Designing of the Information Advising System to Assess the Potential of Creation and Development of Cluster Agglomeration in the Industrial Complex of the Region

E E Averchenkova¹, A V Averchenkov² and N A Kulagina¹

¹ Department of Economics, Organization of Production, Running the Enterprise, Bryansk state technical university, Bryansk, Russia
² Department of Computer Technologies and Systems, Running the Enterprise, Bryansk state technical university, Bryansk, Russia

Abstract. The theoretical aspects of creation of the information advising system to assess the potential of development of the cluster agglomeration are described in this article. The algorithm provided in the article estimates possibilities of creation and development of the regional industrial cluster agglomeration. This article describes the possible use of the information advising system of the evaluation and diagnostic type in making managerial decisions by the participants of the technology innovation cluster.

1. Introduction
Integration of the Economic system of the country into the world economy, global financial crisis, the crudest competition require from the modern management changing the ways of the competitiveness of enterprises [1]. It is reflected in the transfer from the traditional to the innovative industrial politics based on forming of cluster management in the economic processes [2].

An important issue in this regard is the creation of the regional cluster agglomerations, the efficiency of production, which must be evaluated, as well as forecasting the efficiency of their work.

2. The model of the information advising system
The ways of development of the cluster agglomeration include the model of the information advising system. It allows improving the quality of administrative decisions made in the regional industrial cluster agglomerations [3]. Let us present the model of building an information advising system with its input and output parameters (Figure 1).

The input parameters of the model are changes in the environment (F̂jk) and changes in the regional social economic system (Ŝmn). The output parameters are administrative decisions providing an effective management on different levels in the regional industrial cluster agglomerations.

The created information advising system can be attributed to a class of the monitoring system and a subclass of the evaluated and diagnostic advising systems. The primary purpose of these systems is state watching of some objects or processes and making of some recommendations [3].

So, the monitoring of the regional industrial cluster can be done by the offered information advising system. It is based on the permanent watching of the cluster functioning, searching for the positive and negative tendencies in the external dynamic changing regional system.
The structural-functional chart of the system is presented in Figure 2. The offered information advising system has a subsystem of data input, diagnostic block, evaluation block and knowledgebase.

**Figure 1.** The information advising system model, allowing an improvement of the quality of the administrative decisions making in the chosen regional industrial cluster agglomerations.

**Figure 2.** A structural-functional chart of the evaluation-diagnostic type of the informative advising system for the estimation of creation and development potential for cluster agglomeration.

The subsystem of data input is responsible for the correct input of experts estimations, communications and query construction by a user. There is the estimation of the innovation activity cluster level in an evaluation block \( L_{IA} \). There is an external enviromental factor classifier \( F_{ijk} \), a regional social economic system factor classifier \( S_{mn} \) and indexes of \( K_{pq} \) in the diagnostic block. The block of "Recommendations", presented in the knowledgebase, contains business recommendations.
Filling knowledgebase is made by the experienced experts – top-management of industrial enterprises, regional level management, external experts from consulting organisations.

3. The estimation of creation and development potential for cluster agglomeration

3.1. The algorithm of the programm complex for creation and development potential for cluster agglomeration

There is the algorithm of programm complex for the creation and development of the potential estimation of cluster agglomeration:

1. Making of the regional social economic system factor classifier (S\textsubscript{mn}).
2. Making of the external enviromental factor classifier (F\textsubscript{ijk}).
3. Making of the indexes classifier (K\textsubscript{pq}), exposing the active innovative industries in the region (on the basis of classifiers from upper level).
4. Calculation of the middle on every group of indexes K\textsubscript{pq}.
5. Level typology determination of innovative activity (types A, B and C) for the estimation of creation possibility of cluster agglomeration in a region.
6. The recommendations of administrative decisions making for cluster agglomeration development.

3.2. Constituents of the regional social economic system (S\textsubscript{mn}) and factors of the few predicted environment (F\textsubscript{ijk})

In accordance with an above offered algorithm, let us present a region in the form of a social economic system as a complex system of associate interrelated and interacting constituents and relations between them under the conditions of the few predicted environment:

\[ S = \langle \{ S_{mn} \}_{m=1, \ldots, 7}, O \rangle, \tag{1} \]

where S is constituents of the regional social economic system, including:
- S\textsubscript{1n} is industrial and productive constituents;
- S\textsubscript{2n} is national aims and political constituents;
- S\textsubscript{3n} is economical region constituents;
- S\textsubscript{4n} is social demographic constituents;
- S\textsubscript{5n} is constituents of investment attractiveness of region;
- S\textsubscript{6n} is constituents of innovative development of region;
- S\textsubscript{7n} is rating estimations of region.
- O is the communications set, qualificatory for the cross-coupling of S\textsubscript{mn} on each other.

Due to changes in the business environment, a special attention should be paid to the interaction between the regional social economic system and the so-called external environment, which is understood as a set of external influences and relations between them:

\[ F = \langle \{ F_{ijk} \}_{i=1, \ldots, 5}, V \rangle, \tag{2} \]

where F is factors of the few predicted environment, including:
- F\textsubscript{1} is political factors;
- F\textsubscript{2} is economic factors;
- F\textsubscript{3} is scientific technological factors;
- F\textsubscript{4} is social demographic factors;
- F\textsubscript{5} is nuture geografical factors.
- V is the communications set, qualificatory for the cross-coupling of F\textsubscript{ijk} on each other.

Quality estimation of V (factors communications of the little forecast environment - F\textsubscript{ijk}) and O (constituents communications of the regional social economic system - S\textsubscript{mn}) can be conducted by
forming the special evaluation questionnaires. Then they should be treated on the basis of theory of expert estimations.

3.3. Indexes classifier \((K_{pq})\) and calculation of the geometric mean value for every group of indexes \((K_{pq})\)

Formation of indexes classifier \((K_{pq})\), exposing innovative region industry is based on \(F_{ijk}\) and \(S_{mn}\) factors classifiers. The estimation of possibility of cluster agglomeration creation in the region industry can be presented like a set:

\[
K = \{K_{pq}\}_{p=1, \ldots, 5},
\]

where \(K\) is a set of indexes, exposing innovative region industry for further cluster agglomeration creation, including:

- \(K_1\) - political indexes;
- \(K_2\) - economic indicators;
- \(K_3\) - indexes of innovative development;
- \(K_4\) - social demographic indexes;
- \(K_5\) - nature geografical indexes.

Let us calculate the geometric mean value for every group of indexes \((K_{pq})\) to determin the innovative activity of sub-sectors of machine industry for each \(p\)-th position.

\[
\overline{K}_{pq} = \sqrt[n]{\prod_{q=1}^{n} K_{pq}} \times 100\% 
\]

where \(K_{pq}\) is the geometric mean value for every group of indexes \((K_{pq})\);

- \(K_{pq}\) - values of indexes, determining the innovative activity of the sub-sectors of machine industry in the region;
- \(n\) is a natural number, \((n \in N)\).

3.4. Priorities of cluster agglomeration creation for a conditional sub-sector of machine industry

Further, we will build a multidimensional model for creation of cluster agglomeration:

\[
Z = f(\overline{K}_{1q}, \overline{K}_{2q}, \ldots, \overline{K}_{5q})
\]

\(Z\) is values that define the position of a specific sub-sectors of machine industry in the region from the perspective of creating a cluster agglomeration.

For this purpose, we will use the special table (see a table 1) that allows conducting gradation of innovative activity of the machine industry. The next stage is subdivision of the existent sub-sectors of machine industry for further formation of the cluster agglomeration by processing the results with a table method.

There is an example of filling such matrix for a conditional sub-sector of machine industry (table 2).

**Table 1.** A gradation level of the innovative activity of the sub-sectors of machine industry in the region

| The geometric mean value of every group of indexes \(K_{pq}\) | The level of innovative activity |
|-----------------------------------------------------------|-------------------------------|
| \(\overline{K}_{pq}\)                                    | High                          |
|                                                          | > 55%                         |
|                                                          | Middle                        |
|                                                          | From 25% to 5%                |
|                                                          | Subzero                       |
|                                                          | < 25%                         |
Table 2. An example of filling a matrix of priorities of cluster agglomeration creation for a conditional sub-sector of machine industry

| Level of innovative activity | The middle of every group of indexes $K_{pq}$ | Priority of cluster agglomeration creation |
|-----------------------------|---------------------------------|------------------------------------------|
| Subzero                    | $K_{1q}$ | $K_{2q}$ | $K_{3q}$ | $K_{4q}$ | $K_{5q}$ |
| Middle                     |          |          |          |          | «B»       |
| High                       |          |          |          |          |           |

3.5. The estimation of the level of the innovative activity of the investigated sub-sector of machine industry

Thus, let us introduce a concept of the innovative activity level of the sub-sector of machine industry as a sum:

$$L_{IA} = \sum_{q=1}^{5} K_{pq}$$

where $L_{IA}$ is a level of innovative activity of the sub-sector of machine industry.

Consequently, it is possible to set the next numeral intervals of level values of the innovative activity:

- Subzero level $L_{IA} \in [0; 1,25]$;
- Middle level $L_{IA} \in (1,25; 2,5]$;
- High level $L_{IA} \in (2,5; 5]$.

Summarizing the results of the estimation of the level of the innovative activity of the investigated sub-sector of machine industry, we distinguish the following priorities of cluster agglomeration in the region:

7. Priority «A». Here come active sub-sectors of machine industry, having a high score on indexes.
8. Priority «B». Here come sub-sectors with a middle level of development, having an average score on indexes.
9. Priority «C». Here come subsectors with a low level of innovation and investment development, unpromising in terms of forming a cluster agglomeration, having a bad score on indexes.

3.6. A flow-chart of the algorithm evaluating the potential of cluster agglomeration creation in the industrial complex of the region

In accordance with the algorithm, there is a flow-chart. It is a programm complex evaluating the potential of cluster agglomeration creation in the industrial complex of the region. (see figure 3).

4. Conclusion

Thus, designing the information advising system of the evaluated and diagnostic types will assist in development of the innovative cluster in sub-sectors of the machine industry complex of the region to create investment infrastructure for attracting domestic and foreign investments and to improve the competitive advantages of the region.

The algorithm of cluster agglomeration creation in the region industries and the information advising system of the evaluated and diagnostic types were described in different manuscripts [1]. In addition, as it was shown in [2], this model is invariant and can be applied in making management decisions for different levels of region authorities.
Figure 3. A flow-chart of the algorithm evaluating the potential of cluster agglomeration creation in the industrial complex of the region.

References

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