

## EVALUATION OF THE IMPACT OF CLUSTER STRUCTURES ON THE ECONOMY OF THE REGION

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### ABSTRACT

The article defines the necessity of forming complex production groups and technologically connected chains incorporating different business entities in order to achieve concrete economic results within one administrative territory. The authors propose a hypothesis of positive influence of cluster structures on the economy of the region.

In order to assess the economic sustainability of the region and an evaluation system itself which is aimed at identifying priority cluster structures the authors conducted an analysis which identified the main elements of conjugation between the two evaluation systems: employment and investment in fixed assets.

Based on the analysis it could be concluded that it is possible to use two methods to assess the impact of cluster structures on the economy of the region: 1) the comparison method based on the ranking of indicators by the degree of remoteness from the threshold value by the normalizing functions; 2) Shift-Share method. Approbation of the specified estimation methods was carried out in two groups of regions: 1) regions with no cluster structures; 2) regions with a dominant cluster development. Results of the assessment has proved the positive influence of cluster structures on the economy of the region and has revealed the advantages of using each of the proposed methods.

The results of the research can be used by regional government bodies during the managerial decision making process regarding the formation of economic policy that ensure the sustainability of regional development through the implementation of cluster approach.

**Keywords:** cluster structures, network interaction, matching method, Shift-Share method, regional economic development, regional policy.

### INTRODUCTION

The economy of Russia and its subjects is currently undergoing a difficult period of development, when the country, before it could completely recover from the effects of the global financial and economic crisis has faced with new unfavorable environmental

factors associated with sanctions of Western countries, which were expressed in a closed external borrowing and curtailing foreign investment. These circumstances, undoubtedly, predetermine the need for the formation of mechanisms for modernizing the policy of the regions providing not only short-term, but also medium- and long-term stability of their development.

Currently, the use of the cluster approach is becoming one of the key areas of regional policy. The need for the formation of integrated production groups and technologically connected chains bringing together different business entities in order to achieve concrete economic results within the same administrative territory becomes obvious.

The implementation of cluster initiatives creates a number of competitive advantages [1,2,3,4]:

- allows to provide a high level of economic security;
- increases the turnover (return) of the existing resources by improving the interaction between the enterprises;
- stabilizes the economic processes of enterprises through convergence of producers interests;
- extends the regulation of pricing policy on products;
- stabilizes economic ties by increasing reliability and strengthening of mutual settlements between the enterprises;
- expands opportunities to form a market for the sale of cluster' products the possibility of forming new directions;
- ensure stability and guarantee the demand for products of each enterprise.

The creation of a regional cluster structure affects many aspects: increasing competitiveness of the region; increase in the level of business activity; increase of investment attractiveness and, as a result, increase in investments; infrastructure development, increase in the gross regional product, as well as replenishment of the regional budget.

In this connection we hypothesize that the creation and further functioning of cluster structures has an impact on the economic development and economic security of the region.

## **METHODS**

To confirm or refute this hypothesis we conducted an analysis of methods for assessing the economic security of the region and evaluation system aimed at identifying the priority of cluster structures.

Various techniques are used for the estimation of economic stability and security [5,6,7,8,9,10,11,12], which can be roughly differentiated into the following groups:

- 1) monitoring of key macroeconomic indicators and its comparison with threshold values (comparison method);
- 2) assessment of regional economic growth rates on the key macroeconomic indicators;
- 3) expert assessment method to rank the territories by level of threat;
- 4) assessment of the quantitative determination of damage;
- 5) methods of applied mathematics.

According to the authors, for the evaluation of economic security and stability of the region, it is advisable to use comparison method.

The presented technique [10] uses two functions: for the type «not less than» and for the type «no more than». It is also necessary to determine to which type belongs the indicator. For the type «not less than» the function is:

$$y = \begin{cases} 2^{(1-\frac{a}{x})/(\ln\frac{10}{a})}, & \frac{x}{a} > 1 \\ 2^{-\log_{10}\frac{a/x}{a}}, & \frac{x}{a} \leq 1 \end{cases}$$

where  $x$  — the actual value of the indicator,  $a$  — its threshold value. Respectively, for the type «no more than» the function is:

$$y = \begin{cases} 2^{(1-\frac{x}{a})/(\ln\frac{10}{a})}, & \frac{x}{a} < 1 \\ 2^{-\log_{10}\frac{x/a}{a}}, & \frac{x}{a} \geq 1 \end{cases}$$

We should note that these functions are continuous and monotone (the point  $x=a$  provides both the equality of functions and their derivatives).

The normalizing function was chosen in such a way that after normalization all the indicators become «effective» (for «cost» indicators an inversion is made).

This normalization allows to present economically justified risk areas:

- catastrophic risk zone — within a sector limited by a value of 0,25;
- critical risk zone — within a sector limited by values of 0,25 and 0,5;
- significant risk zone— within a sector limited by values of 0,5 and 0,75;
- moderate risk zone — within a sector limited by values of 0,75 and 1;
- «stability» zone — outside the sector, limited by a value of 1: between 1 and 1,25 — exceeding the threshold value in 1 to 1.6 times, between 1,25 and 1,5 — in 1,6 to 3,3 times, between 1,5 and 1,75 — more than in 3,3 times.

To assess the economic security of the regions as the main indicators we choose the following:

- in the field of economic development – GDP per capita as the most typical indicator of sustainable development of the region (the threshold value - 100%);
- in the field of social development – the unemployment rate in the general working-age population (threshold value - 7%);
- in the field of investment development – amount of investments in fixed assets in % of GRP (threshold value - 25%).

Further, the research identified priority cluster structures and potential economic sectors for the development of clusters. Based on the competitive selection system of the Ministry of Economic Development, a sample of regions with the highest level of cluster development was carried out, as well as a sample of regions without cluster development. The selection criteria and sample results are presented in the table 1.

Table 1 – Criteria for selecting subjects of the Russian Federation that successfully integrate cluster structures and subjects of the Russian Federation without a dominant cluster development

Subjects of the Russian Federation (with created cluster structures)	Subjects of the Russian Federation (without created cluster structures)
<b>Criteria for selecting subjects of the Russian Federation</b>	
1) Scientific-technological and educational potential of the cluster. 2) The production potential of the cluster. 3) Quality of life and level of development of transport, energy, engineering and housing infrastructure of the cluster basing area. 4) The level of organizational development of the cluster. 5) Assessment of current level of cluster development, program of measures and dynamics of target indicators	1) The presence of a large number of enterprises and organizations operating in one industry. 2) The presence of this entity in one Federal District with a subject where an active cluster policy is conducted. 3) Quality of life and level of development of transport, energy, engineering and housing infrastructure of the region. 6) Scientific-technological and educational potential of the region.
<b>Subjects of the Russian Federation selected for approbation</b>	
Kaluga region Tomsk region Samara region Moscow city Krasnoyarsk region	Orenburg region Chelyabinsk region Omsk region Sakha Republic Krasnodar region

Based on data [13]

It is proposed to use Shift-Share method as an alternative method for assessing the impact of cluster structures on the economy of the region. This method is widely used by foreign researchers in the field of regional economic analysis.

Shift-Share method is based on the assumption that regional economic growth is explained by the combined effect of the three components: growth of the national economy; growth of the industry in the country; growth of a regional economy where there is a cluster operating in one or more sectors [14].

Calculation of influence can be performed using the following formula:

$$SS = NS + IM + RS, \quad (1)$$

where *SS* –Shift-Share; *NS* –National Share; *IM* –Industry Mix; *RS* –Regional Shift.

To calculate each of these components we use formulas 2,3,4.

$$NS = E_{ir}^{t-1} * (E_c^t / E_c^{t-1}), \quad (2)$$

$$IM = E_{ir}^{t-1} * [(E_{ic}^t / E_{ic}^{t-1}) - (E_c^t / E_c^{t-1})], \quad (3)$$

$$RS = E_{ir}^{t-1} * [(E_{ir}^t / E_{ir}^{t-1}) - (E_{ic}^t / E_{ic}^{t-1})], \quad (4)$$

where *E* – one of the indicators of economic development (employment, turnover, etc.); *t* – current period; (*t-1*) – previous period; *i* – type of economic activity; *C* – country; *r* – region [14].

By calculating the components of formula (1), we can determine the contribution of each of the three factors that will reflect regional economic growth. These factors include: national share (*NS*), industry mix (*IM*) and regional shift (*RS*). By defining and analyzing the activity of regional cluster structures, the indicator *RS* (level of regional contribution) is of the most interest, as this indicator through the types of economic activity can give information of the competitiveness of the presented region in relation to the whole country. If the *RS* index takes a negative value for any type of economic

activity, then this kind of economic activity in the region is developing at a slower pace in the country as a whole. If the RS index takes a positive value, consequently, created clustered associations effectively interact and influence the economic development and economic security of the region, since the type of economic activity, in which the cluster operates, develops at a greater pace than in the country as a whole. The advantages of this evaluation approach are the ease of official statistics use and its availability. On the other hand, it can be argued that if the RS indicator takes a positive value, therefore, cluster structures have a positive effect on both the development of the region and its economic security.

To assess the impact of cluster structures on economic security using the Shift-Share method, it is necessary to take such indicators as an indicator of economic development which will be one of the main indicators that allow assessing economic security. As a result, the main elements of the interface between the two evaluation systems are identified: employment and investment in fixed assets. Thus, the created cluster will directly reflect the economic processes taking place in the region related to employment and investment volume, and the deviation from the threshold value will assess the economic security of the region.

## RESULTS

Approbation of evaluation methods was carried out on the example of regions, the sample of which was made in accordance with the table 1. The results of evaluation are presented in table 2.

Table 2 – The results of the assessment of cluster structures influence on the economy of the region using method of comparison and the Shift-Share method

Region	Shift-Share method (index RS)		Evaluation of compliance of economic stability indicators with the threshold value	
	Employment	Investment size	Employment	Investment size
<b>Regions with a dominant cluster development (Group A)</b>				
Kaluga region	+0,19	+182,48	1,65 (stability zone)	1,07 (stability zone)
Tomsk region	+0,69	+10,36	1,53 (stability zone)	1 (stability zone)
Samara region	+0,16	+1207,09	1,59 (stability zone)	1,02 (stability zone)
Moscow city	+22,79	+228,8	1,69 (stability zone)	0,76 (moderate risk zone)
Krasnoyarsk region	+59,25	+4982,78	1,59 (stability zone)	0,98 (moderate risk zone)
<b>Regions with the absence of cluster structures created on the territory (Group B)</b>				
Orenburg region	-0,75	-87,72	0,92 (moderate risk zone)	0,95 (moderate risk zone)
Chelyabinsk region	-1,13	-203,19	0,98 (moderate risk zone)	0,91 (moderate risk zone)
Omsk region	-0,06	-132,18	0,95 (moderate risk zone)	0,72 (significant risk zone)
Sakha Republic	-0,68	-270,29	0,99 (moderate risk zone)	1,01 (stability zone)
Krasnodar region	-0,32	-104,57	1,01 (stability zone)	1,07 (stability zone)

Calculated according to the Federal State Statistics Service (Rosstat)

Thus, the conducted analysis of regions from the «Group A» showed a fairly high level of economic security. These regions practically by all indicators are in the stability zone

and do not have risks and serious threats. In addition, the RS value for all regions is positive. Consequently, the use of the cluster approach allows to provide a noticeable gain in economic growth, the growth of the domestic market not only for the region, but for the entire Russian economy, which certainly raises the level of economic security.

Evaluation of the results for the regions in the «Group B» using the Shift-Share method showed the negative value of the RS index. Thus, the type of economic activity used for assessment (for each region individually) develops in the country as a whole more effectively than in the regions in the «Group B».

By comparing the results of the assessment of the indicators of economic security in the «Group B», as well as the results of the assessment of the main indicators by the Shift-Share method, we can conclude that the level of economic security in the examined regions does not meet the acceptable.

## **CONCLUSION**

Thus, the conducted comparative analysis of two groups of regions has proved the research hypothesis. Therefore, it can be stated that cluster development directly affects the economy of the region. For a more accurate evaluation of the proposed methods should be applied in parallel, analyzing the obtained results in total.

As a result have been created practical recommendations for state authorities of regions with a dominant cluster development which allow to maintain the leadership positions:

- 1) Creation of cluster development centers, where they do not exist. At the same time, the initiator of the cluster initiative should be a cluster organization, rather than a state authority or a local government body. As a measure that can increase the effectiveness of the established cluster development centers activities, we can recommend the integration of regional infrastructure organizations into a cooperation network.
- 2) Creation of a permanent system of information interaction and stimulation of interaction between organizations and enterprises working in one industry.
- 3) Support and initiation of cluster initiatives and cluster projects by providing grants, allocation of targeted investments and grants. At the same time, a competitive mechanism should be used to support a particular cluster project.
- 4) Provision of tax benefits and reduction of administrative barriers.
- 5) Promoting marketing products produced in the cluster by promoting the brand of the cluster itself and the territory on which it is formed
- 6) Development and improvement of professional training of personnel through expansion of public-private partnership.
- 7) Creation of a system of a regional education complex focused on demand, as the main mechanism for achieving progress in the economic development of the territory.
- 8) An ongoing control and monitoring of development of activity of the clusters created on the territory, by means of a separately created structure

For the regions with a lack of cluster structures the practical recommendations to increase their level of economic development and economic security are as follow:

- 1) Development of a mechanism and structure for the formation of a cluster association.
- 2) Determination of the objectives and cost-effectiveness of cluster operation.
- 3) Development of normative-legal acts, allowing to determine the rights, duties and entry conditions for enterprises participating in the cluster, their further operation and exiting.

4) Carrying out an active cluster policy, by creating clusters and solving the following tasks: identifying priority industries in which a competitive cluster can potentially function; definition of the main directions of cluster development.

5) Inclusion of the provisions in the regional Strategy allowing to regulate the activity of clusters.

Summing up the conducted research, we can conclude that the main result of the implementation of cluster policy is a significant increase in the level of economic stability of the region and its competitiveness.

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