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Industrial clusters development in the regional economic system

Desarrollo de clústeres industriales en el sistema económico regional

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ABSTRACT:
The advantage and novelty of the cluster approach are that it attaches great importance to the microeconomic component. In addition, it offers effective tools for stimulating regional development, which manifests itself in increasing employment, competitiveness of regional production systems, budget revenues, etc. However, this economic practice trend is poorly understood in the post-Soviet space. The purpose of this study is to evaluate the development of industrial clusters in the regional economic system.
Keywords: : industrial cluster, regional economy, management system, construction algorithm

RESUMEN:
La ventaja y novedad del enfoque de clúster es que concede una gran importancia al componente microeconómico. Poe otra parte, ofrece instrumentos efectivos para estimular el desarrollo regional, que se manifiesta en el aumento del empleo, la competitividad de los sistemas de producción regional, los ingresos presupuestarios, etc. Sin embargo, esta tendencia de la práctica económica es poco conocida en el espacio postsoviético. El propósito de este estudio es evaluar el desarrollo de clústeres industriales en el sistema económico regional.
Palabras clave: clúster industrial, económico regional, sistema de gestión, algoritmo de construcción

1. Introduction

The concept of cluster was introduced into economic theory by Michael Porter: "Cluster is a geographically concentrated group of interrelated companies, specialized suppliers, service providers, firms in relevant industries, and organizations related in certain areas, competing, but conducting joint work as well" ("Cluster policy in Europe…", 2008). These enterprises form production chains focused on a specific product. The consolidation occurs, as a rule, around a large base enterprise. In other words, small and medium-sized enterprises are involved in the sphere of industrial production. Large companies with experience in this or that branch should let them in their business, but of course, on a competitive basis.

Thus, the industrial cluster is an integrated structure that consists of interconnected, legally independent enterprises and supporting institutions of the main and related industries that have technological or other interrelations and are oriented towards a common market of resources or consumers united by an innovative program; they do not have control over the property of other members of the cluster, but control over their management remains (Delgado, Porter & Stern, 2014).

There are different approaches to the classification of clusters, while a fairly wide range of characteristics is used, according to which enterprises are grouped into homogeneous groups (clusters). Most often clusters of enterprises are classified by such parameters as geographic location, availability of capital, the proximity of suppliers, state of competitiveness, access to specialized services, development of labor potential, availability of specialized educational institutions and research organizations, industry affiliation, etc. (Malmberg & Power, 2005).

2. Literature review

The foundations of the theory of clusters are laid down in the works of A. Marshall, F. Perroux, M. Porter, D. Sollier and other researchers who studied the spatial aspect of economic activity and highlighted the phenomenon as "the accumulation of economic units". A significant contribution to the development of cluster

theory at the current stage, knowledge of the essence of clusters of economic nature, the formation of theoretical foundations for the functioning of cluster structures was introduced by such Russian scientists as I.E. Egorova, I.V. Pilipenko, R.H. Khasanov, M.A. Jagolnitzer.

In the context of global competition, increasing competitiveness and integration into the global economy of the Russian Federation and Russian regions, clusters are considered by S.M. Gaimalova, N.I. Larina and others.

The problems of creating cluster structures in the economic environment, the methodological support of this process are discussed in the works of V.P. Tretyak, G.A. Yashevoy. Methodological approaches to identification of clusters are developed by T.V. Mirolubova, V.O. Moseyko, V.V. Fesenko, and others.

Individual clusters of economic nature are studied as a spatial phenomenon (N.V. Beketov, C.B. Raevsky, etc.), territorial-branch (A.B. Voronov, R.K. Gazimagomedov, Yu.V. Trifonov, etc.). These approaches are developed in the framework of the study of clusters as tools to stimulate the development of regions (S.V. Sinitsky, A.I. Tatarkin, D.A. Yalov, etc.) and industries (M.G. Akhmadeev, R.G. Bagautdinov, et al.).

A significant number of scientific papers are aimed at researching innovative clusters in the industry as the most pressing topic in cluster problems. The works of such authors as A.A. Alekseev, S.D. Bodrunov, E.A. Monastyrny, S.G. Polyakov, D.B. Rygalin, V.I. Spivak, A.B. Titov, M.V. Shinkevich and others.

An important part of developing a cluster problem is research into approaches to state regulation (support) for the formation and development of clusters within the framework of regional industrial policy. Special issues of this direction are paid attention to by such scientists as P.A. Arkin, Ya.N. Dranev, E.M. Rogova, E.A. Tkachenko, et al.

Clusters as a form of self-organization and co-operation of economic entities are investigated in the works of I.V. Begun, T.V. Tolstikova, M.A. Yagolnitzer, and others.

Among the foreign scientists who are most active in researching clusters in the economy, there are such authors as R. Baptista, M. Enright, E. Feser, A. Isaksen, S. Karlsson, S. Ketels, S. Klepper, R. Florida, M. Porter, E. Reinert, D. Robinson, S. Rosenfeld and others.

At the same time, the problems of the development of the theoretical and methodological foundations of the organization, functioning, and development of cluster structures in the modern economy in general and in the industrial sphere, in particular, have been insufficiently studied in the works of these scientists. The openness of the problems, insufficient investigation of industrial clusters as an organizational and economic phenomenon and the integrational form of interaction between economic entities, peculiarities of their functioning and development, opportunities, forms and methods of management – all this predetermined the purpose, objectives, object, and subject of this study.

3. Materials and methods

The theoretical and methodological basis of the research was the studies of modern domestic and foreign scientists and economists on the problems of formation and development of cluster structures in industry, federal and regional regulations, scientific and methodical literature, official statistics, articles in specialized journals and scientific publications, materials of international, all-Russian and regional conferences, Internet materials, departmental documents.

As a methodological basis, a dialectical method was used, involving the study of phenomena under conditions of dynamic development, the interrelationship of individual elements of the system, and the identification of the leading segments of industrial clusters as complex socio-economic systems.

To solve the problems: system, economic-statistical forecasting, and cognitive modeling methods were used.

4. Discussion

4.1. Technologies of Clusters Formation in the Region

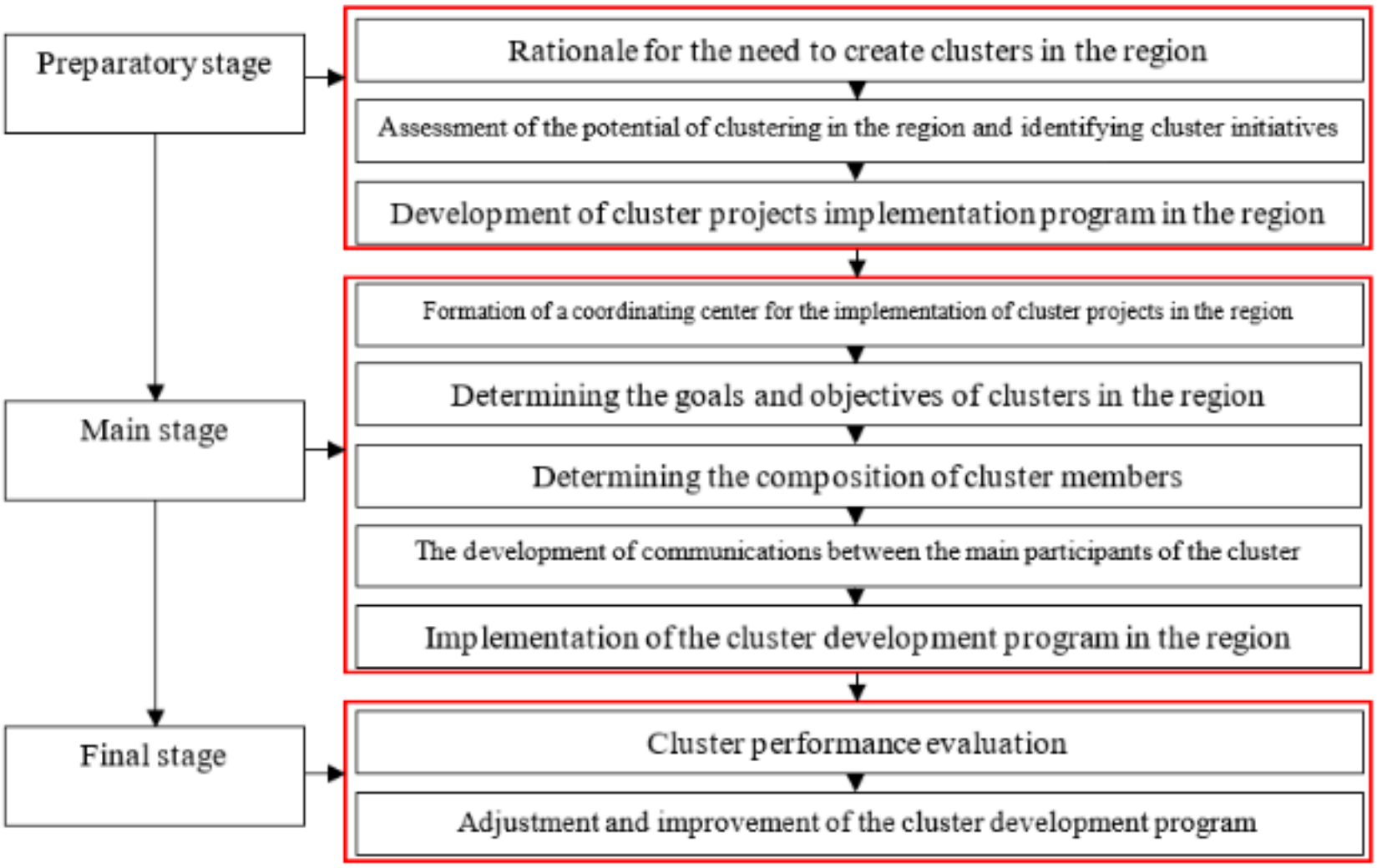
Studying and analyzing theoretical and methodological approaches, foreign and domestic experience, it has been possible to determine the technology for the formation of industrial clusters in the region, which involves three main stages (Figure 1).

The first stage is preparatory, which determines the clustering potential and develops a program for implementing cluster projects.

The task of the second stage is the activation of industrial clusterization in the region, the connection of possible participants to these processes. In order for the clustering process to start, the initiative of the power structures of the region is required. The actions of the authorities should first of all be aimed at forming a coordinating center with the aim of planning and implementing cluster industrial projects, lobbying the interests of their participants, resolving internal conflicts, coordinating activities, and promoting development.

The cluster presupposes interaction of various structures and organizations, therefore all persons interested in its creation and development: representatives of local authorities, various associations, and unions of entrepreneurs, large companies and educational institutions of the region can become members of the coordinating council (Pourdenko, 2007).

Figure 1
Algorithm for the creation of an industrial cluster in the region



Source: Prepared by the authors.

Having created the coordination council, it is necessary to determine: the goals and objectives of the cluster; the composition of its main participants; producers, suppliers, consumers, interrelated among themselves in the process of creating and exporting products; the necessary engineering and social infrastructure; research organizations for the implementation of developments on the profile of the cluster; educational institutions for training specialists required by participating enterprises.

To achieve noticeable internal dynamics, the cluster needs to attract many participants and some critical mass. Its presence will allow forming and permanently keeping constantly updated links between flexible small firms and large resource providers.

The critical mass can serve as a buffer and give the cluster resistance to external influences or other pressures, including the loss of companies (even when these companies can be classified as key), until the critical threshold of the number of remaining participants is exceeded (Vertakova, Rudakova, Shadrina, Kobers & Belova, 2016).

The absence of a critical mass can, on the contrary, make the cluster vulnerable to the loss of specific resources and skills (Pourdenko, 2007).

So, conventionally participants in an industrial cluster can be divided into three groups:

The ministries of the federal government, the regional authorities and the cluster's coordinating council are participants who have an indirect impact on the functioning of the cluster and whose role is to coordinate and regulate its activities.

Enterprises - key goods/services producers of the cluster. They are combined vertically (chains of purchases and sales) as well as horizontally (additional products and services, the use of such specialized costs, technologies or institutions, etc.).

Organizations that serve key goods/services producers of the cluster. These organizations do not directly participate in the production of key goods/services of the cluster, but their presence has a significant impact on its development.

It is also necessary to develop communication between the main participants of the cluster. The basis for the formation of clusters is the possibility and/or the need to share one or several unifying factors among many business entities, such as basic technology, channels for marketing product promotion, a training system, and a system for generating know-how related to a single product line.

The result of the main stage is the implementation of the development program, and consequently, the creation of clusters in the region (Tsihan, 2003).

At the final stage, the performance of clusters is evaluated on the basis of indicators characterizing economic development. Based on the assessment results, the cluster development program is adjusted, the necessary in their activities changes are made.

Thus, the cluster approach allows us to consider and give a description of industries applicable to a particular territory and its features. In this sense, it expands the traditional sectoral approach, since the industry is analyzed not only from the point of view of its development at the moment, but its capabilities are taken into account in the long term, both in the conditions of a particular region and across the country (Pyatinkin & Bykova, 2008).

4.2. Formation and Development of Clusters in the Industry of the District

The Russian economy as a whole, as well as the sectoral and territorial subsystems that make it up, is facing the urgent task of moving from an extensive model of economic growth based on the raw material specialization of the economy to an innovative development model oriented to the world's best practice. The innovative scenario of economic development is the basis for long-term programs of social and economic development of the territories at all levels of government: national, federal districts, subjects of the Federation, municipalities (Fedorova, 2004).

At the same time, it is obvious that the strategic innovative development of the territories should not proceed chaotically, but on a coordinated basis. The formation and development of a system of innovation-oriented clusters in various fields of activity can act as the coordinating and integrating basis of the innovation process in the region.

These clusters can act as “growth points”, generators of innovations with their subsequent diffuse spreading to other sectors of the economy and social sphere of the region.

The role of clusters in the formation and development of national and regional innovation systems lies in the fact that within their framework, stable links are formed between their participants concentrated in regional innovation development centers (“innovation nuclei” of clusters) and enterprises of traditional industries (“production sites” of clusters).

4.3. Effect of Synergy as the Formation of Conditions for the Advancement of Innovative Technologies

The effect of synergy provides the formation of conditions for the promotion of innovative technologies in traditional industries and the emergence of new enterprises that could successfully compete in the world market (Ferova, 2005; Karlsson, 2003).

As one of the regions, the resource potential of which is sufficient for a systematic transition to an innovative development model, we shall consider Yugra, the Khanty-Mansijsk Autonomous District. Along with an inertial scenario for the development of the economy and social sphere of the region, an innovative scenario of changes has been integrated into the strategy of socio-economic development of the district until 2020 and for the period up to 2030.

The innovative strategic development of the District is highlighted as the main strategic goal, which is especially important, given the difficulties of transition to this model in the region with raw material specialization. In the mentioned strategic program document it is noted that the inertial and extensive development scenarios reflect the currently dominant interests in the regional economy and are characterized by a higher probability of implementation than the innovative scenario, since resources, the level of business organization and employment in innovative sectors of the economy are inferior to those of the energy sector (Denisov, 2011; Vakulenko, Egorov & Proskulikova, 2015).

At the same time, in spite of the seriousness of this restriction, an innovative socio-oriented scenario was adopted for the basic scheme in the district development strategy.

It involves a more complex management model for both the state and business, involves investing in high-tech projects and human development, presupposes the transformation of innovative factors into a leading source of economic growth.

An innovative scenario for the development of the district's economy presupposes the formation and development of scientific innovation, oil and gas processing, agro-industrial, medical, mining, forestry and tourist-recreational clusters. The goal of forming a cluster system is to enhance the diversification of the region's economy within the framework of the innovative development model (Tsihan, 2003).

Priorities for the development of the oil and gas cluster in the long term are:

- introduction of innovative technologies to increase the level of oil recovery;
- development of the oilfield services market;
- modernization of transport and energy infrastructure in oil and gas production and processing.

Even in the conditions of implementation of the innovative scenario for the development of the district, it is projected to reduce oil production. This trend in the economy of the District began to take shape in 2008. This is due to both external economic factors (a general slowdown in the growth of the world economy, the eurozone economy) and, as a consequence, a reduction in demand for hydrocarbons, and internal factors (deterioration in the quality of the oil resource base (Tkacheva, Osadchuk, Kapustina, Kobersy & Litvinova, 2017), inadequate activity search, exploration and commissioning of new deposits).

Obviously, the current tax regime in oil production is a brake on the development of the basic industry in the region. So, in the strategy of social and economic development of the Khanty-Mansijsk Autonomous District - Yugra, it is projected to reduce oil production by base deposits by 26% in 2020 compared with 2010. From 2001 to 2011, the annual penetration of search and rescue was reduced by 67% exploratory drilling in the district. Until 2020, there is no plan for a serious increase in this indicator.

The effect of all these factors leads to the fact that the district's oil companies prefer to implement investment projects not on traditional deposits, but outside the region and even abroad. So, OAO “Rosneft”, OAO “Lukoil”, OAO “Surgutneftegaz” and others are actively developing oil production in Africa, Venezuela, Colombia, Algeria, Kazakhstan, Egypt, and Saudi Arabia.

According to the plans of the oil companies, the investment is projected to decrease by 13%, primarily due to

the reduction of geological exploration and works on field development (Denisov, 2011).

Undoubtedly, the formation of an oil and gas producing cluster in the Khanty-Mansijsk Autonomous District - Yugra will not allow for a radical reversal of these negative trends, but, nevertheless, it will solve a number of strategic problems of the industry development. The introduction of innovative technologies for oil and gas production and processing will in the long term lead to an increase in the oil recovery factor from 20-22% in the district to the average Russian level (30-40%).

Technologies to develop the reserves of the Bazhenov suite and other complex deposits, which are available for virtually all large oil companies operating in the district, will be implemented As innovative projects.

The development of the oil and gas producing and oil and gas refining cluster implies the development of oilfield services companies, companies for deep processing of oil and gas (including associated petroleum gas) in Kogalym, Langepas, Megion, Nefteyugansk, Nizhnevartovsk, Nyagan, Surgut, and others. So, for example, in Nefteyugansk it is planned to organize the production of polymers, fertilizers, solvents on the basis of deep processing of associated gas (Denisov, 2011).

In Nizhnevartovsk, it is planned to build mini-factories for the production of PVC, formaldehyde resins, bitumen. All this will allow raising the level of oil and gas processing, thereby successfully solving the tasks of innovative development of the basic sector of the district.

4.4. Mining Cluster Development

The development of the mining cluster is due to the development of the western part of the District (the eastern part of the Ural mountain massif), the creation of a developed infrastructure and energy, and the provision of mineral raw materials to the industry of the Urals. The development of the mining complex of the Khanty-Mansijsk Autonomous District - Yugra is inextricably linked with the implementation of the project “Ural Industrial - Ural Polar”. By its scale, it goes far beyond the regional framework and is able to have a positive impact on the development of key industries of the country (“Official website: Yugra in the format of clusters”, 2015).

The main minerals along the eastern slope of the Urals in the territory of the Khanty-Mansijsk Autonomous District - Yugra, the resources and reserves of which are described most reliably, are coal, quartz raw materials, and gold. According to the Institute of Economics of the UrB RAS, in the Autonomous District, 16 million tons of brown coal, more than 3 million tons of iron ore, up to 100,000 tons of non-ferrous metal concentrates, up to 500 kilograms of gold may be produced annually by 2030. (“Official website: Yugra in the format of clusters”, 2015).

There are geological prerequisites for the identification of industrial accumulations of barite and phosphorites. The main limitations in the development of this cluster are of an infrastructural nature: the development of a network of roads, energy infrastructure, significant investments in geological exploration, training of personnel is required.

Investment projects aimed at the development of the mining complex are currently among the riskiest. The total amount of investment in fixed assets within the cluster development in 2013-2030 is estimated at 120 billion rubles. (“Official website: Companies of the Urals”, 2014).

Despite the fact that the territory of the Khanty-Mansijsk Autonomous District - Yugra belongs to the regions equated to the Far North, and the climatic conditions in the district are not conducive to the development of crop production and livestock, an important role is assigned to the formation and development of the agro-industrial cluster in the strategy for socio-economic development of the territory in order to diversify the region's economy, reduce dependence on imported food and form its own food base.

The main contribution to the production of agricultural products of Yugra is made by the households and farms. Taking into account the climatic features of the District, the output of agricultural products per employed person in the industry is more than 2 times lower than in the rest of the Russian Federation. The level of profitability of agricultural production is also lower than the average Russian level, which requires considerable state support.

Priority directions of development of the agro-industrial cluster are the modernization of agricultural production through the use of modern technologies, increasing the effectiveness of interaction in the “production-processing” chain.

The cluster can be formed on the basis of the development of traditional branches of agriculture and traditional management (reindeer breeding, fur farming, fishing and fish processing, wild plants harvesting).

Processing of agricultural raw materials is one of the priorities of the agrocluster development (“Official website: Companies of the Urals”, 2014).

So, in Kogalym town it is planned to build a mini-factory for milk processing, to build a poultry farm, three meat-processing shops, and create a fish farm. In the town of Pokachi, production of herbal tea will be organized. The Beloyarsky district of the district is planning to build a mini-factory for venison processing. In the Nizhnevartovsk region, the production of pine nuts will continue to develop. In the Soviet area, there are plans to breed quails and rabbits. Thus, aggregate investment in expanding the resource base and processing facilities in the Khanty-Mansijsk Autonomous District - Yugra in 2013-2030 will total more than 11 billion rubles.

4.5. Priorities for the Timber Cluster Development

Priorities for the development of the timber cluster are aimed at modernizing existing and building new enterprises and developing the transport infrastructure of forestry. The timber industry plays an important role in

the economy of the District, ensuring the deepening of the diversification of the regional economy. The Khanty-Mansijsk Autonomous District - Yugra is one of the five subjects of the Russian Federation that are mostly provided with forest resources. The reserves of ripe wood account for 4.6% of the total Russian level. The bulk of the production capacity of the timber industry complex is concentrated in the western part of the District – in the Soviet, Kondinsky and Oktyabrsky districts.

The industry development in 2008-2011 was characterized by a negative dynamics of volumetric indicators. Thus, the production of sawn wood fell from 433 to 267 thousand m3. The volumes of production of wooden building structures, medium density fibreboard (MDF) fell. The specific weight of unprofitable organizations has grown ("Official website: Yugra in the format of clusters", 2015).

The creation and development of the timber cluster will give a new impetus to the development of the industry, will allow breaking the negative trends, will bring the level of development of the timber industry of the district into line with the available forest resources.

As part of the development of the forest industry cluster, it is necessary to clarify the assessment of the forest potential of the District, develop a set of measures to strengthen control over the use of forests, implement investment projects to develop production facilities for deep processing of wood raw materials, intensify the construction of forest roads and train personnel for the industry. For example, the priority investment projects in the timber cluster include the construction of enterprises for the production of wood plates in Nefteyugansk, Nizhnevartovsk, the organization of production of fuel pellets from woodworking waste in Nyagan, the development of capacities for wood-frame house construction in the Soviet district of the District. The total volume of investments in the timber industry complex of the District in 2013-2030 will be about 14 billion rubles. (Denisov, 2011).

5. Conclusions

Thus, cluster approach seems to be the most progressive and effective approach to regional development in the conditions of instability and high competitiveness of the global environment. The main advantage of the latter is the unification of all levels of the development of the region - from the level of administration to individual branch firms and the achievement of a holistic vision of the economy of the territory.

The cluster concept of the region's economic development presents an alternative vision of competition, a new model for structuring the region's economy, as well as an integrated approach to the innovative development of both individual economic agents and the territory as a whole. The logic of the development of the most successful global companies and the most economically developed regions and countries of the world shows that clustering is a natural stage in the evolution of forms of integrated management organization, which allows uniting the single and common, to balance the interests of a person-, firm- and region-directed development.

The cluster approach in managing regional development is a new management technology that allows increasing the competitiveness of the region or industry, and at the same time, of the state as a whole.

Yugra is famous for its oil and gas fields. The development of industry in this region is strategically important for the whole of Russia. That is why it has been decided to implement a new scenario of economic development, i.e. cluster in Yugra. Under the cluster, the unification of enterprises and organizations associated with relations of territorial proximity and functional dependence in a particular sector of the economy is most often understood.

The implementation of the cluster approach in the development of the region will allow:

- To increase trust, improve relations between enterprises and organizations of the region, to acquire a synergistic effect of all enterprises that are part of the cluster;
- To optimize the functioning of value chains, improve business structuring, to establish more favorable conditions for doing business;
- To stimulate economic growth, increase the competitiveness of the region, increase the regional GRP and the volume of tax revenues;
- To improve the quality of life of the population of the region;
- To develop the separated territories;
- To improve the business and investment climate in the region.

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