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Evaluation of Industrial Clusters Efficiency in the Context of Innovation Policy (on the Example of the Krasnoyarsk Territory)

Tatiana V. Kozhinova* and Irina S. Ferova
Siberian Federal University
*79 Svobodny, Krasnoyarsk, 660041 Russia*¹

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The article deals with the problems of socio-economic development of the region with account taken of the innovation component. One of the versions of the economy modernization and transition to the sustainable development is the usage of the cluster model. We have developed the basic methodological principles for evaluation of cluster policy.

Keywords: industrial innovation, technological clusters, principles of cluster policy evaluation.

Methods of cluster policy evaluation

The future of Siberian territories is largely determined by the prospects of global technical and technological changes. Major investment projects in Siberia that are claimed to be implemented are mostly concentrated in the raw materials industries and related to the development of transport and energy infrastructure.

The potentialities of innovative development of traditional industries are high, but innovative development presupposes rapid growth of industries of the “new economy” (information technologies, biotechnologies and medical technologies, electronics and new materials) that are experiencing an acute shortage of investment.

One of the strategic directions of Siberia development in the coming decades as the basis of innovation economy of the Siberian Federal

District (SFD) is science, education and a complex of high-tech industries.

In the forthcoming period, the organization of high-tech production in Siberia will be provided with the help of industrial innovation and technological clusters. Strategies of the SFD territories propose the following:

1. Establishment of the high-tech clusters in Siberia on the state initiative with the help of government programs and projects in the defense industry – (Omsk, Biysk, Novosibirsk, Krasnoyarsk), the state corporations “Russian Technologies”, “Russian Nanotechnologies” etc.

2. Establishment of clusters on the basis of large-scale projects of country’s territory development on the new industrial base:

- comprehensive development of Angara region, Krasnoyarsk Territory;
- comprehensive development of the South-East of Chita region, where processing

* Corresponding author E-mail address: kozhinova@lan.krasu.ru

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facilities will be launched with the help of private investments and on the basis of the energy and transport infrastructure that is created with the government participation;

- development of industrial potential in South Yakutia.

3. Establishment of clusters on the basis of large enterprises and plants of airtechnological equipment in the municipal units (Zheleznogorsk, Biysk, Berdsk, Koltsovo, etc.) and around the major scientific and educational centers (Novosibirsk – Instrument engineering cluster, power electronics, biotechnology), Tomsk (development of infrastructure of special economic area, biotechnology, information technology), Altai territory – biopharmaceutical cluster).

4. Initiative establishment of regional clusters as a complex of enterprises in the regions of the Federation, municipal units of large and medium-sized cities (for example, clusters in construction, food processing, light industry, etc.).

Innovative development is not limited by the high-tech complex modernization; it includes the significant development of human potential of the territory population, establishment of new conditions and lifestyle on the basis of social and organizational innovations.

Several major educational centers will be established in Siberia, including research universities (Novosibirsk, Tomsk), national research centers in priority areas (Kemerovo, National center for the mining industry), the network of regional innovation centers.

Considerable growth of innovative business is expected, including the development of integration and cooperation between small innovative business and large industrial enterprises and scientific and educational centers.

The main problems that are connected with evaluation of the impact of economic policy based on the changes in the collective and systematic behavior can be described in the following way:

1. Identification of clusters that are necessary for evaluation of the impact of the policy;

2. Determination of the behavior that should be measured within every cluster;

3. Linking of the changes in the cluster behavior (in particular, the network formation) with changes in the results of the cluster members work and the entire cluster as a whole;

4. Establishment of the fact that changes in the cluster work that are caused by the given policy have a positive impact on the cluster and the territory economy as a whole;

5. Formation of the standardized basis for comparison of the activity of highly differentiated clusters, and making a decision about profitability of a particular form of support (that is a key decision in those cases when cluster policy includes simultaneous support of several clusters).

These issues represent the sequence (Table 1) that corresponds to the stages of the evaluation process and “products” that appear at every stage.

It is necessary to develop special evaluation methods for every type of competitive advantages, whether it is (we will define three main sources of advantages) special level of qualification, technological infrastructure that is necessary for the innovative ability or the cluster or system of business support that allows new firms to join the cluster. Examples of different estimation options of these advantages are listed below in Table 2.

The evaluation system should also include a solution to the problem of the determination of the effects that will be evaluated for a specific cluster. Many types of cluster policy lay emphasis

Table 1. Problems of cluster policy evaluation

Stages of policy	Problems of the stage	
Policy aims	Definition of clusters	
Policy products	Measurement of cluster work for network formation	
Policy results (micro)	The influence of the network elements on the activity of the certain firm	
Policy results (macro)	The influence of the cluster activity on the economic development of the region	Comparison of work results of various clusters

Table 2. Examples of competitive advantages evaluation within the cluster

Competitive advantage	Evaluation method
Qualification level	- Study of qualification level within a cluster - The need for skills and habits - Study of local structures means to meet the needs for skills and habits
Technological development	- International reputation of specialized studies within the cluster - Extent to which enterprises that are included in the cluster can conduct scientific research - The commercialization of university research
System of support for new firms establishment	- Studies on the evaluation of venture capital availability for the new firms establishment - Study on the evaluation of the production assets availability (value) - Overview of institutional support (or support in the context of economic policy) of cluster development and attitude towards business

on the growth rates, but there is more to basic characteristics of cluster development than that. Successful clusters are not only *competitive* (mainly at the international level, although it is not necessary), but also *sustainable*. Sustainability is quite complicated for evaluation in the short term, when evaluation of economic policy is being made (although the question about the duration of projects that are supported in the context of policy should be considered as a key factor in the project selection). Nevertheless, changes in competitiveness – at least for clusters – are more amenable to evaluation (and, of course, competitive clusters are usually stable over time). Such competitive clusters have the following features:

- *stable (or leading) position in the market* (often in the global market), because the

competitiveness of the cluster definitely depends both on its share in foreign markets and the growth of its share;

- *technological leadership in the industry and ability to innovate*, because the ability to conduct scientific and technological developments and the ability to turn technological leadership into the successful marketable products is typical for all successful clusters (even for industries that are in the phase of maturity or recession, when the rate of technological changes is limited);
- *ability for self-renewal*, because clusters have to conduct activities of self-support and self-government.

Dividing into these elements simplifies the process of evaluation of the cluster

Table 3. Evaluation options for various aspects of cluster competitiveness

Type of competitiveness	Used indicator	Evaluation method
Market position	Presence on the world market	Cluster share change in the world market
	Development of export	Growth in export volumes for the cluster
	New markets for the export	Number of the new markets that involve firms – cluster members
Technological leadership	Reputation	The survey of experts in the given industry about the importance of scientific and research development of this cluster
	Development of new products	The number of significant new products
	Level of the expert qualification	Study of the changes in the qualification level in comparison with other clusters
The ability to renewal	The formation of new firms	Changes in the number of firms that are involved in the cluster
	The inclusion of foreign firms	The amount (and quality) of foreign investment within the cluster
	The share of economic activity	Change in the share of the cluster in gross regional product

competitiveness. Evaluation options of the three marked elements are shown in Table 3. For example, market position can be evaluated with the help of export development, technological leadership – through the recognition of experience that is gained within the cluster, and the cluster ability of self-renewal – through changes in the cluster structure and its significance for the region’s economy.

As with the evaluation of the activity of certain firms, it is likely that researchers will not be able to collect all data that are needed for the comprehensive study of how changes in clusters-launching activity have led to changes in key cluster components. From the viewpoint of policy-makers the most important thing is the possibility to define that the cluster growth is definitely connected with the changes in the clusters formation that are influenced by the economic policy. In this case, such conclusions can be drawn only over a long period of time. For example, such period of time will be required to define whether one or another aspect of cluster formation that has been formed under the political influence (for example, increase

in commercialization of scientific research by the program of the new firms establishment), results in changes in the cluster competitiveness (for example, whether the change in the share of new firms is a consequence of support of the new firms formation). It should be emphasized that the importance of evaluation is not only in measuring of the direct result of cluster policy, but also in its role as a catalyst for deep economic changes (Table 3).

Classification of the region clusters.

Methods of competitiveness evaluation with account taken of the innovation component

There is a serious economic base and real preconditions for the formation of industrial clusters in the Krasnoyarsk territory that in our opinion will be carriers of innovation.

There are two approaches that can be used for analysis and detection of clusters: from the national economic level (the method of standards) and from the level of enterprises that represent the cluster cores.

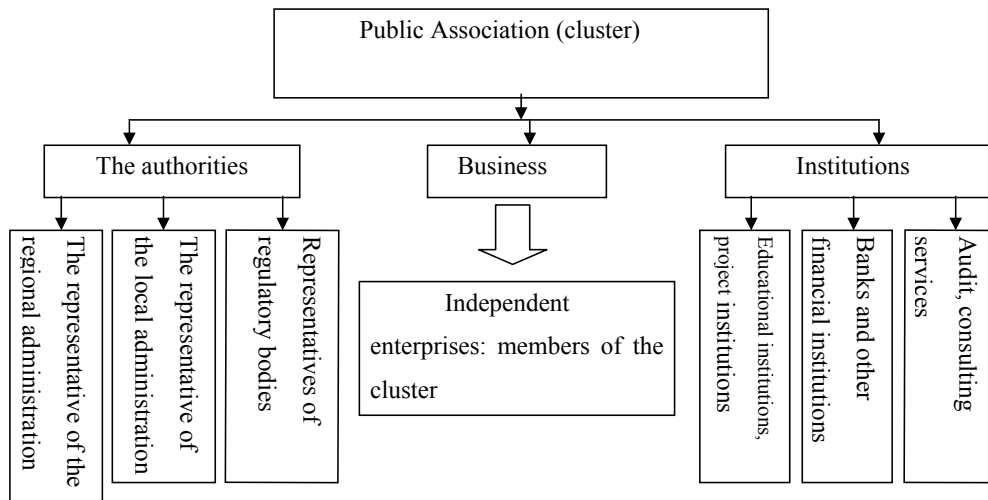


Fig. 1. The general structure of the cluster

We have used the first approach – the method of standards detection at the national economic level and then determination of the availability of these standards in the region.

Taking into account the reference clusters of the Russian Federation, with the statistical methods (in particular the coefficients of concentration and localization) in the industry of Krasnoyarsk territory certain preconditions can be selected for the formation of the following clusters: fuel and energy cluster, metallurgy, oil and gas, machine building, timber and paper and agro industrial clusters. The service sectors include: construction, transport, chemical, technological and innovative (a new cluster for the region).

Then, in our opinion, it is better to implement an approach of evaluation of the competitiveness of the region's economy¹. The principal difference in this case is the implementation of this approach not in the terms of industries, but in the terms of the cluster model. This approach may solve the following issues:

- identification of clusters that are competitive for the regional economy;

- determination of clusters strategic competitiveness with account taken of the innovation component;
- conduct of the updated evaluation of clusters competitiveness and identification of the key factors for its growth.

In this context it is proposed to use strategic planning techniques, as well as the results of the survey of large industrial enterprises of the region.

Strategic planning techniques allow us to answer the following questions:

- which industries and productions, or inter-industry complexes are more desirable to be developed in the region;
- whether the region is competitive and attractive for the identified clusters;
- which areas should be supported for the improvement of the region competitiveness.

One of the variants of this methodical approach is the approach of determination of the region profile. The profile is the structure of the region economic complex. The concept of profiling integrates two aspects: the current

and strategic competitiveness. In our case, these concepts will be applied to clusters.

The goal of the formation of the innovative economic policy consists in the solving of the following subgoals in the context of the given approach:

1. Preliminary evaluation of the current competitiveness;

2. Evaluation of the strategic cluster competitiveness in terms of innovation;

3. Evaluation of the clusters development directions;

4. Identification of the key constraints and the updated evaluation of competitiveness;

5. Development of the system of economic policy measures that are aimed at:

- improvement of key factors;
- support of core clusters;
- sanation of non-core enterprises and complexes.

Evaluation of the current competitiveness is based on the identification of the cluster impact on the criteria indicators of socio-economic development. Thus, this is an attempt to take into account social factors within the cluster concept. Since the influence can be various and controversial, the evaluation is conducted according to the certain components, thus we need to use the term “**factors**”. Evaluation for each factor is based on the comparison of the specific socio-economic features of the cluster and the established environmental conditions of production and activity of the region.

In this case, the basis is represented by the following set of criteria indicators of the quality of the region economic complex that is the target landmark for economic policy in general and indicator of the state and potential growth of the region economy:

- the level of employment (job availability in relation to the active population, unemployment rate);

- the economic provision of the quality of life (income levels of people who are workers of enterprises, GRP per capita, budget revenues per inhabitant);
- degree of income differentiation (income differentiation, the percentage of the population with incomes below the subsistence level);
- GRP growth;
- increase in productivity;
- complexity of the economy, the availability of complementary internal linkages;
- sustainability (ecological compatibility) of economy;
- development dynamics (investment per capita, increase of the work places number, growth of GRP per capita).

Accordingly, for the evaluation of the current cluster competitiveness for the particular region we can use the following factors that reflect the criteria listed above:

1. Assistance to total employment;
2. Assistance to the target groups employment;
3. Assistance to the growth of living standards;
4. Assistance to the budget income growth and decrease in budget expenditures;
5. Assistance to the related industries growth;
6. Labor productivity growth;
7. Impact on the environment;
8. Usage of new technologies, renewal of funds;
9. Assistance to the overall economic growth.

Every factor is given the score according to the scale: (-2) – very low (-1) – low (0) – average, (+1) – high, (+2) – very high.

The next stage is the analysis and evaluation of strategic competitiveness of the given clusters

Table 4. Matrix of correspondence between competitiveness valuations and general index

Consolidated valuations of strategic competitiveness	Consolidated valuations of current competitiveness				
	+2	+1	0	-1	-2
+2	VC	VC	VC	N	N
+1	VC	VC	VC	N	N
0	PC	PC	N	N	NC
-1	PC	PC	N	NC	NC
-2	PC	N	N	NC	NC

VC – highly competitive clusters;

PC – potentially competitive clusters;

N – neutral clusters;

NC – non-competitive clusters.

in the region. The evaluation factors include the following:

- Change in the scientific research expenditures
- Change in the share of innovation active organizations
- Ability for renewal
- Availability of foreign firms
- Growth in export volumes
- Increase of new products number
- Change in the cluster share in GRP
- Change in the cluster share in the world market

For every factor it is necessary to specify weighting coefficients that are used in making the consolidated estimation table. The weighting coefficients can be obtained on the basis of expert estimation.

Integral or consolidated indicators are calculated with account taken of the weighting coefficients in the following way:

$$I = a_1x_1 + a_2x_2 + \dots + a_nx_n, \text{ where}$$

a_1, a_2, \dots, a_n are weighting coefficients that characterize the importance of the certain factor;

x_1, x_2, \dots, x_n are the factors of the current or strategic competitiveness that are evaluated at five-point scale and possess the values (-2); (-1); (0); (1); (2).

After determination of the integral parameters we draw a conclusion about the competitiveness degree of the given complex. We offer to use the development work of the specialists in strategic planning (St. Petersburg)² and use the matrix of correspondence between the consolidated estimation table and the final grouping index (Table 4).

¹ Жихаревич Б.С. [B.S. Zhikharevich] Определение перспективной специализации хозяйственного комплекса города (оценка профильности) по материалам семинара «Основы территориального стратегического планирования на принципах широкого общественного участия», Санкт-Петербург, 28.06.04.

² Там же.

Оценка эффективности промышленных кластеров в контексте инновационной политики

Т.В. Кожина, И.С. Ферова
*Сибирский федеральный университет
Россия 660041, Красноярск, пр. Свободный, 79*

Статья посвящена проблемам социально-экономического развития региона с учетом инновационной составляющей. Одним из вариантов модернизации экономики и перехода к устойчивому развитию является использование кластерной модели. Нами разработаны основные методологические принципы оценки кластерной политики.

Ключевые слова: принципы оценки кластерной политики.
