The Macrotheme Review

A multidisciplinary journal of global macro trends

Innovative methods for evaluating the performance and development of business clusters

Makhmudzoda Peruzai Mukhiddini* and Rustam Bobojonov**
Saint Petersburg State Economic University, Russia
*Univerity of Santiago de Compostela, Spain**

Abstract

In this article the authors propose innovative methods for evaluating the performance and development of business clusters, taking into account economic parameters of each component, which include all kinds of organization and production. Developed specific algorithms for the disclosure of the methodology of evaluating the effectiveness of clusters, the main types of development in accordance with the inventive concept, as well as calculation of Effective Operation and development of enterprises created within the business clusters.

Keywords: innovative method, cluster, business process, efficiency assessment, value added, "brick" model

1. Introduction

Successful and sustainable business is easily adaptable to market changes, economic environment, technology and applicable rules. To continuously adapt and improve, business processes need considerable efforts, rational management, effective strategies and new approaches.

With the growth of a large number of trade and commercial, transport, freight forwarding, warehousing, information and other intermediary firms inevitably entailed a complication of market relations between them, and between producers and consumers of goods and services.

Accelerated development process determines the need to improve the company's activities, infrastructures and business. Another factor in increasing the efficiency of companies and organizations is the globalization and market openness, the high mobility of the world business. All these changes have led and lead to greater competition in different areas of trade and services, which require from companies more highly organized process, coherence, and organization of common information space.

One of the methods to improve the efficiency of enterprises is the development and implementation of the cluster approach, which has proven very effective and successfully used in all spheres of the economy.

In a modern economic theory various methods for evaluating the performance of different types of clusters and parameters of activities of clusters is widely discussed and proposed.

2. An innovative method of calculating efficiency indicators of clusters

After studying all the proposals on evaluating the effectiveness of different clusters we determined that different methodologies which we use today for assessing the effectiveness of clusters are not fully revealing the mechanism of the formation and development of all types of clusters.

As a result of systematic study of economic parameters of the existing clusters in different countries and current theories for calculating the efficiency indicators of functioning and development of clusters we developed an innovative method for assessing economic parameters of functioning and development of various types of clusters.

As a result of systematization of economic parameters of clusters and structural components of clusters in a variety of organizations and industries a universal algorithm for calculating the efficiency indicators and functioning of cluster development in the short and long term was developed. Since the proposed formula for the calculation of these indicators resembles the form of a building brick, we offered to present the methodology for calculating efficiency indicators as a method **"Brick"**. The proposed method of **"Brick"** considers such indicators of companies, business, industry or cluster as:

➢ natural production and its price;
➢ gross revenue and cost structure;
➢ number of workers and the general assets of the company;
➢ relative efficiency indicators as profitability, labor productivity, capital-labor ratio, etc.

To disclose the nature of the methodology for assessing the effectiveness of clusters, we developed a specific algorithm, which consists of four stages:

1. Calculation of cost and gross figures cluster components;
2. Calculation of profitability, labor productivity and capital-labor ratio;
3. Geometrical mapping of cluster parameters in the form of the **"brick"**;
4. Calculation of the main directions of development of clusters and characteristics of clusters.

Presented below are the calculation of these stages.

The first stage of the calculation the efficiency of cluster formation and development involves calculation of cost and gross indicators of cluster components. Presented in table 1 are formulas for calculation of these indicators.

Tab. 1

Calculation of cost and gross indicators of cluster components

Name	Formula	Designation	Number of the formula
Revenue from sales (TR)	$TR_i=\Sigma\limits_{j=1}^{n}(Q_{ij}*P_{ij})$	TR_i- gross revenue of the i-th component of cluster; Q_{ij}- natural quantity of the j-th product of the i-th component of cluster; P_{ij}- price of the j-th product of the i-th component of cluster; n - number of product range;	(1)
Calculation of the pricing structure (P)	TR= C+WF+Tp+NI P=(C+WF+Tp+NI)/Qi	C- costs for goods and services of other organizations; WF- the wage fund; Tp- tax payments; NI- net income;	(2) (3)
Calculation of value added (VA)	VA= WF+Tp+NI	VA- value added;	(4)
Calculation of value added coefficients	Cva= VA/TR Cwf= WF/VA Ctp=Tp/VA Cni=NI/VA	Cva – value added coefficient in a revenue structure; Cwf- wage fund coefficient in a value added structure; Ctp- tax payment coefficient in a value added structure; Cni- net income coefficient in a value added structure;	(5) (6) (7) (8)

The second stage of the calculation of profitability, labor productivity and capital-labor ratio of enterprises, industry or business clusters are presented in a table 2.

Tab. 2

Calculation of profitability, labor productivity and capital-labor ratio of cluster components

Name	Formula	Designation	Number of the formula
The calculation of net labor productivity index (LP)	LP=VA/Nw	Nw – number of workers;	(9)
Calculation of capital-labor ratio (CLR)	CLR=A/Nw	A – assets (noncurrent + current);	(10)
Return on assets	Rva=VA/A NRa=NI/A	Rva – return on assets by value added; NRa – net return on assets;	(11) (12)
Growth opportunity of employment	POE= Rva*Nw ROE=NRa*Nw	POE - potential opportunity for employment growth; ROE - real opportunity for employment growth;	(13)

In the third stage we use the properties of all the performance indicators of enterprises, industries or business of cluster to display the following indicators: assets, capital-labor ratio, number of workers, net return on assets, return on assets by value added and labor productivity in the form of a brick (see Figure 1).

In this system of indicators is also valid the following calculations:
$$\text{"Brick"} = VA = A*Rva = LP*Nw = Nw*Rva*CLR \quad\quad (14)$$
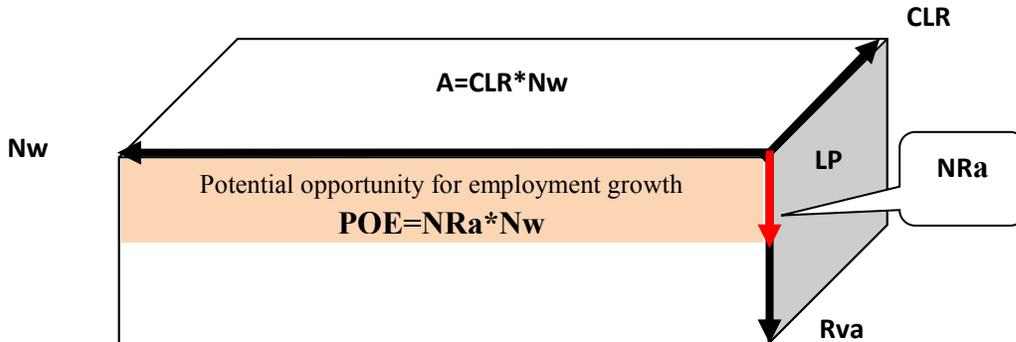

Figure 1. Calculation of efficiency indicators of enterprise or industry and cluster is displayed in the form of a **"brick"**.

According to the figure shown in Figure 1, the quantity of this figure is equal to value-added enterprise, industry or cluster as a whole. Facets of this figure are equal to the number of workers, capital-labor ratio and coefficient of return on assets on value added. In this case, the value of net return on assets is equal to the part of the return on assets on value added. It should be noted that the area of the top of the **"Brick"** figure is equal to the total assets of the enterprise, industry or cluster. The surface of figure on the sides is equal to labor-productivity, and the front of the **"Brick"** area equal to the amount of potential job growth in the enterprise, industry or cluster, provided that the whole value added will be invested for the development of this component. The indicator of real job growth is equal to the proportional value of the net return on assets.

The composition of **"Brick"** in this case consists of three components (wage-fund, tax payments and net profit). Ratio of these three components are equal to a coefficient indicators of value added structure as described in formulas 6, 7 and 8. Accordingly, the structure of a **"Brick"** consists of the following components:
Cwf- wage fund coefficient in a value added structure;
Ctp- tax payment coefficient in a value added structure;
Cni- net income coefficient in a value added structure;

In non-profit organizations, which operate based on economic accountability, the net income is equal to the sum of increasing the organization's assets. Accordingly, in this case, the net earned investment fund of organization should be considered as a net profit.

In the fourth stage we made the calculation of the main directions of development of cluster and features of cluster. According to this methodology, the development process takes place in three ways, namely:

1) A proportional increase in assets and the number of workers;
2) Increase in assets without increasing the number of workers;
3) Without an increase in assets and the number of workers in improving profitability.

Graphically, these types of development can be represented as follows (see Figure 2).
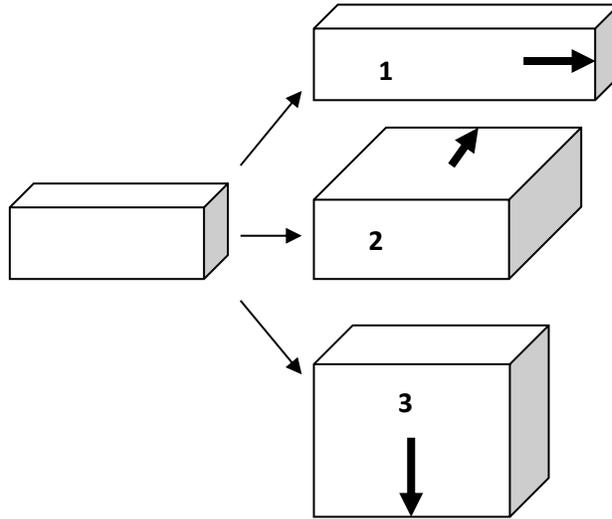
Figure 2. The main forms of development of enterprise, industry or cluster according to the form of **"Brick."**

3. Features and types of development of business clusters

Accounting for value added as the main economic indicator of activity of economic entity, can avoid double counting of gross figures, since the summation of the revenue indicators does not show an objective assessment of the real parameters of a group of enterprises and organizations. Summation of gross value added indicators evaluates the real volume and weight of each organization in the value added chain starting from the primary level to final production or service.

Based on these considerations, as seen in Figure 2, the methods and types of development of enterprise, industry or business cluster basically have three areas, each of which have principal features.

The first method of development involves an increase in volumes of the enterprise activity by a simple extension. This method of development in economy is called the extensive way of development. For example, such a way in agriculture may be in the form of new land development, construction of new model farms and cultivation of new gardens. In industry, the expansion of production volumes is done by assembly of standard equipment, etc.

The second method of development involves technical modernization, in which you can produce more products at the same cost of labor. This method of development in economy is called the intensive way of development.

The third method of development is due to improvement of management, monitoring and planning a sharp increase in profitability of enterprises, industry or business cluster. This way of development is often called a revolutionary way, as this way of development involves a change in organizational structure and management of the enterprise, industry or business cluster without additional capital costs and increase in the number of employed staff.

In today's economy for the development of all these kinds of development are used at the same time, but each kind of development can be combined together in different proportions, and thus forms the structure and direction of development of the enterprise, industry or cluster as a whole.

In Table 3 below you can see in detail all the main types of development according to the offered development concept model **"Brick"**

Table 3

The main types of development of enterprises, industry or cluster according to the concept of "Brick"

Explanation of development	(+) increase, (0) no change, (-) decrease		
	The number of workers	Capital-labor ratio	Return on assets by value added
1. Simple (extensive) development	+	0	0
2. Technical modernization	0	+	0
3. Improvement of management, monitoring and planning	0	0	+
4. Modernisation with simultaneous expansion of staff imployment	+	+	0
5. Increase in the production by loading empty capacity	+	0	+
6. Renewal of fixed assets to more perfect types of technologies, at the same time reorganize the management system	0	+	+
7. Wide-ranging reform and modernization provided an increase in loading the productivity capacity.	+	+	+
8. Stagnation	0	0	0
9. Degradation	-	-	-

As you can see from the table 3, the most favorable way of development of enterprise, industry or cluster is number seven. In this case, all the three main parameters of enterprise (number of employees, capital-labor ratio and return on assets by value is added).

To achieve these results, a wide-ranging reform, modernization and increase in loading the productivity capacity of enterprise, industry or cluster at the same time should be performed. In the case when such activities are not done we can get the opposite result, which may be stagnant performance or worse, degradable performance of the enterprise, industry or cluster. Therefore, the purpose of any enterprise, industry or cluster is to achieve the best results of development which would correspond to the way of development number seven.

Calculation of performance efficiency and development of enterprises within created clusters based on **"Brick"** calculation method will allow for more effective planning of the activity of each component of the created cluster and synchronize activities between each of its components.

The **"Brick"** calculation method will also allow for identifying the amount of required investment and human resources for the implementation of plans within created clusters.

To determine the gross indicators it is necessary to summarize all the main indicators of the **"Brick"**, which is shown below:

Gross value added cluster (GVA) = ΣValue added of each component of of the cluster (V$_\text{A}$ $\qquad$ (15)

Total number of workers in the cluster (TNw) = Σ Number of workers of each division (16) cluster (Nwi)

Total assets (OA) = Σ Assets of each units of cluster (Ai) $\qquad$ **(17)**

4. Conclusion

If we count the difference of assets and the number of employed workers before and after the formation of the cluster, we can determine the size of the necessary resources to implement these plans. And if we identify the necessary resources for the implementation of development plans, regulatory mechanisms and stimulation at various levels, starting from enterprise-level and ending the state level can be developed. Also on the basis of these calculations and analysis a detailed program for the development of clusters depending on the level of its performance can be developed.

Proper use of the proposed methodology for assessing the performance within the clusters on the basis of "Brick" and assessing the potential opportunity of development of clusters may reveal hidden potential for growth in these sectors of economy and further give the opportunity to develop the economy and business sector by clustering these industries. Cluster development will give the opportunity for the development of other related sectors of the economy which will eventually increase the overall competitiveness of the national economy.

References:

1. Avdonina S.G. Quantitative methods for assessing synergy innovative cluster [electronic resource] / Access: www.e-rej.ru/Articles/2012/Avdonina.pdf

2. Antipenko N.A. Assessment and economic analysis of the efficiency of innovation activity of territorial and sectorial clusters in APC [electronic resource] / Access: http://www.mfmesi.ru/uploads/catalog/uois/archive/protokol_3_mart.doc

3. Yekimova K.V. Fedin EV Organizational-economic mechanism of interaction between participants of regional and economic artificial cluster [electronic resource] / Access: www.lib.csu.ru/vch/187/030.pdf

4. Naumov V.A. Economic efficiency of formation of the cluster in the oil and gas region [electronic resource] / Access: www.ogbus.ru/authors/Naumov/Naumov_1.pdf

5. Mega, Mathew, et al. "Residential Cluster Development: Overview of Key Issues". Regents of the University of Minnesota. Retrieved 28 July 2013.

6. Fairbanks, M, & Lindsay, S, Plowing the Sea. Harvard Business School Press, 1997.

7. Silvestre, B. S. (2006) Aglomeracao Industrial de Petroleo e Gas da Regiao Produtora da Bacia de Campos: Conexoes de Conhecimento e Posturas Tecnologicas das Firmas. Ph.D. Thesis, Department of Industrial Engineering — DEI, PUC-Rio.

8. Silvestre, B. S., Dalcol, P. R. T. (2009) Geographical proximity and innovation: Evidences from the Campos Basin oil & gas industrial agglomeration — Brazil. Technovation, Vol. 29 (8), pp. 546–561.

9. Solvell, O Clusters - Balancing Evolutionary and Constructive Forces, 2009.

10. Teigland, R, & Lindqvist, G, Seeing Eye-to-Eye: How Do Public and Private Sector Views Differ of a Biotech Cluster and its Cluster Initiative? *European Planning Studies*, Forthcoming.

11. Atje R and Jovanovic B 1993, 'Stock Markets and Development,' European Economic Review, 37: Pp632-640.

12. M. Porter International competition. New York: International relations. 1999. P. 13.

13. Frank Moulaert and Farid Sekia: Territorial Innovation Models: A Critical Survey, No. 3 (2003), p. 289-302.

14. Sergio Arzeni. Promoting enterprise in central and eastern Europe: Business Clusters, 2005. P. 21-25

15. Toledano J. A propos des filieres industrielles. //Revue d'Economie Industrielle. V. 6. № 4. 1978. P.149-158.

16. Scott A. New Industrial Spaces. London, 1989; Scott A. Regions and the World Economy. Oxford, 1998;

17. Amin A., Thrift N. Neo Marshallian nodes in global networks/ International Jomal of Urban and Regional Research, 1992;

18. Harrison B, Kelley M., Gant J. Innovative Firm Behavior and Local milieu./ Economic Geography, 1996;

19. Markusen A. Sticky places in slippery space: A typology of industrial districts./ Economic Geography, 1996.

20. Boosting Innovation. The Cluster Approch. OECD, 1999; Keeble D, Wikinson F. High-Technology Clusters, Networking and Collective Learning in Europe. Aldershot, 2000