Methodology of Assessment of Industrial Regional Industry Clasting

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*Abstract***. In the paper have been discussed the methods of the cluster approach, namely the method of S. Zamansky, the maximum method, principal component analysis, the method of spatial econometrics, which makes it possible to more accurately and quickly search for a cluster member, interaction with which will maximize the profit of an economic entity through participation in cluster interaction. The purpose of this work is to develop an econometric model that allows assessing the impact of the level of organizational development of regional clusters on the change in the differentiation of socio-economic indicators of regions based on methods for analyzing spatio-temporal data sampling. The author has developed an assessment model that allows assessing the impact of the level of organizational development of regional clusters on the change in the differentiation of socio-economic indicators of regions. The model reveals a more accurate and faster search for a cluster member, interaction with which will maximize the profit of an economic entity through participation in cluster interaction.**

Keywords: Cluster approach, clusterization, regional clusters, industry, organizational development, visualization, competitiveness, enterprises.

I. INTRODUCTION

Changes in political and economic processes in the world are the core of changing the socio-economic direction of society. All economic processes require new development strategies, and changes in the public consciousness will take place in view of the changing international economy. This system also leads to changes in the economic sectors that make up the economies of states and regions. Among the economic spheres of education, industry, which is an important part of the economic formation and development of international trade, has a special place.

Year by year, the volume of exports and imports of industrial products is growing, increasing their competitiveness, which puts countries at a certain level of development on a global scale. Industrial optimization is one of the state, regional development strategies, which brings countries to a certain level of development on a global scale. Optimization of the industrial sector is one of the strategies of the state and the region. Clustering the industry of a particular region is relevant. Clustering involves particularly characteristic types of new structures in the economic system and requires a special approach to research.

The aim of the work is to develop econometric models, to assess the impact of the level of organizational development of regional clusters on changes in the differentiation of socio-economic indicators of regions on the basis of spatial-temporal data selection analysis methods.

Thus, based on the above, it becomes clear that the cluster approach is one of the ways to increase the socio-economic development and competitiveness of the state and regions.

Literature review

As the production capacity and economic activity of industrial enterprises increase, special attention is paid to the development of the cluster. Many scholars are studying this area, which is the main direction of the new structures, a strategy to improve the economic development of a particular region. To understand the essence of the industrial cluster, local Z. Hakimov [19], G.Zohidov [20] and Jihong Chen, Yijie Fei [3], Juan Pineda – Jaramillo [5], Markus Grillitscha [9], Nazan Yelkikalan [11], Weidong We explore the basic ideas of the concept of “cluster” given by foreign scholars such as Liu [15], Wen Tiana, Weihong Lib [16]. For example, the importance of the industrial cluster was determined by EV Kozonogova, DS Kurushina, Yu.V. Dubrovsky [7].

The authors define the cluster approach on the basis of visualization of the task of identification of industrial clusters, which allows to predict the future of this area of activity [7]. O.L.Ksenofontova, M.A.Khaydarova [17] Understands the concept of cluster as a complex of industrial enterprises located in a particular region, OL Ksenofontova expresses the concept of a cluster approach as follows: “As the experience of many countries shows, the cluster approach serves as a tool to achieve goals, but also strengthens the direction of innovation, employment, wages, allocations to different levels of budgets, is a powerful tool to increase the efficiency and sustainability of the region's industry, which contributes to the development of the region. According to him, the clusters will allow regional authorities to manage the socio-economic situation in the region.

According to Yu.A. Solikov, S.V.Vandysheva, L.V.Smarchkova, E.A.Chudakova, the regional strategy for achieving socio-economic development, modernization of the regional industrial sector is the most effective direction, and the cluster approach will be widely successful. and has a positive impact on small and medium enterprises. This approach has a significant impact on the innovative development of the region, as well as on the scientific, technical and reproductive activities of the regional industrial complex [13].

According to G.Ya.Belyakova, D.V.Bezrukikh, the cluster approach is the basis for structuring the regional economic system. M.A.Haydarova emphasizes the essence of the cluster approach to increase the budget efficiency of the regions, in her opinion, the most important task is to "clarify the difficulties that hinder their implementation" [21].

According to K.V.Pisarenko, it is the clustering of regions that promotes the economic development of competition and cooperation. This means that clustering helps to increase the economic stability of regions, enterprise income, production activity and regional competitiveness [12].

D.E.Morkovkin, V.A.Nikogosyan, O.I.Dontsova, as well as K.V.Pisarenko noted the positive aspects of the approach [10].

It is interesting that E.A. Bakhshyan explains the cluster approach, which defines clustering of industrial enterprises as a basis for increasing the competitiveness of regions based on the cluster-specific characteristics algorithm. The main incentive mechanisms for the formation and development of clusters, according to the author, are government support based on subsidies, the provision of tax incentives. The authors, Philip McCann and Tomokazu Arita, are very interested in the idea that clustering has become a key area of economic development in many states [14].

The JijRG MEYER-STAMER cluster approach changes the behavior of companies as they build economic relationships based on collective efficiency [4]. According to Markus Grillitscha, Josephine V. Rekersb, Franz Tödtlingc, the formation of regional clusters consists of the resource component, users and institutions of a particular region, and the main direction of cluster development is government support, which can be approved.

RV Kostrigin's opinion is also interesting, he defines the cluster as an enterprise - the core of economic development of the region. According to him, the main enterprise is the most important economic mechanism for developing the industrial potential of the region. "Cluster enterprise as a core is the basis of innovative development" [8].

II. ANALYSIS AND RESULTS

Based on theoretical and practical research by foreign and local authors, we analyze some methods of assessing industrial clustering in the regions. V.V. Ilin's approach to evaluating cluster formation methods in industry is very interesting [2].

The author of such an approach defines the structural classification of cluster development based on the efficiency factor. The purpose of this method is to optimize technological chains, to form and develop marketing, supply and financial relations, and to reflect the specific impact of the "cost-output" production function. The method is based on the calculation of a set of criteria that reflect the economic efficiency: The first indicator is the increase in production:

$$\Delta Ук = Ук - Уб, \quad (1)$$

ΔУк – increase in production capacity by cluster members compared to the main structure of industry in the region;

Уб – total production of products expressed in comparable prices by enterprises within the cluster;

Уб – gross output expressed in comparable prices by enterprises operating outside the cluster (in the main structure of the network).

The second indicator is the reduction of unit costs:

$$УЗк - УЗб < 0, \quad (2)$$

УЗК - Production and sales within the cluster (at the cost of enterprises) costs per soum, cop.;

УЗб – costs per unit of production and sales in the basic structure of the industry (in terms of value of enterprises), cop.

The third indicator is the effect of clustering, which is determined by the rate of increase in profitability:

$$Рк - Рб > 0, \quad (3)$$

Рк and Рб – production profitability expressed in percentages within the cluster and accordingly in the main structure.

The fourth indicator is the clustering effect. The effect of clustering was determined by the author on the criteria of labor productivity:

$$ПТк / ПТб > 1, \quad (4)$$

ПТк *and* ПТб – employee productivity (in monetary terms) within the cluster and accordingly in the main structure.

Based on such criteria, the complex effect of clustering is measured. The advantage of this method is its expected efficiency, the priority of cluster formation. According to VV Ilin, at the initial stage it is necessary to form innovative clusters that will lead the economy to more modern technological structures [6]. The next interesting approach is to use E.V. Karpichev explains: it is based on the contractual base of the subjects of industrial clusters. The author bases such an approach on the criteria of the relationship according to the stages of the "customer-executor" innovation process [6]. E.V. Kirpichev identified 4 main critical processes that unite business entities - “practical ITI; SKI (SNI); start-up works; logistics”. Such processes are the basis of innovative cooperation in the cluster.

According to the author, "radical innovation is the main direction of managing the effectiveness of innovation cooperation of industrial clusters." The advantage of such a methodology is that it identifies important stages of the innovation period of radical innovation, which allows to manage the effectiveness of innovation cooperation of industrial enterprises. The innovation period is the object of industrial cluster management.

M.V. Zavyalov proposes a specific methodology for evaluating a cluster approach based on a multi-stage system of sustainable development indicators that covers all components of sustainable development of industrial facilities in the selection of assessment indicators [1]. The cluster approach evaluation model based on a multi-level system of sustainable development indicators looks like this:

$$I_{\text{ур.пр.}} = \prod_{N=1}^{F}(I_{\text{ур.пр.}N}), \qquad (1)$$

F – number of enterprises in the industrial complex;

$I_{\text{ур.пр.}N}$ – a separate N - complex index of sustainable development of the regional industrial complex. $I_{\text{ур.пр.}N}$ is calculated on the basis of indices showing the complex social development, ecological, institutional, economic development of the regions:

$$I_{\text{ур.пр.}N} = \sqrt[4]{I_{\text{эф.}N} * I_{\text{эколог.}N} * I_{\text{соц.}N}} * I_{\text{инст.}N}, \qquad (2)$$

The advantage of the model is that the evaluation criteria are limited, comparable at different levels and evaluation objects, the ability to create a single integrated indicator, sustainable development and setting boundaries for evaluating existing information resources. Thus, the study of cluster approach evaluation methods differs from domestic and foreign researchers, but everyone has a common opinion that determines the effectiveness of clustering based on the economic entity, region, country’s development economy.

According to many authors, clustering is a direction of increasing socio-economic development, which determines the level of competitiveness of regions, is the direction of optimizing production processes, personnel system, so this cluster approach has recently become relevant for stronger economic development of regions.

The aim of this study is to create an econometric model that allows to assess the impact of the level of organizational development of regional clusters on changes in the differentiation of socio-economic indicators of regions based on methods of analysis of environment-time selection. Thus, the maximum method and S. Zamansky's method based on the data of the symmetric table "cost-output" (CCI) are taken as a basis.

In the modeling process, we introduce our own criteria that allow us to show the impact of the level of organizational development of regional clusters on changes in the differentiation of socio-economic indicators of regions. The model involves assessing the dependence of the resulting component on factor performance based on the coefficient method [7].

S. Zamansky's method provides information about the pure branches of industry, in which each branch produces only a specific type of product. Producer networks are arranged in rows, and consumers are arranged in columns. Criteria for the intersection of rows and columns are determined, which we record later in the model.

The data of the CSR are carried out taking into account the identification of clusters. We apply our own criteria on the impact of changes in the level of organizational development of regional clusters on the differentiation of socio-economic indicators of the regions. The following factors contribute to the level of organizational development of regional clusters: resource component; socio-economic development of the region; consumer component; the institutional component is affected. During the testing of the model, we calculate the regions of the first cluster of the Republic of Uzbekistan (7) and the second cluster of the Republic of Uzbekistan (6). First, we will gradually study the algorithm for creating an econometric model based on the method of S. Zamansky [7].

The first stage involves the formation of X and U matrices. Their criteria are as follows:

$$x_{ij} = a_{ij} \,/\, \sum_{k=1}^{n} a_{kj}\,, \qquad (3)$$

$$y_{ij} = a_{ij} \,/\, \sum_{k=1}^{n} a_{kj}\,, \qquad (4)$$

a_{ij} – j Production volumes of the industrial sector in a certain range of the industrial sector (an element of the symmetric table "costs-output");

x_{ij} – inter-sector procurement of sector j in proportion to the total procurement of industrial products (regions with high economic growth);

y_{ij} – j is the volume of consumption from sector i of the sector in proportion to the total sales of the industrial sector (industrial production per capita).

n – Number of regions in the Republic of Uzbekistan (13).

It should be noted that in this variant the matrix X and Y is formed, where X - purchase of industrial products, Y - sale of industrial products.

The second stage is to determine the relationship between network j and intermediate purchases in proportion to the total volume of purchases of industrial products (regions with high economic growth) and consumption of network i in proportion to the total sales of industry j (industrial production per capita) release.

Let us determine the similarity of the pairs discussed above. The matrix XX, whose indicators r (xl, xm) measure the degree of similarity of intermediate purchases of industrial products l and m;

YY matrix, its indicators r (yl, ym) measure the degree of similarity between l and m between the consumption volumes of industrial products; The XY matrix, whose indicators r (xl, ym) l show the degree of similarity between the samples of purchases of industrial products and sales volumes m;

The YX matrix, whose indicators r (yl, xm) show the degree of similarity between the samples of purchases of industrial products m and sales volume l, this option shows the level of participation of consumers of industrial products in the total volume of the industrial network.

Учинчи босқич – симметрик Lv матрицасини тузиш. Матрица кўрсаткичлари $lvij = max\ (xxij, yyij, xyij, yxij)$, агар корреляция коэффициенти муҳим бўлса, яъни $p - value < 0.05$.

The third step is to construct a symmetric Lv matrix. The matrix values $lvij = max\ (xxij, yyij, xyij, yxij)$ if the correlation coefficient is significant, i.e. p-value <0.05.

The fourth stage defines the organization of clusters using the method of key components of the industrial sector of the Republic of Uzbekistan (PCA). The purpose of this method is to reduce the original number of factors. The key component search algorithm is to standardize the initial indicators; obtaining its own vectors and its own criteria of the covariance matrix and the correlation matrix; separate the criteria according to the degree of reduction and select their vectors k; construct a matrix W consisting of selected vectors k; Change the X-specific criteria to W to obtain a k-dimensional functional small space.

The fifth step is to construct a C matrix of subsequent joints. In this variant, the calculation of consumption and industrial production per capita is carried out by the "maximum method". The founders of the "maximum method" M. Montforta and D. Dyutelli is. This method defines a value chain without taking into account the connections in the network, the main diagonal of the STZV is zero. In this option, the consumer of the industrial network k (ckl) l is calculated as follows (9):

$$\mathrm{c_{кл}} = \underline{max a_{кж}}, \qquad (5)$$

$\mathrm{a_{kk}} = 0, \mathrm{j} = 1, \overline{\overline{\mathrm{n}}}, \mathrm{a_{ij}}$, , so far $n \times n$. dimensional matrix elements are taken into account.

As a result, the importance of the volume of sales of industrial products to the consumer is checked by comparing the share of sales in total volume (GDP) with the empirical threshold value (l). A binary matrix of the following links is constructed - C (10), in which the index, if this relationship is significant, is equal to 1, i.e. the following is done:

$$\begin{cases} \mathrm{c_{иж}} = 1, \text{иф} \frac{\mathrm{c_{кл}}}{\sum_{ж} \mathrm{a_{кл}}} > \lambda \\ \mathrm{c_{иж}} = 0, \text{иф} \frac{\mathrm{c_{кл}}}{\sum_{ж} \mathrm{a_{кл}}} \leq \lambda \end{cases}, \qquad (6)$$

The sixth step is to construct the previous C link matrix. At this stage, a region with a high level of economic growth is defined to form a binary C matrix of “previous link”, which is similar to the “next link” matrix. l region of the industrial sector with the highest economic growth k (11) is calculated according to the formula:

$$\mathrm{c_{кл}} = \underline{max a_{ил}}, \qquad (7)$$

Its continuation is to fill in the important regions of the industrial network - consumer binary matrix S (12):

$$\begin{cases} \mathrm{c_{иж}} = 1, \text{иф} \frac{\mathrm{c_{кл}}}{\sum_{ж} \mathrm{a_{кл}}} > \lambda \\ \mathrm{c_{иж}} = 0, \text{иф} \frac{\mathrm{c_{кл}}}{\sum_{ж} \mathrm{a_{кл}}} \leq \lambda \end{cases}, \qquad (8)$$

The seventh step is to create a matrix of the relationship between the volume of sales of industrial products to the consumer and the level of economic growth in the CS region. The value of the matrix has the following form (13):

$$\mathrm{cc_{иж}} = \mathrm{c_{иж}} + \mathrm{c_{иж}}, \qquad (9)$$

As a result, the CS matrix criteria are calculated, which proves a significant correlation between the volume of sales of industrial products to the consumer and the rate of economic growth in the region.

Based on the calculated coefficient, a model is formed to assess the impact of the level of organizational development in regional clusters on the differentiation of regional socio-economic indicators by introducing the value of important CS links discussed above and the level of socio-economic development of regions. The level of socio-economic development of the region is calculated by the method of the following coefficients:

$К_{пр}$ – labor development coefficient in the region (permanent population of working age; employment rate; unemployment rate);

$К_{эр}$ – Coefficient of economic development of the region (GDP; volume of investments in fixed assets; level of foreign trade turnover; rate of growth of output; total area of housing stock (if quantitative data are converted into cost indicators);

$К_{инфр}$ – innovation development coefficient (share of enterprises with personal computers; share of enterprises with Internet access; share of enterprises with local network);

$К_{ср}$ – social development coefficient (birth rate, mortality rate, real gross income per capita).

To find the coefficients included in the algorithm, we calculate the average value of these criteria for the regions of the Republic of Uzbekistan (10).

$$К_n = \frac{\sum_k^n К}{н}, \qquad (10)$$

$К_n$– socio-economic development coefficients;

$\sum_k^n К$ – the level of socio-economic development of each region;

n – the sum of the values of socio-economic development for each region.

Now it is proposed to calculate a complex indicator of socio-economic development coefficients of regions according to formula (11) [18].

$$У_{с-э.р.} = \sqrt[n]{К_{пр} * К_{эр} * К_{инфр} * К_{ср}}, \qquad (11)$$

This level of socio-economic development of regions is used in subsequent calculations to assess the impact of the level of organizational development of regional clusters on changes in the differentiation of socio-economic indicators of regions. To do this, the following formula is developed (12):

$$ОВ_{эф} = \frac{СС}{У_{с-э.р.}}, \qquad (12)$$

$ОВ_{эф}$ – the effectiveness of the impact of the level of organizational development of regional clusters on changes in the differentiation of socio-economic indicators of the regions (%). Thus, this model can be used to calculate the impact of the level of organizational development of regional clusters on changes in the differentiation of socio-economic indicators of regions. This model shows which interaction with a region (cluster member) will maximize the profitability of the business entity by participating in the cluster interaction. The disadvantage of the model is that it takes a lot of time to calculate all the coefficients across all regions, CS important connections. The second drawback of this model is that a large database is required for the calculation.

Now it is necessary to enter the level of economic status of the cluster participant (Table 1)

Table 1: Criteria for assessing the level of economic situation in the region (cluster member)

Degree	Rating	Note
0.1 and 0.3 respectively	Low level (insignificant correlation between result and factor criteria)	Low economic indicators of economic entities in the region, negative or low level of efficiency of the level of management, negative efficiency
0.4 to 0.7 each	Intermediate level	Economic indicators of economic activity in the region (cluster participant) are stable, dynamic formation and development
0.8 and 1.0 each	High level	High economic indicators in the region (cluster participant): high level of trade, investment, social development

The advantages of the model are:

This model identifies all problem areas of the industrial complex at the enterprise level, taking into account factor indicators, the lower the coefficient between efficiency and factor characteristics, the more attention should be paid to this specific indicator to eliminate problem areas.

The model establishes the relationship between the effective criterion and the factor metrics, while determining the criterion levels. The model shows the level of development of regional clusters, identifies the cluster

participant with whom the interaction maximizes the profitability of the business entity through participation in cluster interactions. This model will then be tested on the example of the Republic of Uzbekistan.

III. CONCLUSIONS

This paper presents research by foreign and domestic authors on the cluster approach and a theoretical analysis of clustering assessment methods. The article discusses some methods of cluster approach, identifies advantages and disadvantages. In the study, a model for assessing the level of organizational development of regional clusters was developed to change the differentiation of socio-economic indicators of the regions.

In the modeling process, we introduced our own criteria, which allow us to show the impact of the level of organizational development of regional clusters on changes in the differentiation of socio-economic indicators of regions. The developed model showed the level of impact of industrial clusters on the socio-economic development of the regions. The model takes into account many factors: factors of economic development of regions as well as factors of social development, which predetermines the assessment of the effectiveness of the impact.

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