Logic of interrelation of indicators and generated estimates in information-analytical system of economic integrated structures (clusters)

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Abstract. The formation of national economic clusters, considered today as one of the important ways to promote the economic growth and intensification requires not only the expressed interest of the subjects of clustering (top management of companies, territorial administrations, etc.). It is also important here is the degree of applicability of the conceptual and instrumental base of these processes for the Russian conditions. Data collection, its grouping, analysis, and further use in cluster management should be based on the logic, which is reasonable and transparent for managers. This logic should organically include the specifics of the interrelations within the system of indicators of the state of clusters, and then - the essence of the estimates formed on this basis. The proposed article is devoted to the reflection of the author view on the solution of these issues.

1. Introduction

The study of the processes of clustering of the economy is currently one of the topics that has received increased attention from scientists in the economic field of knowledge [1–8].

However, the effectiveness of the management function of economic integrated structures (in particular, clusters) is directly related to the success in the implementation of their accounting and forecasting tasks, which in turn seriously depends on the validity of the set of used categorical grounds and indicators for assessing the state of the object [9, 10].

First of all, this set itself should give to the analyst the reliable and sufficient information to make the adequate management decisions (with a reasonable minimization of the number of indicators in their set).

Secondly, the problem of achieving sustainable operation of the information-analytical system of the cluster in obtaining multiple and inconsistent data at different levels should be solved.

Thirdly, in the process of analysis and evaluation of the activity of cluster (based on the work with the values of integral indicators in their system), it is very important to have a deep understanding of the logic of their interrelation, both in vertical hierarchies and within their classes, subclasses (higher level), groups and subgroups (lower level). This understanding is designed to significantly improve the analyst's perception of cause-and-effect interrelation in the activity of such a complex object as cluster and, accordingly, a general understanding of the features of the processes occurring in it.
In turn, it will allow generating estimates of the extent of the *validity of managerial influence* on the status of certain indicators or their groups to modify other indicators or groups of indicators in their system.

In addition, the interrelation of individual indicators can be used to obtain values of the *set of additional indicators* that deepen and detail the analyst's understanding of the specifics in the related implementation of the categories of productivity, effectiveness and efficiency in the activities of both the cluster as a whole and its participants.

Thus, the formalization of understanding the interrelation within the system of integral indicators, the formation of the resulting set of useful additional indicators is a separate research task that requires attention in the implementation of the support function of decision-making in clusters.

2. Approaches to problem decision

The tables 1-5 present the examples of results of the analysis carried out by the author in the array of integral indicators of the cluster state, in the framework of the above logic. They relate to the specifics of the interrelation between the integrated indicators at the individual level, the nature of the estimates generated by the analysis of this interrelation, as well as specially forming on this base, additional derivative indicators (\(dI\)).

The information of these tables should be included in the relevant directories of the cluster’s information-analytical system. The details for level \(i\) (classes) of the integral indicators of the cluster are presented below: the condition of *core activity* of the cluster participants and the condition of *integration activity* of cluster participants (i.e. two main “projection” of activity of the cluster participants).

Indicators of this level are: \(I_i\), where \(i=1…2\).

| Table 1. Interrelation of integral indicators (level of classes, \(i\)) |
|---------------------------------------------------------------|
| **1.** The nature of the interrelation;                        |
| **2.** Derivative indicator (\(dI\))                          |
| **1.** Interrelation between the integral indicator of state of core activity of the cluster participant in the accounting period - \(I_1\) and the integral indicator of the state of integration activities of the cluster member in the accounting period - \(I_2\) . |
| **2.** Ratio of these indicators is used to calculate the derivative indicator of *integration-conditioned state of the cluster participant’s core activity* in the accounting period: \(dI_1 = \frac{I_1}{I_2}\). |

The data for the level of subgroups (\(l\)) of indicators is presented below: the state of the “logical parts” of four analytical aspects (“Finance”, “Resources/processes”, “Products”, “End results”) of the participant’s core activity (so, here we talk about the four “potentials” and four relevant “relizations” of each analytical aspects) [4]. Indicators of this level are: \(I_{jkl}\), where \(j=1…5; k=1…4; l=1…2\).
Table 2. Interrelation of integral indicators (level of subgroups, l) within the same “logical parts” of the analytical aspects of activity of the cluster participant

| 1. Nature of the interrelation; | 1. Nature of the estimates generated by the analysis of this interrelation; |
| 2. Derivative indicator (dI) | 2. Purpose of the indicator |

1. Interrelation between the integral indicator of state of the “potential” of cluster participant’s particular analytical aspect in the accounting period \(I_{1jk1}^t\) and the integral indicator of state of the “potential” of the previous analytical aspect of the same participant in the accounting period \(I_{1j(k−1)1}^t\).

Note: the value of the index of subclass \(j\) characterizing the type of participant should be the same in both of these indicators.

2. Ratio of these indicators is used to calculate the derivative indicators of performance in realization of potentials of the participant's analytical aspects in its core activity in the accounting period:

\[
dI_2^t = \frac{I_{1jk1}^t}{I_{1j(k−1)1}^t}, \text{ where } j=1...5; \, k=2...4.
\]

Table 3. Interrelation of integral indicators (level of subgroups, l) within the different “logical parts” of the analytical aspects of activity of the cluster participant

| 1. Nature of the interrelation; | 1. Nature of the estimates generated by the analysis of this interrelation; |
| 2. Derivative indicator (dI) | 2. Purpose of the indicator |

1. Interrelation between the integral indicator of state of the “potential” of cluster participant’s particular analytical aspect in the accounting period \(I_{1jk1}^t\) and the integral indicator of state of the “potential” of the previous participant's analytical aspect in its core activity in the accounting period \(I_{1j(k−1)2}^t\).

Note: the value of the index of subclass \(j\) characterizing the type of participant should be the same in both of these indicators.

2. Ratio of these indicators is used to calculate the derivative indicators of efficiency in realization of potentials of the participant's analytical aspects in its core activity in the accounting period:

\[
dI_3^t = \frac{I_{1jk1}^t}{I_{1j(k−1)2}^t}, \text{ where } j=1...5; \, k=2...4.
\]
### Table 4. Interrelation of integral indicator (level of subgroups, \( l \)) of cluster participant’s state of the analytical aspect “Products” and integral indicators within its previous analytical aspects

| 1. Nature of the interrelation; | 1. Nature of the estimates generated by the analysis of this interrelation; |
|-------------------------------|---------------------------------------------------------------|
| 2. Derivative indicator \((dI)\) | 2. Purpose of the indicator |

1. Interrelation between the integral indicator of state of the participant’s potential of the analytical aspect “Products” in the accounting period - \( I_{1,j1}^{t} \) and the sum of the integral indicators of state of the potentials of the previous aspects of the same participant in the accounting period - \( \sum_{k=1...2} I_{1,\text{jk}}^{t} \).

Note: the value of the subclass \( j \) index characterizing the type of participant should be the same in the above indicator and the sum of the indicators.

2. Abovementioned indicators are used for calculation of the derivative indicators of productivity of participant’s core activity in the accounting period: \[ dI_{4}^{t} = \frac{I_{1,j1}^{t}}{\sum_{k=1...2} I_{1,\text{jk}}^{t}} \], where \( j=1...5 \).

### Table 5. Interrelation of integral indicator (level of subgroups, \( l \)) of cluster participant’s state of the analytical aspect “End results” and integral indicators within its previous analytical aspects

| 1. Nature of the interrelation; | 1. Nature of the estimates generated by the analysis of this interrelation; |
|-------------------------------|---------------------------------------------------------------|
| 2. Derivative indicator \((dI)\) | 2. Purpose of the indicator |

1. Interrelation between the integral indicator of state of the participant’s potential of the analytical aspect “End results” in the accounting period - \( I_{1,j4}^{t} \) and the sum of the integral indicators of state of the potentials of the previous aspects of the same participant in the accounting period - \( \sum_{k=1...3} I_{1,\text{jk}}^{t} \).

Note: the value of the subclass \( j \) index characterizing the type of participant should be the same in the above indicator and the sum of the indicators.

2. Indicators are used for calculation of the derivative indicators of effectiveness of participant’s core activity in the accounting period: \[ dI_{5}^{t} = \frac{I_{1,j4}^{t}}{\sum_{k=1...3} I_{1,\text{jk}}^{t}} \], where \( j=1...5 \).
3. Conclusion

Due to the limitations on the volume of this article, the authors demonstrated only a part of the additional derivative indicators that were obtained using the proposed logic in the analysis of relationships in the array of integrated indicators for assessing the state of the cluster. Thus, for example, a cross-assessment of the interdependence between the indicators characterizing the state of the individual logical parts (“potentials” and “realization of potentials”) of the different analytical aspects (“Finance”, “Resources/processes”, “Products”, “End results”) of the different participating organizations give an opportunity to form a valuable enough set of derived indicators.

The work with such a set of indicators maximally details and clarifies for the analyst the picture of cause-and-effect relationships in the functioning of the cluster, allows successfully translating the full logic of “productivity-effectiveness-efficiency” in accounting and analytical function, contributing to the adoption of competent management decisions both at the level of the cluster as a whole and at the level of its individual participants.

References

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