ESPACIOS
REVISTA

Features of managing innovative clusters of modern Russia

Clusters innovadores de la Rusia moderna: características de gestión

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Contents

ABSTRACT:
The availability of resource advantages for today is not a guarantee of successful existence in a competitive environment. The clustering process requires the systematization of scientific ideas about clusters, their characteristics, stages of development and features of territorial location in terms of long-term prospects for the development of the region. A separate problem is the need to study the conditions, measures and tools for forming competitive advantages of the cluster.
Keywords: management, innovation cluster, management resources, cluster activity study.

RESUMEN:
La disponibilidad de ventajas de recursos para hoy no es una garantía de existencia exitosa en un entorno competitivo. El proceso de agrupamiento requiere la sistematización de ideas científicas sobre clusters, sus características, etapas de desarrollo y características de la ubicación territorial en términos de perspectivas a largo plazo para el desarrollo de la región. Un problema aparte es la necesidad de estudiar las condiciones, medidas y herramientas para formar ventajas competitivas del clúster
Palabras clave: gestión, clúster de innovación, recursos de gestión, estudio de actividad de clúster.

1. Introduction

Clusters are commonly understood as a group of geographically concentrated interdependent companies and institutions functioning in a certain area and connected by a commonality and complementarity (Zemtsov, 2013). Clustering is beneficial, first of all, to small and medium-sized companies, as this increases their competitiveness due to the expansion of opportunities for cooperation, the use of a unified infrastructure, interaction with local research organizations.

As a result of cluster formation, regions, in turn, increase their attractiveness to business, investors, skilled workers and researchers, so cluster policy has become one of the most

used instruments of regional policy in the European Union (Rosenfeld, 2002). The identification and support of clusters is an important tool for stimulating economic development in countries with economies in transition.

The management of innovative clusters and the implementation of cluster policy have relatively recently become popular topics in Russia. In early 2012, the Ministry of Economic Development of Russia initiated a competitive selection of projects for the development of clusters in the regions of Russia. In total, about 100 cluster initiatives took part in the competition, among which 25 were selected for pilot support in subsequent years.

A total amount of 3.8 billion rubles was allocated from the federal budget for the development of clusters in 2016-2017. This amount was distributed among the clusters depending on the quality of their development programs and specific projects on co-financing terms from the regional budgets. In 2016, the highest volume of subsidies (269 million rubles from the federal budget) was allocated to an innovative territorial cluster (ITC) in the field of information and telecommunication technologies of the Novosibirsk region.

The lowest federal subsidy (1.3 million rubles) was provided to the information technology cluster of St. Petersburg. The average subsidy for the clusters was about 100 million rubles. At the same time, almost 1.9 billion rubles out of 2.5 billion rubles the federal subsidy of 2016 was aimed at developing the innovative and educational infrastructure of pilot ITCs and more than 500 million rubles were allocated for professional development, retraining of personnel, methodical, organizational, expert-analytical and information support.

The methodology and implementation of cluster policy in Russia as a whole corresponds to the conceptual foundations of similar European programs, especially French and German ones (Abashkin, Boyarov & Kutsenko, 2012). However, it is equally important to compare the clusters themselves, identify their strengths and weaknesses, and adapt the directions of state support accordingly.

2. Literature review

The theoretical substantiation of economic regionalization and organization of territorial production complexes is presented in the works of M. Bandman, U. Izard, G. Kleiner, N. Kolosovsky, V. Polyakov.

The works of the following domestic scientists: S. Vazhenin, Yu. Gadzhiev, V. Malov, L. Markov, A. Migranyan, D. Yalov, and others are devoted to studies of the formation of new forms of territorial organization; A significant contribution was made by foreign researchers: G. Boush, A. Gambardell, M. Grou, C. Ketels, V. Kristaller, A. Lesch, G. Lindqvist, I. Mandel, S. Ozkan, M. Porter, A. Saxenian, O. Solwell, and others.

Problems of the formation of regional clusters, network structures, business associations in the economy, and the evaluation of the effectiveness of their functioning are discussed in the works of V. Agafonov, E. Akinfeeva, J. Brennan, S. Bludova, M. Buyanova, D. Vuilov, I. Korobeinikov, N. Larina, R. Paturyrel, V. Radaev, S. Raevsky, M. Samoilov, M. Enright, and others.

Cluster organization and innovative character of the region's economy became the object of research by L. Dadaev, A. Dyrdonova, I. Kobersy, A. Zaitseva, O. Inshakov, N. Kizim, E. Kurkudinova, V. Kurchenkova, D. Shkurkin, O. Lomovtseva, V. Moseyko, V. Novikov, N. Nelyubova, V. Fesenko, V. Cherednik and others.

A significant part of the scientific research is in the field of cluster management policies, which are largely reflected in the works of foreign researchers: T. Anderson, V. Gilsing, T. Röelandt, J. Sinderen, J. Sorvick, J. Furré, E. Hansson, P. Hertog and others.

However, it should be recognized that there is a lack of research devoted to the formation of competitive advantages of clusters at the regional, national and international levels based on economic rather than territorial boundaries. The definition of the relationship between the existing advantages of clusters and the methods of stimulating their organization implemented by the state makes it possible to propose effective instruments of cluster policy aimed at realizing the competitive advantages of regional clusters, which predetermines the

need for additional scientific study.

3. Materials and methods

The purpose of the study is theoretical substantiation of the features of innovation cluster management, development of tools for the formation and realization of their competitive advantages in the region.

The object of research is innovative clusters, the formation, development and implementation of competitive advantages of which determines the competitiveness of the region's economy. The subject of the research is a system of economic and managerial relations that arise in the process of forming and realizing the competitive advantages of innovative clusters.

The methodological and theoretical bases of the research were the concepts presented in the works of domestic and foreign scientists in the field of cluster formations, regional economy, cluster policy and innovations (Bogoviz Alexei, Vukovic Galina & Stroiteleva Tamara, 2013). The research was carried out on the basis of application of general scientific methods of cognition: system and structural analysis, historical-logical, comparison, analogy, formal logic, including abstraction.

The information and empirical basis of the study was the regulatory legal acts of the Russian Federation, resolutions of the Government of the Russian Federation; materials of the Federal State Statistics Service of the Russian Federation, the Ministry of Finance of the Russian Federation, the Ministry of Economic Development of the Russian Federation; expert assessments and calculations of Russian and foreign scientists published in scientific literature, periodicals, materials of international and All-Russian scientific and practical conferences, reference legal systems, the Internet; the author's calculations as well.

4. Discussion

4.1. Innovative Clusters as an Instrument of Innovation Activity

To carry out a comparative analysis of models for the formation of innovative clusters, it is first necessary to determine what precisely is implied by the term "cluster".

In classical economic theory, this concept was introduced by M. Porter as "... geographically concentrated groups of interrelated companies, specialized suppliers, service providers, firms in relevant industries, and organizations associated with their activities (for example, universities, standardization agencies, and also trade associations) in certain areas, competing, but at the same time, working together" (Porter, 2000).

In other words, the cluster is a kind of structural network that promotes achievements in various interrelated areas: from new technologies and products to the competitiveness of the country at the international level.

Over the past few decades, most countries have not only used clusters as a foundation for the development of their economic performance, but have also been successful with the so-called "cluster method." The latter means "... a new management technology that allows to increase the competitiveness of a particular region or industry and the state as a whole" (Porter, 2000).

Regardless of the field of their activity but according to their peculiar features, clusters are classified into the following types:

- Regional clusters – those geographically limited ones, with similar territorial units, tied to some scientific organization.
- Vertical clusters, in which the production chain acts as a link for the entire cluster.
- Industrial clusters: in this type the defining factor for classification is the business sector in which the cluster is profiled, for example, educational, high-tech, chemical, agro-industrial, etc.

It turns out that a cluster unites various enterprises and organizations that take part in the production chain, and also underlies the national innovation system of the country as one of its most important elements. Most often, such cooperation carries a non-commercial partnership.

Over the past decades, most of the world's states, not only developed but also developing ones, have been competing for the greater weight of their national companies in the world market arena, along with increasing competitiveness (Mindlin et al., 2016). Due to the fact that traditional industrial policies no longer bear such fruits as before, innovative clusters, at the heart of which knowledge creation takes place, are in demand.

Innovative clusters practically fall within the already considered definition of the cluster by M. Porter (Porter, 2000), namely: the task of such informal associations, be they universities, research centers, entrepreneurs, or industries, is the dissemination of knowledge, technology and innovation, which subsequently, after the transformation, acts as a competitive advantage.

Innovative clusters constantly and at different levels create innovations, whether in marketing, technology or management, which certainly cannot be achieved without quickly accessing various resources (financial, market, marketing, etc.). In this regard, even the leading competition companies definitely benefit from being in an innovative cluster, because all the conditions that make the clusters attractive to investment are created in such a partnership.

The formation of clusters can take place according to the following parameters:

- vertical cluster strategy: based on the existence of a phased production, where each enterprise is fully aware of the element of the chain in which it is located;
- horizontal cluster strategy: the case where different industries are connected by one large cluster;
- qualitative cluster strategy: special attention is paid not to the number and frequency of interrelations between organizations, but also to their qualitative characteristics;
- technological cluster strategy: concentration of various industries that use the same technology;
- geographical cluster strategy: the extension of clusters in space – they may be local or international;
- focus cluster strategy: concentrating an entire cluster around one organization;
- lateral cluster strategy: with the help of economies of scale it is possible to achieve the emergence of new interactions along with economies among different sectors.

In itself, an innovative cluster unites companies that do not generally compete with each other; on the contrary, they complement each other in that they produce their products and services for various elements of the cluster, that is, for different sectors.

Sometimes different companies are combined to carry out R&D, thereby significantly reducing the financial costs for them. It is this fact that implies "innovative integration" ("*Europe INNOVA*", 2008), which suggests that large companies attract financial flows of money for the functioning of an innovative cluster in general, while small firms, being very flexible, are ready to adapt to this or that new economic conditions.

Thus, it turns out that innovative clusters form qualitative links among localized organizations and enterprises, as well as scientific institutions, laboratories, universities, etc., concentrated around several leading companies. At the same time, all the participants of the cluster are working not only to increase their competitiveness beyond its borders at the expense of their products, but also pursue a reduction in costs against the background of close interrelationships. All participants of the cluster share a spirit of innovation.

It becomes clear that an innovation cluster in itself is capable of encapsulating a technological chain that starts with the development of a product and ends with the introduction of it onto the market. Often, innovative products and services emerging from innovative clusters are designed for the international market, that is, for export. It turns out that it is the innovative clusters that can actually strengthen the positions of this or that state in the global arena.

The creation of clusters involves the use of the following mechanisms:

- allocation of financial resources, both in the form of interest-free loans, and direct financing, the share of which sometimes reaches 50% of the total investment in the development of an innovation. Periodically investments act as target grants for scientific research, as well as reduction of state duties or full exemption from them;
- provision of preferential terms for companies and enterprises in taxation;
- guarantee of protection of intellectual property and copyright in terms of legislation;
- the provision of a patent attorney by the state;
- insurance of possible risks from projects and developments: their reduction, as well as compensation for damages;
- attraction of "brains" from abroad, that is highly skilled and experienced professionals.

At the same time, it is necessary to investigate the importance of state participation in the process of creating clusters, because the very first clusters appeared because of the necessary development of huge transnational companies, in other words, because of market competition. In recent decades, a trend has been observed when different states began to act as initiators in the creation of clusters, promoting these projects in every way (Biggiero & Sammarra, 2010).

Innovative clusters are not just a territorially localized group of enterprises with common characteristics and objectives, they are always designed and implemented in such a way that any special characteristics of the country, locality, population, etc. are taken into account.

As to cluster policy, it is the provision of all kinds of support from the state or the municipality, namely legal, personnel, information, investment, etc. With the help of the above-mentioned measures, the authorities pursue the following goals: to become a support for the development of small and medium-sized businesses, as well as increase the potential innovation of a particular region or company.

Obviously, cluster policy does not necessarily look like a clearly developed strategy that dictates all the necessary measures, it can, for example, act only as a separate block in the strategy of economic development, or an option is possible when only isolated sections of the innovation development strategy are introduced.

Proceeding from this, it is possible to present the following taxonomy of cluster policy ("*Ministry of Economic Development of Russia…*", 2015):

- Administrative cluster policy: it represents, in fact, the way "from above", when the power autonomously selects a particular region or enterprise, to which a fixed budget is already assigned. Moreover, the state immediately promotes the creation of relevant infrastructure (including both scientific, research and management organizations, and transport components);
- Democratic cluster policy: this type of policy, one might say, is "opposed" to the administrative one. This is due to the fact that the authorities in no way participate in the development and growth of clusters that were born independently by market means, with the exception of small financial injections and grants, as well as the creation of general conditions that stimulate innovation.

4.2. The Research into the Experience of Innovative Clusters Formation in the Russian Federation

World experience shows that in the most successful clusters there are mechanisms and organizational forms for the accumulation and dissemination of knowledge and the accumulation of social capital. According to the documents of the European Cluster Excellence Initiative (ECEI), the quality of management is an important prerequisite for the successful development of not only businesses, public and state organizations, but also clusters.

Let's proceed to the description of cluster policy and the introduction of clusters in the territory of the Russian Federation. Initially, the idea to engage in the development of

clusters at all levels in Russia arose more than 10 years ago, in 2005. It was planned to begin to increase the degree of interest in innovative products and services, as well as in research activities and, at the same time, to create a strong relationship between science and production (Bogoviz Alexei, Vukovic Galina & Stroiteleva Tamara, 2013). In addition, it is believed that the state itself will help create favorable conditions for business development, the necessary infrastructure and an adequate institutional environment (Kutsenko, 2014). As for the documentary component, it is worth noting the following documents: "The Strategy of Innovative Development of the Russian Federation for the Period to 2020".

If we consider the regional level of the innovation strategy in Russia, then here we should pay special attention to the fact that in 2009, in the framework of the Concept for the Improvement of Regional Policy in the Russian Federation, the territories for outpacing economic growth were identified; they were meant to act as a liaison for production clusters, resulting in the output of products with high added value, which, as is known, is a distinctive feature of the cluster and leads to economic growth in the region.

The state believes that clusters should be created "from below", that is, in a market economy way, although, for a number of reasons, this seems a little complicated. Obstacles are poorly developed business, along with unfavorable conditions for its management, undeveloped production, partly Russian mentality (disinterest in long-term business planning, low level of trust, closeness of people and, as a consequence, the business they lead), as well as the narrow focus of certain regions of the economy, behind which there are large national companies.

Nevertheless, from 2012, when the competitive selection for participation in the program for the development of innovative clusters was held, the Government of the Russian Federation still tries to work on the creation of innovative clusters.

As one of the decisive criteria was the factor of international competitiveness, that is, the results of the operation of clusters should lead to this.

As a result, after consideration of all accepted applications by various experts, 25 that received the highest scores were selected. To ensure that so different innovative clusters can show a high result, when building a regional policy, it is necessary to take into account all the special characteristics of a given locality.

4.3. Cluster Ratings by Scale, Level of Integration and Quality of Management

Most of the selected clusters were formed on the basis of former large Soviet enterprises, using their infrastructure and human capital. Many clusters include large enterprises that survived during the transition period of the 1990s, as well as small firms - the spinoffs of Soviet plants.

The main areas of specialization of pilot clusters are biotechnology and pharmaceutics, aerospace, nuclear and information technologies (Bortnik, Zinov & Kotsyubinsky, 2013). A typical problem for most innovation clusters is the small number of small companies and the insufficient level of interaction between their participants.

The scale rating reflects the significance of the cluster for the regional economy - how many participants are in the cluster and their aggregate size (revenue or number of employees). The integration level rating shows how actively the cluster members interact with each other. The rating of management quality characterizes the qualification of the cluster management team and the effectiveness of its activities (Rating of innovative regions for monitoring and management purposes (AIRP rating)).

Among the indicators for assessing the quality of management in clusters, we selected the most relevant indicators, which, on the one hand, reflect the purpose of each rating and, on the other hand, are characterized by the best data coverage (have the largest number of responses from clusters).

So, for the scale rating of the cluster, the number of employees of organizations-participants of clusters ($x1$) 5 and the number of organizations participating in clusters ($x2$) was used as

the main indicators.

For the cluster integration rating, the main indicators were: the share of cluster participants involved in 2016-2017 in joint projects (x3), the number of joint research and innovation projects (x4) and the number of joint "business for business" (B2B) projects (x5).

The cluster management quality rating is based on two indicators: the number of days during which the staff involved in cluster management in 2017 (x6) were trained and the number of activities aimed at supporting the communication of cluster members with internal and external organizations in relation to the number cluster managers (x7). The initial data on the main indicators are presented in Table 1.

Table 1
Values of the main indicators of cluster ratings.

Cluster name	Region	The main indicators for ratings by directions						
		scale		Level of integration			Management quality	
		x1	x2	x3	x4	x5	x6	x7
Shipbuilding Innovative Territorial Cluster	Arhangelsk region	39,1	26	77%	n.d.	n.d.	0	3
Pharmaceutical, biotechnology and biomedical cluster	Kaluga region	4,3	52	35%	16	9	42	7
Complex processing of coal and man-made waste	Kemerovo Region	н. д.	30	33%	2	5	6	7
Cluster of Medical, Pharmaceutical, Radiation Technology	Leningrad region	59,3	18	83%	2	0	10	5
"Zelenograd" Cluster	Moscow	6,8	124	9%	27	100	14	3
"Fiztekh XXI" Cluster (Dolgoprudny, Khimki)	Moscow region	10,1	25	64%	n.d.	n.d.	7	3
Biotechnological innovation territorial cluster of Pushchino	Moscow region	5,0	57	44%	10	2	14	1
Cluster of Nuclear Physics and Nanotechnology in Dubna, Moscow Region	Moscow region	10,6	91	49%	2	100	0	4
Nizhny Novgorod Industrial Innovation Cluster in the Automotive and Petrochemical Industry	Nizhny Novgorod Region	23,1	8	n.d.	n.d.	0	11	0
Innovative territorial cluster in the field of information and telecommunication technologies	Novosibirsk region	16,2	120	75%	4	6	16	6
"Technopolis "Novyy zvezdnyy"								

		x1	x2	x3	x4	x5	x6	x7
innovative territorial cluster for rocket engine manufacturing	Perm Region	26,4	35	43%	8	15	28	1
Petrochemical territorial cluster	Republic of Bashkortostan	23,8	76	59%	5	0	0	2
Energy-efficient lighting technology and intelligent lighting control systems	The Republic of Mordovia	11,0	21	86%	8	3	4	0
Kamsky Innovative Territorial and Production Cluster	Republic of Tatarstan	367,9	43	74%	5	n.d.	8	2
Innovative territorial aerospace cluster of the Samara Region	Samara Region	45,0	47	43%	n.d.	n.d.	0	8
Information Technology Cluster	St. Petersburg	44,6	85	41%	n.d.	n.d.	5	2
Cluster of pharmaceutical and medical industry	St. Petersburg	59,3	30	13%	6	10	0	0
Titanium cluster	Sverdlovsk region	22,6	17	n.d.	n.d.	n.d.	0	n.d.
Pharmaceuticals, medical technology, information technology and electronics	Tomsk region	2,4	298	39%	35	15	39	90
Nuclear-Innovation Cluster in Dimitrovgrad, Ulyanovsk Region	Ulyanovsk region	27,4	31	77%	17	31	29	2
Innovative territorial cluster of aircraft building and shipbuilding	Khabarovsk region	23,7	30	17%	2	0	0	0

Source: Prepared by the authors.

Notes:

> x1 is the number of employees of organizations - members of the cluster (thousand people, 2013);
> x2 is the number of cluster members;
> x3 is the share of cluster participants involved in 2016-2017 in joint projects;
> x4 is the number of joint research and innovation projects;
> x5 is the number of joint "business for business" (B2B) projects;
> x6 is the number of days during which trainings were conducted for personnel involved in cluster management (2017);
> x7 is the number of activities aimed at supporting communication of cluster members with internal and external organizations in relation to the number of cluster managers;
> n.d. – no data.

A number of clusters lack answers to some of the survey questions. Therefore, when constructing ratings, these clusters had to be excluded from consideration. When constructing the rating of clusters by scale, we did not consider the cluster "Complex processing of coal and man-caused waste" of the Kemerovo Region due to the lack of data on the number of employees of the organizations participating in the cluster (x1). The ranking of clusters by the level of integration of participants was built for 14 clusters because of the lack of data on indicators for 7 clusters.

The rating of clusters on management effectiveness was calculated for 20 clusters, as for the titanium cluster of the Sverdlovsk Region there is insufficient data on the number of communication activities (x7).

The Kamsky Innovative Territorial-Industrial Cluster of the Republic of Tatarstan (about 370 thousand people) is the leader in terms of the number of employees in the organizations that make up the cluster. The number of participants is ahead of the cluster of Tomsk region (about 300 organizations). According to the share of cluster participants involved in joint projects, the cluster of the Republic of Mordovia (86%) is in the first place.

The largest number of joint research and innovation projects in 2014 was organized in a cluster of the Tomsk region (35 projects). By the number of joint "business for business" (B2B) projects are allocated clusters of Zelenograd and Dubna. In the cluster of the Kaluga region in 2014, the longest training program for cluster managers was held, which in the total sum lasted 42 days. The largest number of communication events was held in 2014 in the Tomsk region.

To build the cluster scale indices, the level of its integration, and the quality of its management, we used the arithmetic mean of the parameters included in their composition, which were previously subjected to the normalization and smoothing procedure. This method is widely used in the construction of ratings of economic and innovative development of countries and regions.

5. Conclusions

Most of domestic clusters are formed on the basis of former Soviet enterprises in traditional high-tech industries (aerospace complex, nuclear technology, etc.). Therefore, one of their distinguishing features is the inadequate number of small and medium-sized firms, which are the main target group of cluster initiatives abroad.

In order to attract additional participants to the cluster, intensify interaction between the cluster participants and create additional competitive advantages for them, the Ministry of Economic Development of Russia allocates subsidies to regions for the development of management companies and cluster infrastructure from 2013 onwards.

It should be noted that the multifield Kamsky Innovative Cluster in Tatarstan, clusters of information and communication technologies in St. Petersburg and the Novosibirsk Region, as well as the Samara Aerospace and Bashkir Petrochemical ITC, have the highest impact on the regional economy and on the development of the country as a whole. At the same time, while clusters of information and communication technologies became leaders in the rating due to the number of participants, then in traditional high-tech industries they gain leadership due to the number of employees.

The most mature from the point of view of interaction intensity are the nuclear-innovative cluster of Dimitrovgrad in the Ulyanovsk region, the multi-profile cluster of the Tomsk region, the Zelenograd cluster of microelectronics (Moscow), and the lighting cluster in Mordovia. In these clusters, the largest share of participants in joint projects, a high number of joint innovation projects and projects for business.

The most professional management companies have been formed in the Tomsk multiprofile cluster, in the Kaluga cluster of pharmaceutics, biotechnology and biomedicine, the nuclear innovation cluster in Dimitrovgrad, the Novosibirsk ICT cluster and the Perm cluster of rocket propulsion. The largest number of communication events was held in 2014 in the cluster of the Tomsk region, and in the cluster of the Kaluga region the longest program of training cluster managers was conducted.

The key factors for the success of the Center for Cluster Development in the Tomsk Region are quality communication, formalized and shared rules of interaction between the participants, and a professional organization.

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