Modeling of Parameters of Clusters Economic Efficiency

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Abstract

As one of effective forms of region competitiveness increase at the present stage of economy development the clusters act. Within the clusters policy in the Russian economy it is created and functioning 25 innovative and technological clusters. Till nowadays there is no researches directed on assessment of clusters functioning efficiency in economic space of the region. In this regard the main research objective is the analysis of parameters of clusters economic efficiency for further research of the given parameters influence on region economy. Hypothesis of research presents by situation that among the major factors influencing yje indicators of production in the cluster there will be the state and private investments, and indicators of innovative development and on research and development indicators the most influence exert on by expenses and qualification of workers. In article the conclusion that the measures for attraction of bigger volume of private investments are necessary for increasement of cluster functioning efficiency in the territory of the region is drawn. In process of development of productive forces, increase in scales of production and change of its structure in vector of so-so - and hi-tech production there is number of the large interbranch and interregional problems, which solution by traditional methods within the developed system of territorial and sectoral planning is impossible, or application of these methods does not allow providing an expected effect.

Keywords: territorial and production complexes, cluster, scientific and reasonable planning, state investments, honest investments, expenses on innovations.

1. Introduction

Increase of economy competitiveness at the expense of high efficiency of work and growth of innovative production in general structure of production depends more on available potential of separate territories, and on measures of the state stimulation of innovations system as well. In the last some years the economical policy of many countries is concentrated on development of network interaction between the enterprises of one or several branches in certain territory. The approach to of economic potential development in separate territories, based on strengthening of geographical concentration gains more and more wide circulation, confirming the efficiency of local geographical networks in the conditions of global competition. Despite of globalization of world economy which offers the comparative advantages at the expense of reduction in transport and transactional disbursements in development of economy competitiveness the clusters gain an increasing value. Globalization allows for many enterprises to expand the framework of their activity out of national economy boundaries, however, as the experiment shows, the enterprises aim to be grouped in certain regions. It is connected with those advantages which arise due to geographical concentration and region specialization on certain kinds of activity.

2. Theory and Hypotheses

2.1 Territorial and production complexes

In period of planned-economical development for the solving of interbranch and interregional problems character the interbranch control systems of groups of homogeneous and interconnected branches with targeted orientation of plans for the end results were created. Territorial and production complexes became the most important elements of improvement

of planning and forecasting system, and also of spatial organization of productive forces. The creation of territorial and production complexes (TPC) directly has been connected with implementation of long-term target programs, with solution of large branch and regional problems. Thus, the programmable and target TPC have proved as highly effective form of the spatial organization of productive forces while solving the problems of interbranch and regional development.

As the examples of effective organization of interbranch and inter regional cooperation it is possible to present the TPC of Bratsko-Ust-Ilimskiy, Sredne-Obskiy, Sayanskiy, Tsentralnoirkutsky, Yuzhno-Tajikskiy, Mangyshlakskiy, TPC of Kursk magnetic anomaly.

Territorial and production complexes are the constituent part of country uniform economic complex representing the set of the enterprises and constructions of various branches of national economy in the certain territory, connected among themselves by use of district wide natural and economic resources and conditions, and also by general system of settling that allows to increase the economic efficiency of production.

In addition to branches of production specialization such complexes included the branches of infrastructure serving the production and population along with the huge and largest enterprises - the medium-sized and small enterprises and constructions, that is the whole set of enterprises of production sphere and the sphere of non-material production. Such structures of complexes use to provide the forming of production chains in the territory of certain region. The activities on increase TPC functioning efficiency for solving problems of interbranch and interregional development use to include not only the construction of manufacturing enterprises and constructions, but also housing, municipal and cultural objects, schools and hospitals, preparation of qualified personnel - experts in mass professions.

Within the improvement of planning system, and also an increase of level of scientific justification of productive forces placement the schemes of formation was worked out in large TPC development as component of general scheme of the USSR productive forces placement which was based on scientific-technical and economic assessment of placement of raw, energy, water and manpower resources, and also their rational use within country complex development. Schemes of TPC formation and development were operated on the basis of alternative technical and economic calculations, proceeding, first, from the assessment of natural and economic conditions and definition of their role in the solution of social and economic tasks, and, secondly, proceeding from facing the national and its separate regions' economy tasks in the period predicted.

Alternative TPC at the present stage of Russian economy development is the cluster representing a new organizational form which is designed in order to increase the competitiveness of the territories Shevchenko, Razvadovskaya (2013). Uniting into cluster of the enterprise can lower the investment expenses and facilitate the process of highly specialized shots search, and also to gain an access to new technologies, methods of management, bases of suppliers and buyers.

2.2 Clusters

Considering an existence of certain positive effects from localization, the governments of many countries try to stimulate the process of clusters creation and development. Depending on national conditions, characteristics of the branch and geographical conditions the approaches to creation of regional or branch clusters differ. Many countries apply so-called drastic (financial) and soft measures of clusters stimulation which also lead to various effects. Recently the policy of clusters development is concentrated on high-technology industries which will allow increasing the competitiveness of economy in the world market. Such approach to development of branches and the territories is disputable and might not give the positive effects expected as it does not consider the provision of comparative advantages theory and the provisions of regional agglomeration theory.

According to Porter's theory «The competitive advantages in global economy is often strongly localized and resulted from concentration of highly specialized skills and knowledge of the related enterprises». According to general statements of Porter's theory the cluster's advantages are based on geographical localization, economy of scale and resource specialization of the territory. Preceding from these provisions, in the research it is assumed that major factor of cluster viability is an existence of geographical and resource advantages which are capable to give the positive effects from network interaction of the enterprises of the region.

In the last few years the cluster kind policy has taken wider space in economic policy of Russia. However the territorial sectoral planning parameters are disputable in implementation of cluster kind policy as at higher level oriented on definition of priority directions of innovative development with no taken into account the geographical localization and territorial specialization Pogodina, Kata (2014). Thus in modern economic literature there no researches are devoted to diversified specialization of the region as the conditions of formation of multi-purpose cluster with development of convergent technologies of management.

Existence of problems has predetermined in the given field the subject of this article which main hypothesis is that the efficiency of cluster is dependent on specialization of the territory and its geographical features.

In the last some decades it is traced the considerable interest from domestic and foreign scientists to the problems of management by the industry through generation and dissemination of knowledge and innovations in cluster Arikan, (2009); Bell, (2005). Development of new approach to the management of economic development of both: the separate territories and the branches is connected with that in high-competitive innovative environment the companies are suffering of lack knowledge and are trying to compensate it at the expense of network cooperation. Due to the narrowness of knowledge and resources limitation in modern high-competitive conditions the reference point of economic policy at regional and branch levels is the cluster promoting a support of innovative development of the industry Casanueva, Castro, Galn, (2013). Many researches confirm that the enterprises entering into structure of cluster have higher indicators of innovative development, than the enterprises which are not entering into network structures of cluster type Gertler, (2003).

Since the time of A. Marshal the territorial agglomerations admit the important characteristic of industrial society. According to its definition the agglomeration is «the industry, concentrated in the certain territory» Marshall, (1920). The bases for formation of agglomerations are the certain geographical or natural characteristics which provide a concentration of production and as a result a vertical and horizontal integration. A. Marshal was insisting that the unique geographical or environmental conditions might become the reason for industry localization in certain territory. Thus in Elison's research grounds that the natural advantages are observed only in 20 % of studied clusters, the remaining 80 % of agglomerations are created not on principle of geographical advantages.

The term "cluster" use for description of agglomeration rather recently and in most cases is associated with M. Poter's Porter, (1998) works which describes the clusters as geographically close groups of companies and as their infrastructure provider which supplements the effects from network interaction of the enterprises Zhang, Li, (2010). The geographical closeness and network interaction lead to appearance of effects not only for organizations concentrated in cluster, but also leads to creation of additional benefits from interaction for the external enterprises and the organizations. The main effects from the cluster type organization are: the access to specialized manpower, access to dissemination of knowledge, access to specialized communications Bahrami, Evans, (1995); Amin, Thrift, (1995).

As the infrastructure elements providing the additional effects from cooperation the scientific and educational centers act. Krugman notes that the clusters create a structural element of the market for specialized workers effects from which are used by both: workers at employment, and employers which are receiving an access to labor of necessary qualification and specialization Krugman, (1991).

The cluster represents a new organizational form which is intended for increase the region competitiveness. Uniting into cluster the enterprises can lower an investment expenses and facilitate the process of highly specialized experts search, and also get access to new technologies, methods of management, bases of suppliers and buyers. The conventional is considered the statement on that the enterprises entering into structure of regional cluster have the higher economic indicators Piore, Sabel, (1984); Storper, (1997); Pyke, Becattini, Sengenberger, (1990).

Nevertheless, in the researches there is no consensus about what internal mechanisms of cluster provide an economic and innovative development of the enterprises. The basic principle on which the advantages are explored in the cluster is the geographical localization. However, according to many scientists opinion the cluster identification by geographical principle does not give the exact results Tallman, Phene, (2007) and according to them thee very social networks, which arise in cluster, provide the high indicators of economic and innovative development of the enterprises Whittington, Owen-Smith, Powell, (2009); Singh, (2005). Shevchenko, Razvadovskaya (2014).

Potential benefits from competitiveness and innovation increase in cluster arise, first, from external factors of agglomeration and, respectively, from localization of economy, which are uniting the sectors and enterprises, connected by access to collective resources, such as specialized labor markets and infrastructure, and provide, as well, the stimulating combination of competition and cooperation. Secondly, the clusters promote the training and knowledge creation system dynamics, based on socially built-in vertical and horizontal interrelations of the enterprises, interaction with educational and scientific-research organizations Steiner, (1998); Maskell, (2001).

The clusters, in this manner, cover the material elements, such as infrastructure, and as well the non-material aspects, allowing the joint innovative development realization.

Hypothesis of the research is presented by statement on that among the major factors influencing the indicators of production in the cluster there will be the state and private investments, and on indicators of innovative development in more extend will influence the expenses on research and development and qualification of workers.

3. Methodology

The cluster creates the certain effects for enterprises and branches; and the main problem is identification of cluster kind formations for the purpose of identification of priority directions of territory development and creation of certain measures of the state support. Nevertheless, in the researches, there is no consensus about what kind of internal mechanisms of cluster provide an economic and innovative development of the enterprises included into agglomeration structure.

In this regard the main objective of this article is the identification of the factors defining an efficiency of cluster as institute of territorial and branch development. The main hypothesis of the research is the statement that the major factor influencing on cluster success are the private investments, and expenses on scientific researches and development as well.

Within this research the correlation and regression analysis are applied, and the calculations are made by means of SPSS program.

For identification of factors influencing the cluster the following indicators have been chosen:
- the volume of the shipped goods of own production, executed works, services by own forces;
- the benefits from sales of the goods, executed works, rendered services in foreign market, billion rubles;
- the of volume private investments, billion rubles.
- the quantity engaged, thousands of people.
- the volume of financing of research and development;
- the top skills staff (doctors, candidates);
- the number of development institutes (scientific research institute, higher education institutions, engineering centers)
- the State investments
- the number of organizations in total.

As independent variable in the first case it is chosen the volume of the shipped goods of own production, executed works, services by own forces. In second case - the volume of manufactured innovative production. The calculations will allow establishing dependence between the volume of production and investments, and also between the manufacturing volume of innovative production and research and development financing.

4. Results and Discussions

For analyses of cluster parameters effecting its effectiveness it is conducted the calculations which will allow to reveal a dependence between the volume of production manufactured and the following indicators: Variable 1 - the private investments volume, Variable 2 - the quantity of engaged, Variable 3 - the volume of research and development financing, Variable 4 - the top skills staff, Variable 5 - the number of development institutes, Variable 6 - the state investments, Variable 7 - the number of organizations in total. Settlement data are provided in table 1. By results of calculations it has been established that the greatest influence on production volume manufactured by the cluster's enterprises have the state investments (0,9), on second place - the private investments (0,5). Also it has been established that such indicator as the number of development institutes and the number of organizations in total do not influence the cluster activity connected with production. Thus, it is possible to make the assumption that the size of cluster does not influence its efficiency.

Table 1. Modeling of cluster parameters influencing on volume of production manufactured by enterprises which are a part of the cluster.

	df	SS	MS	F	Significance F			
Regression	7	0,14447764	0,02063966	0,477720714	0,837588359			
Residual	17	0,734475724	0,04320445					
Total	24	0,878953364						

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0,035118666	0,07869782	0,446247	0,66105064	-0,13091922	0,201156552	-0,13091922	0,201156552
Variable 1	0,585575663	0,483058814	1,21222436	0,242005512	-0,433589347	1,604740673	-0,43358935	1,604740673
Variable 2	0,113474683	0,21417661	0,52981828	0,603089474	-0,338398466	0,565347833	-0,33839847	0,565347833
Variable 3	-0,19384594	0,229334644	-0,84525363	0,409708515	-0,677699744	0,290007864	-0,67769974	0,290007864
Variable 4	0,004465348	0,241167435	0,01851555	0,985443151	-0,504353463	0,513284158	-0,50435346	0,513284158
Variable 5	0	0	65535	0	0	0	0	0
Variable 6	0,919835877	0,771400908	1,1924226	0	-0,707677776	2,547349529	-0,70767778	2,547349529
Variable 7	0	0	65535	0	0	0	0	0

For the analysis of cluster parameter influence on volume of innovative production the same variables have been chosen: Variable 1 - the volume of private investments, Variable 2 - the quantity engaged, Variable 3 - the volume of research and development financing, Variable 4 - the top skills staff, Variable 5 - the number of development institutes, Variable 6 - the state investments, Variable 7 - the number of organizations in total. Calculations are provided in table 2. By results of calculations it has been revealed that on volume of manufactured innovative production the greatest influence has such indicator as the state investments (0,6), however its influence not that strong as in the first case (that is on production volume as a whole). On second place per significance is occupying by volume of frequent investments (0,5). It should be noted that in the provided model the influence of such indicator as the top skills staff is very insignificant.

Table 2. Modeling the cluster parameters influence on volume of innovative products manufactured by enterprises which are a part of the cluster.

	df	SS	MS	F	Significance F			
Regression	7	0,129224019	0,018460574	2,380631504	0,06829651			
Residual	17	0,131826265	0,007754486					
Total	24	0,261050284						

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0,034043814	0,033340718	1,021088213	0,32152466	-0,036298952	0,104386581	-0,03629895	0,1043866
Variable 1	0,522909543	0,204650241	2,555137681	0,02049199	0,091135276	0,954683811	0,09113528	0,9546838
Variable 2	0,157601428	0,090736974	1,736904167	0,100487413	-0,033836853	0,34903971	-0,03383685	0,3490397
Variable 3	-0,088934793	0,097158749	-0,915355475	0,372807117	-0,293921836	0,11605225	-0,29392184	0,1160522
Variable 4	-0,077826039	0,102171769	-0,761717636	0,45666666	-0,293389629	0,137737552	-0,29338963	0,1377376
Variable 5	0	0	65535	0	0	0	0	0
Variable 6	0,61033107	0,326807788	1,86755363	0	-0,079173091	1,299835231	-0,07917309	1,2998352
Variable 7	0	0		0	0	0	0	0

As a whole it is necessary to note that in both cases it is greatest influence on parameters of production renders such indicator as volume of the state investments. I.e. it is possible to assert that in the Russian economy the main model of clusters creation is centralized modeling.

5. Conclusion

Now in Russia there is the number of "spontaneously" created clusters formed around the key branches of the industry. The structures of such clusters are rather unstable, and cannot be compared to the real clusters possessing the well debugged systems of suppliers and consumers. Formation of highly competitive multi-purpose clusters could become the basis of infrastructure development of many regions in the presence of target investments. Thus the clusters shall be created on regional basis as to the region it is intrinsic a high geographical concentration of branches which also will become the precondition of the interbranch intracluster type network of organization.

These actions will allow to the region to attract the necessary quantity of investments which are the basis of technological modernization of branches, of inflow of new knowledge and technologies.

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