

## ARTICLE

# CLUSTER FORM OF RAW MATERIALS PROCESSING AND ITS IMPACT ON REGIONAL ECONOMIC SYSTEMS

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## ABSTRACT

*In the framework of the measurement system used by Russian statistics, it is possible to identify those industries that provide the largest share in the cost of products and services in the region, as well as show good dynamics of development and economic efficiency. However, the current classifiers are focused on data aggregation within the industry, therefore, based only on the basis of the State Statistics Committee, clusters cannot be identified (or, when this is done at the all-Russian level, it is possible with a large degree of conditionality). Therefore, in order to further analyze the industry enterprises (which of them are included and which are not included in the cluster under study), it is necessary to conduct a primary statistical survey, which requires a survey. The questionnaire provides questions regarding: general resources, with the help of which it is planned to single out the cluster core, the performance indicators of these enterprises, with which it is supposed to evaluate further development trends of the cluster. The effectiveness of the influence of the cluster form of processing raw materials on regional economic systems is due to the development of partnerships between business entities. The cluster form of activity in the commodity sector, organized in the form of horizontal rather than vertical ties, is particularly relevant in the conditions of high monopolization of oil producing companies.*

## INTRODUCTION

To determine the subset of key success factors for clusters, it is advisable to carry out a multifactor statistical analysis, where it is proposed to use indicators of the number of employees, profitability and their changes as criteria for the effectiveness of the functioning of clusters. A small sample size, along with a large number of variables studied, requires a preliminary reduction factors, therefore it is necessary to carry out the following sequence of statistical data analysis techniques:

- **Factor analysis** - to select the most informative variables.
- **Correlation analysis** - in order to determine the factor variables directly associated with the resulting indicators, and the exclusion of factor signs that are closely related to each other (identification of multi collinear variables); the formation of a set of independent factors for the construction of regression equations by using the results of correlation and factor analysis: Building regression equations for both the generalized space of factors and their internal and external subsets.

In order to increase the size of the sample, it is recommended to implement the selected stages on a full set of companies belonging to regional clusters (without division into types of clusters). Modeling, carried out with regard to the division of parameters into external and internal, allows to make a conclusion about the comparative influence of various factors and their groups on the performance of clusters. Such modeling provides an opportunity to somewhat expand the range of studied characteristics (due to those variables that are not included in the general regression model, but turned out to be significant in the space of internal / external factors). In addition, this approach is interesting because along with the general regression model, we obtain equations that characterize the dependence of the resulting indicators on two subgroups of factors that are different from the point of view of management.

In the case of a profitability indicator, all three models obtained are quite reasonable. In the space of internal factors, the profitability of companies in a cluster is determined by four variables that have a comparable impact on it (as evidenced by the values of the corresponding standardized regression coefficients). Using the achievements of NTP can increase the profitability of companies by more than 9%. The organizational and legal form (CJSC on average by 4.8% more profitable than LLC) and the presence of its own production areas (firms owning them are almost 6% more efficient) have a lesser impact. The provision of office space, although it has a slightly smaller impact, is described by four ranks and, therefore, with maximum growth, it can add companies more than 8% profitability (these and the following numerical results are given for a cluster of high-tech companies in Novosibirsk, but they are indicative of any Russian cluster).

## MATERIALS AND METHODS

Consideration of the profitability of clusters in the context of environmental factors allows us to reveal the influence of two factor signs and a dummy variable. An increase in the share of supplies from the regional

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market by one rank on average contributes to an increase in profitability by almost 10% (this factor is the most influential in the equation). The variety of equipment available in the region is negatively related to the profitability of the business, which is probably explained by the amount of transaction costs in the selection of means of labor. The increase in the diversity of equipment by one rank (only five ranks), while the other variables remain unchanged, causes a decrease in profitability by almost 2%.

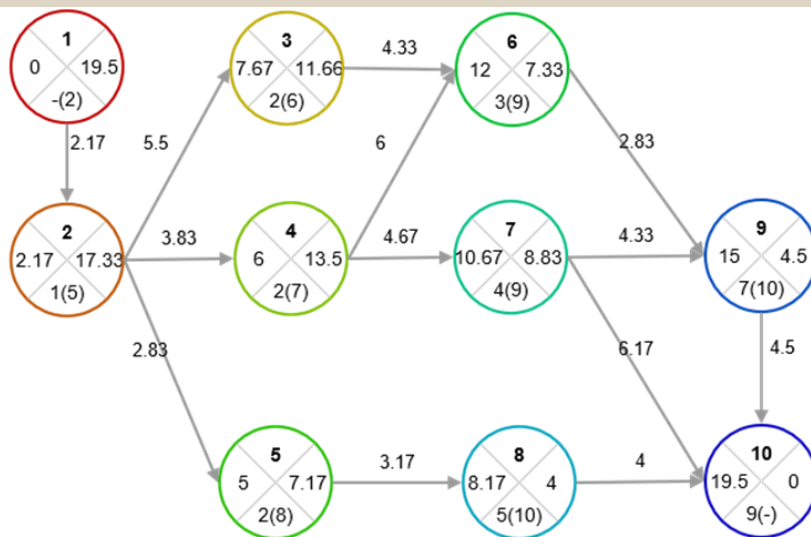
The most significant variables from both particular equations are reflected in the general model. In the combined space of factors, the size of the procurement of materials on the regional market and the use of scientific developments reveal their influence on the profitability of high-tech companies. The first of these two factors has a relatively larger impact on the resulting indicator (with its growth by one rank, the increase in profitability is 7.7%). The influence of the use of scientific developments is no longer as high as in the space of internal factors (about 4%). Its relevance to profitability is also demonstrated by the affiliation of firms to one or another cluster. Verification of a model built in the combined space of factors reveals a deviation of the calculated value of profitability from its real level by 5.6% for the entire sample of companies, which indicates its sufficient reliability.

## RESULTS AND DISCUSSION

The modeling considered in the section above can also be carried out for other resulting cluster performance indicators: the number of personnel, its growth rates and the trend in profitability. The described toolkit allows you to identify the most attractive from a managerial point of view (that is, having the greatest management potential) groups of factors. Impact on them can have a significant impact on the performance of clusters and the cores of their enterprises. The results of the regression analysis allow us to present individual firms and clusters in the three spaces of the identified factor signs, including internal and external. Internal factors can be conditionally considered manageable at the level of an individual enterprise; external factors can be considered regulated at the level of industrial unions, government bodies, social institutions and other super-firm entities, the latter are determined not only by the line of conduct of a particular company, but can also be formed at all without its direct participation. To this end, for each company, a taxonomic indicator should be constructed characterizing the measure of the difference between the corresponding vector of factors (in a given n-dimensional space) and the hypothetical standard. As components of the standard, it is recommended to use the best (maximum or minimum, depending on the nature of the influence of the variable) values of the factors studied, assigned by the respondents to the input research. A taxonomic indicator constructed in this way synthetically characterizes the values of the factor signs of the resulting indicators studied. High values of this indicator indicate high values of the considered signs, low values - on the contrary. Its most important advantage is that this single synthetic trait can show differences in the processes that characterize the internal and external aspects of the activities of enterprises. By its magnitude, one can judge about the existing growth potential for individual firms and clusters as a whole in the context of key factors and, accordingly, the advisability of applying managerial influences to them.

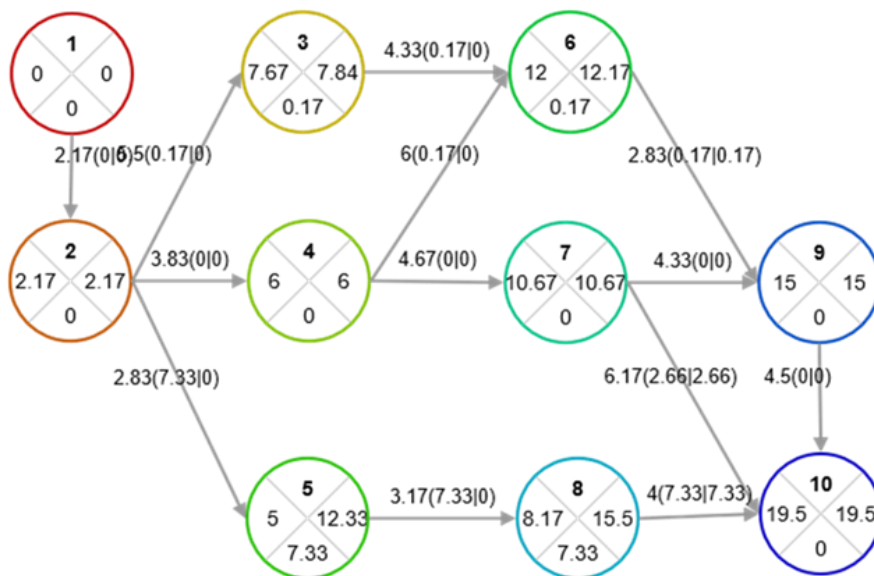
This confirms the analysis of variance, according to which taxonomic indicators built in the system of environmental factors have statistically significant higher values for the entire cumulative sample of companies in a cluster. At the same time, the clusters do not demonstrate significant differences among themselves in all three factor spaces. A similar approach is advisable to use for the remaining result indicators, as well as to build a generalized taxonomic indicator in space of all four selected resultant characteristics (number of personnel, profitability and their changes). Such an indicator can be interpreted as a characteristic of the level of competitiveness of clusters and their individual enterprises. At the same time, the competitiveness of individual enterprises (in the space of the above-mentioned resulting factors) varies within 20–70% of the maximum possible value for the cluster as a whole. Next, an analysis of the correlation relationships between the values of taxonomic indicators of the competitiveness of enterprises and the factors determining it (a variety of factors selected as potential variables for modeling all the resulting indicators) was carried out. This analysis allows us to conclude that the competitiveness of companies, regardless of whether they belong to a particular cluster, demonstrates a statistically significant dependence on a number of cluster operating conditions. These conditions, as a rule, determine the profitability of enterprises in the space of environmental indicators, from which it can be assumed that the key contribution to ensuring the competitiveness of companies is their profitability, which, in turn, largely depends on the external environment of the business. It should be noted that these variables in the conditions of underdevelopment of regional clusters in Russia belong to the same type - factor conditions, which confirms the fact that the availability of this particular group of factors influences the competitiveness of clusters in developing and transitional economies.

Traditional approaches to solving regional industrial development problems by modeling interconnections in territorial production complexes, forming production nodes on a given basis, solving the problems of locating productive forces and production capacities by minimizing transportation costs or reduced costs are now largely simplified [Fig. 1].



**Fig. 1:** An example of a traditional approach to modeling relationships in the territorial-industrial complexes of the region in the form of a network diagram (potential method) of portfolio investment in innovative projects.

Prospects of modern industrial development are determined by the interaction of various functional subsystems. The mechanism of research and implementation of the regional industrial development strategy that is necessary in modern conditions is provided by the concept of clusters, the distinctive features and advantages of which are taking into account comprehensive dynamic competition and linking the problems of the meso- and macro-level with the operating conditions of individual enterprises [Fig. 2].



**Fig. 2:** An example of a regional cluster industrial development strategy taking into account dynamic competition in the form of a sectoral method of a network diagram of portfolio investment of innovative projects.

Identification of clusters, modeling of their development and evaluation of the effectiveness of activities are associated with a number of problems, the main of which are:

- Lack of a clear methodological basis for analyzing and modeling regional cluster-type economic systems;
- The absence at the territorial level of the necessary organization of statistical data, in particular inter-branch product flows in a fractional sectoral classification;
- The discrepancy between the spatial boundaries of the clusters and the territories for the collection of statistical data;
- Lack of information on many qualitative characteristics of cluster activities;
- Lack of a single agreed list of cluster activity meters.

At present, the most common method of identifying and evaluating the activities of regional clusters in the Russian context is the approach of identifying clusters based on the nature of economic activity in a particular locality, based on data obtained mainly by expert analysis. Most of the existing studies on the evaluation of the functioning of clusters are limited to a statement of individual characteristics of their activities, from which conclusions are drawn about the dominant position of clusters in a particular industry or locality. At the same time, almost no attention is paid to the economic and mathematical modeling of the processes of creation and functioning of regional clusters and the study of the factors responsible for their actual success and potential for their growth. Therefore, an important task is the development and testing of models that adequately reflect the relationship in local clusters.

## CONCLUSIONS

The considered approaches to modeling and evaluating the activities of economic clusters will contribute to the establishment of quantitative relationships between the performance indicators of cluster entities and the factors determining their functioning. According to the authors, in the study of the functioning of regional clusters as complex economic systems, a comprehensive expert-econometric modeling of the activities of the companies participating in the clusters is necessary. The described approaches will help identify the growth potential of clusters and their individual participants, establish the direction of managerial influence on the factors contributing to the resulting performance indicators of clusters, which will certainly be useful for the management of the companies participating in the cluster both in organizing the current activities of companies and in developing a cluster development strategy generally.

### CONFLICT OF INTEREST

There is no conflict of interest.

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### FINANCIAL DISCLOSURE

None.

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