

Development of industrial clusters in the regional economic system

Desarrollo de clusters industriales en el sistema económico regional

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Received: 18/03/2018 • Approved: 01/05/2018

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ABSTRACT:

The decrease in investment and innovative activities and scientific and technical potential, the predominance of food and consumer goods in the import supplies, and the strengthening of the fuel and raw materials orientation of domestic exports threaten the national security of the country and adversely affect the development of many sectors of the domestic economy. The presence of preferential lending and taxation, etc. is combined in the mechanism of creation and functioning of industrial clusters.

Keywords: industrial cluster, regional economy, management system, economic effects.

RESUMEN:

La disminución de la inversión y las actividades innovadoras y el potencial científico y técnico, el predominio de alimentos y bienes de consumo en los suministros de importación y el fortalecimiento de la orientación de combustibles y materias primas de las exportaciones nacionales amenazan la seguridad nacional del país y afectan negativamente el desarrollo de muchos sectores de la economía doméstica. La presencia de préstamos preferenciales e impuestos, etc. se combina en el mecanismo de creación y funcionamiento de clusters industriales

Palabras clave: clúster industrial, economía regional, sistema de gestión, efectos económicos

1. Introduction

Cluster organization of production has become the leading type of organizational and economic structure of the regional economy. The scientific literature rightly emphasizes that "the application of the cluster method is most relevant at the regional level due to the need for close contact between the cluster participants, which implies some territorial limitation" (Bludova, 2004).

In turn, the financial crisis of 2008 showed that "the basic conditions for the effective survival of companies are the system integration of their business processes at the regional

level, the establishment of fruitful partnership between them" (Nosov, 2010). From this point of view, the formation of economic clusters is justified, since they are represented by a system of relations (formal and informal institutions) arising between economic entities in the region.

Cluster is perceived as an effective tool for increasing the competitiveness of regional and national economies, improving the welfare of the population, accelerating technological advances and innovative development as centers for activating economic growth.

2. Literature review

The works of all existing schools (three schools are singled out (Pilipenko, 2006) in the field of formation and development of clusters, exploring the theory of new forms of territorial organization of production, mostly consider the formation conditions, scale and sources of competitive advantages.

The formation of the ideas of the American school, in addition to M. Porter's theory of industrial clusters, can be traced in the framework of the following theories: The theory of regional clusters by M. Enright, continued in the works of S. Rosenfeld, P. Maskell and M. Lorentzen, in M. Storper's theoretical development of the "ideal cluster".

Scandinavian school is formed by the theories of the economics of education and the national system of innovation of Danish scientists B-O. Lundwall and B. Johnson, the theory of the regional innovation system of the Norwegian researchers B. Asheima and A. Isaksen and the model of innovative regional growth of A. Anderson and J. Mancinen.

The British school of theories of new forms of territorial organization of production is represented by J. Dunning's eclectic OLI paradigm, the concept of interaction of the value-adding chain and the cluster, J. Humphrey and H. Schmitz, and the concept of K. Freeman's technical and economic paradigm.

The result of the study conducted by M. Enright was the conclusion about the formation of competitive advantages at the regional level, rather than at the national or supranational, as was previously thought. Analyzing several industries concentrated in different regions of the world - the chemical industry in Germany and Switzerland, the production of synthetic fibers in Japan, the production of ceramic tiles in Italy, M. Enright concluded that there are regional clusters and introduced this concept into economic theory. He defined an industrial cluster as "a geographical agglomeration of firms operating in one or more related branches of the economy".

3. Materials and methods

The theoretical and methodological base of the research was scientific works based on fundamental principles developed by Russian and foreign scientists in the field of network organizations of social and economic systems, cluster entities and industrial associations.

In the course of the research, the authors relied on general scientific methods of analysis: scientific abstraction, systemic generalization, logic, comparison.

The information and empirical basis of the research was based on specialized publications, official statistics, business practices and analytical information published in official sources and retrieved from the Internet.

4. Discussion

Industrial clusters are competing groups, collaborations and interdependent enterprises operating in the general industry, and are concentrated in a specific geographic region. They rely on a common infrastructure and skilled workers. The first industrial clusters were developed a century ago. An example of a world-famous industrial cluster is the "Silicon Valley" (Ageev, 2008).

Clusters are structural elements of the economy. The cluster approach allows us to identify new opportunities for increasing labor productivity in industry without reducing the intensity of competition. The combination of conditions in some spheres helps to successfully compete

in others.

Clusters can take a variety of sizes and shapes, depending on their depth and complexity. Usually they include the production of finished products, serving production, marketing channels, financial institutions, by-products, infrastructure (research organizations, educational institutions). The cluster forms a system in which the whole is greater than the sum of its constituent parts.

Clusters are fundamentally different from other hybrid forms of coordination: people live and work in one locality, as a result, there are constantly recurring unofficial contacts (interactions) that stimulate the establishment of trust, effective communications, and reduce transaction costs.

4.1. Cluster as a Form of Industrial Networks

Cluster is one of the forms of industrial networks that provide for increasing the frequency and strength of interaction between enterprises, so there is an additional "social capital" that facilitates access to resources. In other words, the essence of the cluster is the development of effective communications (Vasilchenko, 2006).

M. Porter (Porter, 2000) showed that clusters ensure the strengthening of interconnection and complementarity of industries due to the faster dissemination of technologies specific for the region (adequate to its special conditions), skills, information and marketing (specific competitive advantages flow through enterprises and industry). This means accelerating innovation, which is the basis not only for productivity growth, but also for updating strategic differences (advantages), maintaining dynamic competition.

Enterprises, located near, have many common needs and opportunities to increase productivity, as well as restrictions and obstacles along the way. Improving the conditions for the development of the cluster, the government bodies act simultaneously in the interests of many enterprises in the region. As a result, the location of the enterprise (or the quality of the economic situation) becomes a factor in the growth of labor productivity (Häussler & Zademach, 2006).

For modern Russia, this aspect acquires special significance, because in the 90 years of the last century there was not a reduction, but an increase in the backlog of industry in terms of productivity of labor from developed countries. The development of clusters, existing and new, will mean the creation of another source of long-term economic growth.

The practice of developing clusters in different countries shows that they: provide privileged or cheap access to specialized factors of production (new equipment and technologies, qualified personnel, developed infrastructure, including training and R & D, etc.), provided that in region there are competitive on the domestic or foreign market suppliers and competitive related industries.

Such accessibility, as shown by the analysis carried out by M. Porter (Porter, 2000), leads to a reduction in transaction costs, inventory minimization, exemption from imports, price restraint by suppliers and failure to fulfill their obligations, and reducing the costs of adapting enterprises to changes in markets.

Often a cluster can provide more efficient access to required resources than vertical integration (holdings):

- allow to accumulate specialized information (knowledge), access to which is better organized and requires lower costs, to facilitate the flow of information flows. One can directly observe the activities of other companies, respond more quickly and adequately to the needs of customers (in the cluster there are earlier trends in consumer demand, it is easier to find new suppliers and partners);
- ensure the complementarity of activities (to meet customer demand, marketing, procurement), thereby increasing the quality and effectiveness of work (Ketels, Lindqvist & Sölvell, 2012).

Incentives for higher labor productivity create competitive pressures within the cluster, but under certain conditions, clusters can slow innovation. So, there may be a kind of group

thinking that will be aimed at preserving the chosen strategies of behavior, and will suppress new ideas.

Today, in conditions of intensive vertical integration, competitive enterprises are rather individual "islands" rather than clusters, the existing communications network serves the interests of a few large structures. The formation of clusters is constrained by the lack of available capital, their needs are not matched by the curricula of universities and colleges, which is increasingly claimed by enterprise managers. It is at this point that regional government bodies must do everything to accelerate the development of clusters and turn them into a source of long-term economic growth.

The objectives of the regional industrial policy for the development of clusters are:

- the formation of such a nature and intensity of local competition, which would make it possible to give the development of industry an innovative character. In the mid-1990s, many Russian industries were characterized by competition based on cost cutting and imitation of foreign technologies and goods.

Industrial policies can be designed so that cost-containment strategies that require wage restraint gradually give way to differentiation strategies, since the preceding require an increase in production efficiency, quality, wages, and lead to an increase in the well-being of the population;

- creation of a common environment (climate), favorable for the opening of new types of business in the region. For this, macroeconomic and political stability (sustainable, predictable and reasonable policy) is needed to increase the efficiency of investments, develop infrastructure, establish clear rules for competition and corporate governance;
- ensuring effective mechanisms for formal and informal interaction of cluster members, creating incentives for teamwork (Ketels, Lindqvist & Sölvell, 2012).

It is important to note that, when developing an industrial policy for the development of clusters, it is impossible to copy what is in other clusters. Effective clusters are built on regional features that turn into sources of competitive advantages. The benefits to the business from participating in the cluster are largely dependent on industry characteristics, but in general they can consist in increasing efficiency and reducing costs in the current activities, increasing flexibility and innovative capacity in creating new products, technologies and markets.

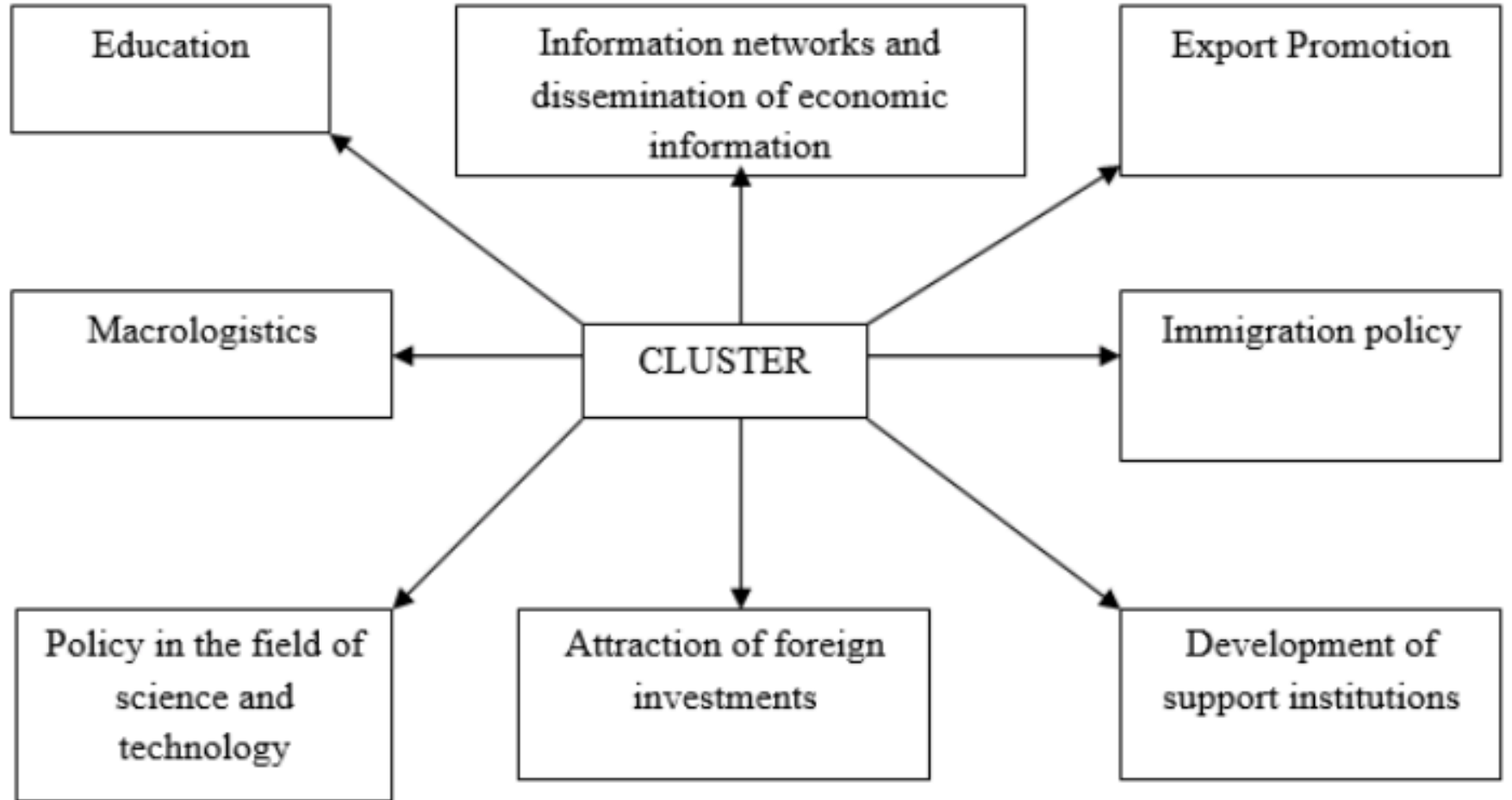
Enterprises can receive similar benefits by improving the efficiency of the raw materials supply system, components and components, access to various financial resources, accessibility and quality of R&D opportunities, availability of specialized and productive human resources, building a network of formal and informal relations for the transfer of market and technological information, knowledge and experience, creating a system for identifying collective benefits and dangers, forming a common vision and strategy once Itijah cluster (Müller et al., 2012).

4.2. General economic policy of the region and cluster structuring of the economy

Cluster structuring of the economy has a significant impact on the overall economic policy of the state. First of all, this is due to the support of science, risky innovations, export activities, the creation of the necessary infrastructure and education. This relationship is shown in Figure 1.

Figure 1

The impact of clusters on overall economic policy



Source: Prepared by the authors

A policy based on the development of clusters leads to an increase in the competitiveness of the state. For the whole economy of the state, clusters serve as points of growth of the domestic market. After the first one, more often than not new clusters are formed, and the international competitiveness of the country as a whole increases. It rests on the strong positions of individual clusters, while outside them even the most developed economy can only produce mediocre results.

In the whole world there is an increased interest in cluster strategies for achieving competitiveness. However, it is important that there is a clear understanding of the concept and a critical mass of knowledge that would allow us to judge how much the cluster strategy is applicable to Russia.

At present, each Russian region has about 20-30 largest enterprises, which can be classified as strategic economic entities. These subjects can be considered as supporting clusters in the analysis of the dynamics of the region's economic development (Sultanova & Akhmediyeva, 2010).

With this in mind, the following recommendations can be proposed, as applied to the Russian economy:

- The cluster approach to economic development is a useful tool for analyzing regional economies or the national economy, but it should be used as one of the alternatives, without idealizing or turning it into a panacea;
- It is important to avoid approaches that justify excessive government intervention in the country's economy, even under the slogan of achieving national competitiveness. The policy should work to create the conditions for economic growth: removing barriers to the development of entrepreneurship, investing in social capital and science, stimulating innovation, improving the business and investment climate, developing social and economic infrastructure;
- It is necessary to achieve an understanding that clusters are relevant to the relationships of private sector companies that share related markets using similar technology or based on the concentration of labor resources of a certain orientation. Therefore, it is important to focus on existing intersectoral links and work in favor of public-private sector cooperation, develop dialogue and industry professional associations that could inform about economic decision-making;
- Before making important decisions in the development of the economy, such as the

specialization of regions or the development of clusters, it is important to accumulate a critical mass of knowledge on: how much the economy of a particular region depends on a particular industry, how specialization affects the growth of the region, working in the same geographical area;

- Recognizing the objective limitations of the country in terms of technological breakthroughs for developing innovative clusters or importing technologies from other countries, it is nevertheless necessary to encourage the introduction of innovations in a broad sense in the production of goods and services, and to develop value chains and stimulate export industries.

Thus, the cluster approach is a powerful tool for stimulating regional development, which ultimately can consist in increasing employment, wages, allocations to budgets of various levels, increasing the sustainability and competitiveness of regional industry

4.3. Clusters Modeling

The formation of the cluster involves several possible scenarios, i.e. operations that ensure the construction of the cluster. Since the famous works by M. Porter, a lot of work has been devoted to the modeling of clusters. Many of them are based on Porter's "rhombus of competitiveness" (Porter, 2000).

So, in the work by I.R. Ferova there is the following model of the formation of local industrial clusters on the basis of M. Porter's "rhombus of competitiveness" (Porter, 2000). Ferova's model is shown in Table 1.

Table 1
Local industrial clusters formation model.

The firm's strategy and forms of competition (intense competition between competing firms located in the same locality)		
Features of production resources (local labor resources, capital, natural resources, natural, administrative, information and technological infrastructure, specialized factors of production)	Local features (features of the area, stimulating appropriate forms of investment and constant renewal)	Demand features (local consumers with a high level of requirements for products, specialized demand factors, customer needs, the occurrence of which can be expected everywhere)
The development of auxiliary and service industries (the presence of potential suppliers and competing industries in the same locality)		

In other works, modeling is used as a means of forming the ground for the typology of clusters. Thus, the results of modeling by Gordon and McCann can be represented in the following chart form, shown in Table 2.

It is undeniable that any model is an ideal design intended to explain the behavior of real objects. In this sense, in reality there is no "pure" cluster, which could be described only with the help of one of the above models. At modeling of clusters it is necessary to consider modern tendencies of development of postindustrial economy. At present, the social sphere has an increasing influence on economic processes, including the emergence and formation of clusters.

Table 2
Clusters classification models by Gordon and McCann

Net Model of Savings from Agglomeration	Industrial Complex Model	Social Network Model
Particular attention is paid to external effects at	Clusters that are spatial participants of models of interbranch balance in the	Clusters are strong, local networks are implemented on the basis of

geographical concentration	regional economy, geographical clusters that have arisen on the basis of inter-firm trade relations and minimization of transaction costs	interpersonal, trusting relationships, within the established institutional environment.
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Source: Prepared by the authors

According to M. Porter, "social involvement, i.e. the existence of serving social networks and social capital - is absolutely necessary for the successful operation and development of clusters. Moreover ... the cluster theory also makes it possible to closely connect theories of networks, social capital and civil orders, attaching them to competition in business and economic prosperity ... Cluster theory ... can show how network relations are formed, and how social capital" (Porter, 2000).

In recent years, there has been a tendency for clusters to spread in the world economy. Moreover, clusters are now increasingly being considered only as a theoretical model, but also as an instrument of economic policy (Bogoviz, Vukovich & Stroiteleva, 2013). This fact is connected with the fact that the cluster concept is organically combined with the development of the information economy, the knowledge economy.

According to D. North, the cause of US global leadership in the new economy is the existence in this country of a number of large, dynamically developing clusters of innovative entrepreneurial activities.

Bringing to an end the brief overview of the work in the field of modeling cluster schemes, the following conclusion should be drawn. In the methodological sense, the modeling of clusters in these works has a predominantly general character. The importance of social aspects in the cluster approach is noted, however, the complex institutional theory in cluster analysis is not applied. In addition, the cluster is not considered as a tool for managing the company's value.

The key characteristic of the cluster is to increase the competitiveness of companies in it. Classically, it is believed that one of the sources of this increase is the increase in the efficiency of the use of factors of production (Vertakova et al., 2016).

In the postindustrial economy, however, the emphasis shifts from the factors of production and distribution to intangible, institutional factors. Moreover, the exchange and sharing of the key competences of its participants is of particular importance in the cluster.

There are several models of cluster formation. The three of them are worth a closer look:

- technological model of the cluster;
- business model of the cluster;
- model of links between the cluster and the determinants of the competitive advantage.

Based on these models, it is possible to implement the methodology for forming an industrial cluster.

The following method for cluster formation is proposed:

- Development of a cluster technological model on the basis of basic factors, determination of growth points, opportunities and weak components of the cluster. Identify the ways of technological development and cluster boundaries;
- Building a business model based on the core of the cluster (defining the core of the cluster, the links between enterprises within the cluster, potential business opportunities);
- Formation of a model of links between the cluster and the determinants of the competitive advantage (based on the adaptation model for the formation of a competitive cluster in the conditions of Russia).

The technological model of the cluster. Let us consider the factors on which the technological model of the cluster will be based:

- The model takes into account the products of enterprises related to each other, both production links, and the commonness of raw materials, technologies, the

- interchangeability of personnel, and so on;
- A number of enterprises are represented in the model, taking into account both existing competitive manufactures and potential cluster participants;
 - The model implies the use of different types of connections between cluster enterprises, including, supplier-buyer relations, competitor-competitor, supplier-potential buyer;
 - Given the uneven distribution of competitiveness of the enterprises examined, cluster leaders are identified - enterprises that have high competitiveness, so-called middle units with the potential to increase competitiveness, and uncompetitive companies;
 - The model can be expanded by restoring the enterprises experiencing the current problems.
 - The model is created on the basis of the conducted research, while the essential point is the notion - potential competitiveness, since at low estimations of some enterprises most still have a high potential for competitiveness, since the output can indeed be claimed by the market. Enterprises belonging to a cluster may have different competitiveness assessments, which should be taken into account when building models. The possible output is the use of graphic and color interfaces.

Geographical proximity promotes the exchange of these implicit knowledge, and also allows the creation of a market for skilled labor that allows, instead of organizing the transfer of knowledge, to involve their carriers in the ranks of the company. It is these circumstances that explain that certain types of craft or approaches to craft are usually developed and practiced in strictly limited territorial limits.

Similarly, the importance of informal communication of company representatives with consumers located in its area is important.

Thus, geographical proximity is important not for the dissemination of formalized scientific knowledge, but for the dissemination of less formal implicit knowledge.

The decrease in transportation and communication costs that has taken place for a long time has an ambiguous effect on geographical concentration.

On the one hand, the importance of geographical proximity for the successful interaction of firms is reduced in part. On the other hand, the transfer of implicit knowledge continues to be based, first of all, on personal contact, and low transport and information costs contribute to the further division of labor on a global scale and the specialization of regions.

The advantages of the approach of allocating clusters, including support clusters, in analyzing the dynamics of the region's economic development for the authorities are that it allows a complex, systemic view of the situation in a group of interrelated enterprises belonging to different sectors. In addition, the cluster approach allows us to use as initiatives of the cluster development strategy initiatives put forward and implemented by business leaders, which, therefore, are guaranteed to be successfully implemented.

5. Conclusions

At present, the vector of economic analysis shifts to the space between micro- and macroeconomic systems, to the study of not individual economic entities, but their aggregate - clusters. The wide spread of this phenomenon in the economy of many countries is due to the fact that the cluster organization of production contributes to the activation of economic growth, strengthening of competitive positions of economic entities in the world market. In the existing interpretations of clusters, their systemic, network, structural character is noted, clusters are considered as a group or concentration of enterprises, the form of industrial organization of production, etc. Analysis of ideas about the concept of cluster made it possible to identify the characteristics and characteristics of clusters, the totality of which distinguishes cluster formations from other forms of spatial agglomeration.

Clusters have certain common properties, conditions of origin and patterns of development that are inherent in all cluster structures, regardless of their nature, but the specific features of economic clusters are also present.

The formation of a specific system of relations of economic entities that distinguishes clusters from other forms of interaction between entities is a condition for them to obtain

competitive advantages that are created and are mainly used at the regional level.

When considering the cluster, in the first approximation, the following characteristics attract attention: spatial localization, the belonging of economic entities to functionally related activities and related industries, the existence of a close network structure of relations between the participants; subordination to the collective brand, the availability of related infrastructure facilities.

The motivation of the market players to function within the cluster is reduced to obtaining positive effects from the processes of competition, cooperation and diffusion of resources, namely, the advantages that determine competitive positions in the regional, national and international markets, and also promote the growth of adaptive opportunities to market changes.

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