

Chapter 13

Acceleration of Education in the Cluster Structure of the Economy



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13.1 Introduction

One of the progressive and effective models of socioeconomic development is the integration of cluster associations in the local area in the context of growing regional and international competition.

The founder of the clusters is considered to be Michael Porter, who analyzed the industry development in a dozen countries and revealed the focus on the systemic location of companies in the local region to ensure the growth of competitiveness due to the positive effect of cooperation between suppliers, manufacturers, and various institutions. Porter defines a cluster as a group of geographically adjacent, interconnected companies (suppliers, manufacturers, etc.) and related organizations (educational institutions, government bodies, infrastructure companies) operating in certain areas and complementing each other (Porter, 1998). Geographic proximity, interconnection, integration, interdependence, complementarity, and competitiveness are

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usually attributed to the universal properties of clusters (Andersson et al., 2004; Porter, 1998; Rosenfeld, 1997).

In practice, the creation of clusters was successfully implemented about half a century ago in the famous “Silicon Valley” in the United States; in the formation of the shipbuilding cluster in Norway, which had a beneficial effect on the development of coastal regions; forest, paper, and printing clusters in Finland, integrating different regions of the country; as well as a cluster that restructured the territory of the industrial center of Italy (Cruz-Jesus et al.; Hill, 2000; Hinderink, 2002).

World experience in the development of cluster integration shows the efficiency, growth of economic potential and competitiveness of their subjects. Clusters have opportunities to increase labor productivity and raise wages, which significantly increases the standard of living in the region where the cluster is located. A significant effect of the functioning of clusters is the activation of innovative activity, which provides its elements with an additional competitive advantage. Clusters are distinguished by their invaluable ability to generate new knowledge, entrepreneurial ideas, and technologies in the context of cooperation between educational, scientific, and entrepreneurial structures. In turn, the intellectualization of production and the development of the knowledge economy require the creation of clusters of a new type, with a pronounced strengthening of the role of actors creating, distributing, and using knowledge as a resource and as a product.

For all these reasons, let's formulate the main goal of this study as defining ways of developing education as a subject of cluster development of the economy. The achievement of the goal is realized through: (a) the choice of the category of the cluster that is most suitable for the development of the educational element, based on the structure, composition, and location; (b) determining the ways of formation or development of the educational subject of the cluster; (c) designation of the directions of acceleration of the educational subject of the cluster; (e) determination of target indicators of acceleration of education.

13.2 Methodology

The study was carried out using a complex of private and general scientific methods: abstract-logical, systemic, dialectical, situational approach, comparative analysis, and graphical reception of data visualization.

13.3 Results

Choosing a cluster category that is most suitable for the development of an educational element. The following strategies are used to create clusters, depending on the development of production, the state of market relations, the availability of resources, the location of the territory, the level of competition, directions of state

social and economic policy: geographic (choosing the place of the cluster structure of the economy); horizontal (one sector or several industries form a cluster); vertical (building a vertical of production with the allocation of an innovator); lateral (a combination of different sectors providing economies of scale); technological (based on the unification of related industries); focus (the cluster is concentrated around one large production or educational institution); qualitative (stimulating the development of innovations).

The most developed clusters are characterized by the following features:

- the presence of competitive and investment-attractive companies exporting a cluster product;
- the presence of regional competitive advantages that contribute to the development of the cluster (the corresponding geographical location, the availability of resources, the existing infrastructure, the presence of educational organizations, the availability of suppliers);
- geographical concentration and affinity (level of specialization of the region, active interaction of cluster subjects located in close proximity to each other);
- a wide choice of participants and the presence of a “critical mass” (a high level of employment in multiple subjects of the cluster, the presence of vocational and educational institutions, scientific institutes);
- the existence of connections and interactions between the subjects of the cluster (the presence of working relations and coordination of efforts between the members of the cluster) (Kudryashov, 2016).

Let's cite different opinions of scientists about the need for state influence on the creation and development of economic clusters due to the usual influence of the authorities on any processes in Russia. American researchers are of the opinion about the independence of the developed clusters from the protectionist policy of the state (Matray & Poisat, 2015). On the contrary, French economists question the possibility of creating and developing clusters without state support (Slaper & Ortuzar, 2015). We made a conclusion about the importance of the role of state influence on the development of economic clusters in Russia based on the materials of numerous scientific publications of Russian scientists.

So, clusters created in accordance with a focus or quality strategy are most suitable for the development of an educational element, in our opinion. Understanding the role of the leading subject of the cluster—a large company—is the basis for the choice. Also, a cluster that encourages innovative development and created or developed with the support of authorities can be selected.

It is worth paying attention to the geographical location as the choice of the location of the cluster. Moreover, the choice must be made not on the basis of proximity or remoteness from something (capitals, large urban agglomerations, etc.), but from the point of view of the effectiveness of the influence of the cluster on the level of development of the region. At the same time, geographical remoteness can serve as an additional competitive advantage for the educational segment of the cluster.

A significant part of attention should be paid to the demographic situation in the territory of the localization of the cluster when deciding whether to enter the

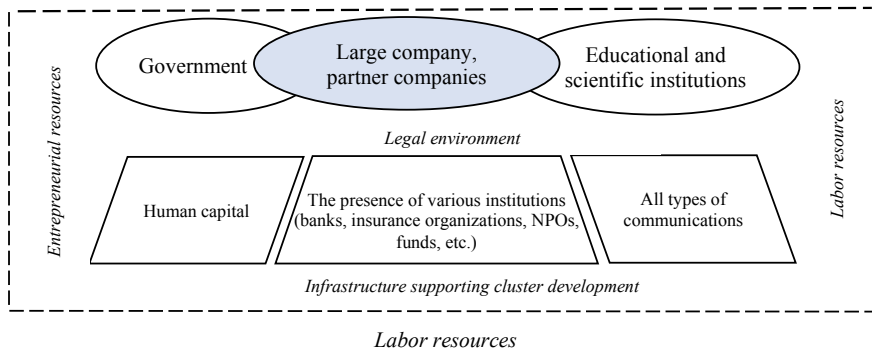


Fig. 13.1 Traditional cluster structure. *Source* The figure was prepared by the authors of the article

cluster. First of all, it is worth taking into account the level of provision of labor resources, their age composition, and the birth rate required for the resumption of the labor force. Entrepreneurial resources, the renewal and generation of which can be provided by the educational subject of the cluster to some extent, are of great importance for the development of the cluster. The traditional structure of a cluster that meets the requirements of its educational subject is shown in Fig. 13.1.

Considering the above, we state our choice and move on to the next task for the formation or development of the educational subject of the cluster.

Determination of ways of formation or development of the educational subject of the cluster. We propose to build the educational segment of the cluster as an out-of-space aggregation of the subject's elements based on infocommunication links, synergy of cooperation and competition, taking into account the reorientation of clustering in the information economy from an industry device to a system of socioeconomic relationships.

This decision is due to the possibility of using infocommunication links, IT technologies, telework, allowing the educational organization to be located outside the cluster region.

Let's choose a *modular structure of the educational segment* of the cluster based on the cluster simulation process described by Baranov, as well as the opinions of other researchers. The choice is also based on the fundamental control law of Ashby—"the theorem on the need for diversity", one of the consequences of which explains that the diversity of the system should be no less than the diversity of the controlled object (Baranov, 2020).

Let's include various elements in the modular device system to ensure the development of the educational segment of the cluster: large university (*core of the segment*); research centers (elements of type *A*); organization of vocational education (elements of type *B*); training centers for advanced training and retraining of employees (elements of type *C*); branch of noncore educational institutions of vocational education on an outsourced basis (elements of type *D*); university unit or outsourced unit that check and evaluate competencies on terms (elements of type *E*);

educational organizations geographically located in the cluster zone and under the supervision of the university (elements of type *F*).

The composition of the elements is determined on the basis of the cluster problems identified in various studies in terms of training and retraining of qualified workers and engineers. The effect of the cluster as a multiplier of employment in the region is also taken into account. A significant number of jobs are created by the infrastructure of the cluster (medical care, car service, housing repair and design, etc.), this also contributes to the development of educational activities in noncore specialties for the cluster (Kazeeva, 2016). The role of research centers is to create innovative technological and management processes, information technology, and intellectual property.

We consider it possible to use the “third place”, described by Komarova and found a place in the US educational system, in the activities of the educational segment as *innovations in the educational process*. “Third place” (or space) is a social environment that is separate from the two usual social conditions—at home (“first place”) and office (“second place”). These can be libraries, parks, swimming pools, shopping centers, colleges, universities, etc. “Third place” has characteristics that collectively create a breeding ground for innovation: a place without commitment; “leveling” place (equal status of a person for all); communicative place (speaking activity); accessible place; adjustable place that gives the space a tone (Komarova, 2019).

“Third place” can be used in terms of retraining and advanced training of personnel in the educational process, in “brainstorming” in scientific research and other activities of the educational subject of the cluster.

It is necessary to consider the *potential sources of its financing*, in which all subjects of the cluster, including the authorities, should participate, having determined the structure of the educational subject.

The costs of small and medium-sized Russian businesses for the training of specialists are quite small. Based on this, it is worth considering the costs of large corporations in the form of loans and investment loans, sureties and guarantees, participation in authorized capital. In addition, measures of nonfinancial support from state corporations are of great importance for the scientific elements of the educational subject. This is project management, scientific, technical, and technological expertise of innovative projects, registration of trademarks, patents, etc. (Gokhberg, 2013). Based on the experience of state corporations in promoting education and science, it is worth involving large companies of the cluster in the financing process.

Subsidies for the fulfillment of the state assignment for the training of specialists of various levels are dominant in the financing of education in Russia. Existing experience in education confirms the stability of cash flows from students.

Potential sources of funding for the educational subject of the cluster are shown in Fig. 13.2.

It should be noted that, in addition to the financing procedure, it is required to determine the system of legal, organizational, and business relations with the elements of the segment and adapt it to a similar cluster system of relations and relationships for the successful functioning of the educational segment of the cluster.

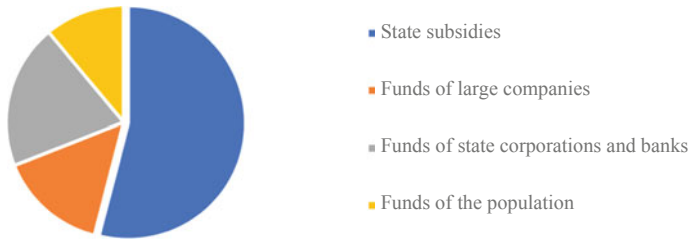


Fig. 13.2 Potential sources of funding for an educational entity. *Source* The figure was prepared by the authors of the article

We offer *ranking by weight coefficients* for the distribution of managerial efforts and determining the influence of the core of the university segment on the elements of the educational segment. We recommend including the indicators shown in Table 13.1 in the coefficient system.

Weight coefficient is calculated by multiplying the score and weight of the indicator. In this case, the indicator weight is determined by the expert commission of the segment core. Weight coefficients are calculated for each element of the educational segment of the cluster.

We propose to use a dynamic series of changes in external signals in time of an additive form, obeying regularities, to solve the problem of analyzing input data from the external environment, as well as to ensure the interaction of an educational subject with other elements of the cluster. To do this, let's build a dynamic element series, highlighting—a constant element (trend of the series), a cyclic element, a random element formed under the influence of unknown reasons, an element of comparability of the components of a dynamic series and a control element that sets the required trajectory of changes (Baranov, 2020).

Table 13.1 The system of indicators used in the distribution of management efforts in the educational segment of the cluster

No.	Indicator name	Indicator score	Determination procedure
1	Amount of proceeds from activities carried out in the interests of the cluster	Monetary (descending)	Responsible university employee
2	Significance in the activity of the cluster	Relative (descending)	Expert assessment
3	Innovative development	Score (descending)	Expert assessment
4	The volume of attracted material resources	Monetary (descending)	Responsible university employee
5	The number of the population of the cluster involved in the educational process	Quantitative (descending)	Responsible university employee

Source The table was compiled by the authors of the article

After summarizing the arguments and suggestions for determining the ways of formation or development of the educational subject of the cluster, we proceed to the next task of our study to designate the directions of acceleration of the educational subject of the cluster.

Designation of the directions of acceleration of the educational subject of the cluster. It is necessary to determine the directions for the further development of the educational segment of the economic cluster to achieve its sustainable growth.

For this purpose, we studied the opinions of various specialists published in scientific publications, and indicated the following directions of its development:

1. *Innovative scientific and educational activities.* When choosing this direction, we assigned a special role to the intensity of cooperation between the university (the core of the educational segment) → business structures → the state, accumulated by building an effective organizational and management model of interaction between the considered elements of the cluster. We propose to take into account the presence of a developed chain of links within the cluster and with various federal development institutions, a system of preferences and benefits for innovation when building a model.
2. *Improving the material and technical base of the elements of the educational subject.* Involvement in the practical part of the educational process of the developed industrial and technological base of the cluster companies, in our opinion, will contribute to the effective use of funds of educational entities, increase their competitiveness and prestige in the educational services market.
3. *The network device of the educational subject of the economic cluster.* Networkization is used as one of the promising management approaches (Serebryakova et al., 2020). The focus of this study is *geographically open networks* that allow to involve elements from other regions in the scientific and educational process, or allow the university itself to enter into clusters geographically remote from it. The network device will make it possible to fill the missing resources and competencies of the educational segment by establishing partnerships with their owners.
4. *Development of a scientific school in the direction of the economic activity of the cluster.* The choice of this direction is based on the possibility of attracting highly intellectual and highly professional personnel potential of the cluster in the scientific process. The success of involving practitioners in the scientific process is evidenced by domestic and foreign experience (Kokuytseva & Orlova, 2015). Interaction with the industrial sector of the cluster will provide an opportunity to generate ideas that are in demand at this stage, to attract experts and observers to the scientific process.
5. *Development based on synergy and economies of scale.* This direction is a priority in the acceleration of the educational segment of the cluster. An increase in revenue, an increase in the importance of the university and other elements can be achieved by differentiating and expanding the types of educational services,

increasing the number of students by age, profile, and type of education. Business stimulation of scientific developments will increase the prestige of the university and will contribute to the development of science and innovation.

It is necessary to provide target indicators for the development of the educational segment of the cluster in order to fulfill the control function of performance, summing up the results of the above about the designated areas of development. To do this, we turn to the last task of our study.

Determination of target indicators of acceleration of education. Let's propose a number of target indicators, determined based on the opinions of researchers reflected in various scientific publications, as well as existing Russian practice, to ensure the operational and strategic goals of the educational entity of the economic cluster (Notchenko & Vinogradova, 2017; Vinogradova, 2019). We suggest to carry out control annually. The determination of the *estimated value* is carried out independently by the educational subject, taking into account resource capabilities and target tasks. The name of the indicators, their estimated values, and the expected result are given in Table 13.2.

Table 13.2 Assessment of indicators of development of an educational subject of an economic cluster

No.	Indicator name	Estimated value	Result
1	Increase in the total number of students	Less than A%/more than A%	Negative/positive
2	The proportion of students in higher education programs	Less than B%/more than B%	Negative/positive
3	Increase in the number of students in secondary vocational education programs	Less than D%/more than D%	Negative/positive
4	Increase in the number of students in retraining and advanced training programs	Less than G%/more than G%	Negative/positive
5	R&D revenue growth rate	Less than F%/more than F%	Negative/positive
6	Growth rates of off-budget income	Less than N%/more than N%	Negative/positive
7	Increase in material and technical base	Less than K%/more than K%	Negative/positive
8	Quality of education (employment and career growth of graduates)	Less than L%/more than L%	Negative/positive
9	Increase in the areas of training and retraining of specialists	Less than W%/more than W%	Negative/positive

Source The table was compiled by the authors of the article

13.4 Conclusion

The approach to choosing a cluster category that contributes to the development of the educational segment was developed as a result of research. The ways of forming the educational subject of the cluster using the system of the modular device have been determined, the “third place” in the conduct of educational activities has been proposed, and the approach of entering the educational element into geographically remote clusters, taking into account the use of infocommunication links, IT technologies, telework, has been developed taking into account advanced scientific experience. The ranking of the elements of the educational subject of the cluster by weight coefficients is proposed to improve the efficiency of their management. A number of estimated indicators have been proposed as a control function of development.

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