The development of the innovative man and the increase of innovation activity are due to the fact that a regional cluster acts as a kind of "repository" of knowledge, skills and experience of talented people who are specialists in the core business of the cluster. The concentration of new knowledge prompts the participants to generate new ideas, developments and solutions, which is a significant factor in the development of the knowledge economy.

This means that progress towards the formation of an innovative person is associated with such type of interactions between government, science and business, as corresponds to a cluster mechanism of development of an innovative man. Concentration of ideas and intellectual activity takes place in a localized area of knowledge. Here representatives of business and science forge cooperative ties of innovative people to transform resources into unique new products, ideas and technology.

The process of cooperation is characterized by selection of a model of an innovation man which reduces the level of uncertainty and generates configurational information, i.e. new knowledge and, consequently, development of an innovative man. To achieve this effect continuous negotiations between representatives of science, business and government are necessary Leydesdarf, 2008.

Additionally, universities play a significant role in the development of clusters and the economy in general. There is an upward trend in interaction between clusters and universities that allows preparation of qualified specialists in narrow fields of professional activity. For example, the Kaluga pharmaceutical cluster cooperates with Lomonosov Moscow State University. Jointly they organized a Scientific and Educational Center. In the same cluster, a Training center for pharmaceutical production was opened along with the industry businesses.

In 2011, creation of new specialties in the field of "living systems" was included into the strategy of development of Tsiolkovsky Kaluga State University. 270 million rubles were allocated from the federal budget for implementation of these objectives.

Active and professional work with the universities is carried out in Zelenograd cluster with NIU MIET, the primary task of which is the establishment of relevant departments in the university. A Decree on new education program for engineers and world-class specialists is being developed in Zheleznogorsky cluster (Krasnoyarsk).

No doubt besides these positive aspects there are unfinished, problematic areas. This is one of the primary problems of cluster projects. As stated in the programs that the author examined, clusters often suffer from the complexity of organizing joint projects for research and development between cluster participants due to weak regulatory mechanisms resulting in in many cases, not all cluster participants receiving benefits from ongoing projects. These problems lead to depreciation of a concept of "cluster" and the need for its existence. The situation may be solved through the development of a concept of cluster formation and management, and the development of management systems for common cluster projects on the basis of a network model of interaction with implementation of LEAN, and CALS / PLM technology in all production facilities.

Secondly, there is a problem of dominance of large companies that the cluster interaction format is not always relevant for. Large companies are able to run a project to solve a problem on their own.

The authors found out that the aid provided to small and medium-sized businesses in the context of cluster policy is the most effective measure of their development. Because of their limited size the enterprises unite and, thus, are able to quickly and effectively tackle the problems associated with increasing levels of innovation and competitiveness.

Foreign experience shows that small and medium-sized enterprises are the main beneficiaries of cluster programs implemented by the state. For example, 80% of the companies –participants of "Competitive Clusters" cluster program in France are small and medium-sized enterprises. These companies received a total of 54% of funding for projects within this program.

Thirdly, there is a need to create a single process chain linking research and development work with industrial sales activities.

Fourth, it is necessary to create a marketing center of a cluster, whose main task would be to collect information about the suppliers and manufacturers of goods analogues, and information about competitors and dynamics of market niches for products and products being prepared for production.

4. Conclusions

Thus, the current cluster policy is one of the priority directions of innovative development of the Russian economy, which should reflect not only the initial configuration of the industry, but also a specific system of promising industrial and technological schemes, taking into account existing resources, infrastructure, and market conditions. As we found out, an innovation cluster is a dynamic system that fosters self-development through synergies. However to ensure an effective development a cluster policy should create necessary conditions for the productive accrual of educational potential, consider complexity and nuances of joint cooperation between the companies, as well as build a well-functioning infrastructure of cluster management. An important factor of the development, in this aspect, is state policy. Providing tax incentives and preferences will help to significantly reduce the risks related to cluster interaction. One of the expected results of the development of innovation clusters should be improvement of the quality of human capital, as well as formation of innovative businesses that can raise the level of the economy and implement breakthrough technologies, both in domestic and foreign markets.

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