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Formation of the optimal model of the industrial cluster of Chinese garment enterprises based on the management of strategic economic zone

Formación del modelo óptimo del cluster industrial de empresas de confección chinas basado en la gestión de la zona económica estratégica

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Abstract.

The article discusses the mechanism for developing an optimal model of an industrial cluster associated with the formation of strategic economic zones using the example of Chinese textile enterprises. The problem of determining the optimal set of promising strategic economic zones in maximizing revenue from sales of industrial cluster products in a given set of strategic economic zones is being solved. The condition of the enterprise is determined, which most closely corresponds to the market needs in the volume and assortment of products in accordance with the composition and capacity of strategic business areas. A search is underway for such an investment and innovation policy that will ensure the evolutionary transformation of the enterprise architecture in accordance with the vision of the current state and based on minimizing attracted investments. The cluster approach and vertical integration are investigated, which can provide a sustainable competitive advantage for light industry enterprises for many years. An original model for creating an industry cluster is proposed and tested on the example of sewing enterprises in China.

Keywords: industrial cluster, optimal model, strategic economic zones, cluster approach, light industry, sewing enterprise

Resumen.

El artículo analiza el mecanismo para desarrollar un modelo óptimo de un clúster industrial asociado con la formación de zonas económicas estratégicas utilizando el ejemplo de las empresas textiles chinas. Se está resolviendo el problema de determinar el conjunto óptimo de zonas económicas estratégicas prometedoras para maximizar los ingresos de las ventas de productos de clúster industrial en un conjunto dado de zonas económicas estratégicas. Se determina la condición de la empresa, que se corresponde más estrechamente con las necesidades del mercado en cuanto al volumen y la variedad de productos de acuerdo con la composición y capacidad de las áreas estratégicas de negocios. Se está buscando una política de inversión e innovación que asegure la transformación evolutiva de la arquitectura empresarial de acuerdo con la visión del estado actual y basada en minimizar las inversiones atraídas. Se investigan el enfoque de clúster y la integración vertical, lo que puede proporcionar una ventaja competitiva sostenible para las empresas de la industria ligera durante muchos años. Se propone y prueba un modelo original para crear un grupo industrial en el ejemplo de las empresas de costura en China.

Palabras clave: cluster industrial, modelo óptimo, zonas económicas estratégicas, enfoque cluster, industria ligera, empresa de costura

Introduction

China's light industry enterprises are constantly looking for innovative directions of development in modern conditions of a market economy and fierce competition in the world market.

The problems of development of Chinese light industry enterprises require serious governmental attention and receive not only support, but also a certain set of requirements to ensure the interests of the regions where they are located. These are organizational, technical, financial and staffing issues of light industry enterprises in a particular region and the features of their interaction with the relevant organizations involved in the cluster. They are reflected in a number of publications on the China's light industry features of the development (Motuz et al., 2015; Nikitina & Yuan, 2015a; Nikitina & Yuan, 2015b; Nikitina & Yuan, 2015c; Novoseltsev, 2016). «With the rapid development of information technology, the current social communication has undergone a revolutionary change. In the current society, people's communication methods have evolved from traditional wired network communications to wireless network technologies. Although the wired network communication method still occupies a large proportion, wireless network technology has become an integral part of the current social production and life. In particular, the emergence of mobile Internet technology has caused fundamental changes in the Internet communication. In the era of wireless networks dominated by mobile Internet, virtual and the real world are blended with each other, and the distance between people, people, society, people, and groups has become zero. Based on this zero-distance basis, commerce has achieved a true sense of democracy. Correspondingly, the economy has become an era of knowledge economy. The use of knowledge innovation has become a necessary path for the development of individuals, groups, and organizations (Lan et al., 2019).

The lack of unified approaches to the regional innovative development of China's light industry enterprises, the need to form adaptive mechanisms for managing light industry in the context of globalization determines the scientific novelty of the study and previously published articles (Yuan, 2014). «From the above, the provincial government should fully

consider the inter-regional impact of correlation in profit margin when they formulate a plan of the spatial distribution of this industry. They should pay attention to encouraging element flow in adjacent areas, building cross-regional cooperation platform, improving the industry profitability of the clusters and promoting sustainable development of the industry. We also suggest the entrepreneurs in this industry to strengthen cross-regional industrial cooperation with the entrepreneurs in the provinces which are in the same cluster to optimize the regional allocation of production factors and promote profitability» (Wang et al., 2019).

The development of an optimal model of a cluster of light industry enterprises in China in the most difficult conditions of world competition and globalization of the economy is an urgent task that must be addressed at the present stage. In this regard, a crucial role is assigned to the Strategic Economic Zones (SEZ). SEZ is a separate market segment, characterized by the uniformity of consumer requests in terms of specific products on which the company sells or intends to sell its products (Olkhovskiy, 2018; Schwarzkopf, 2018; Kupryushin & Chernyatina, 2017; Narkevich & Narkevich, 2018; Moiseenko, 2017).

Materials and methods

The indicator “attractiveness of the Strategic Economic Zone (SEZ)” is an assessment of the market that one can focus on. The indicator "position in competition" is an assessment of the capabilities of the cluster and depends on the results of its activities. Using the extended version of the BCG matrix, which was developed by McKinsey for General Electric (GE) as a tool, allows one to evaluate the capacity and highlight the most promising strategic management zones for cluster production. The capacity of the set of allocated SEZ for each type of product is usually greater than the production capabilities of the cluster. Therefore, the problem arises when determining the optimal assortment of these zones for the cluster.

To solve this problem, we are given a set of SEZ - J , in which it is possible to implement the cluster products. We are given I as well - the set of products produced by the industrial cluster.

For each product $\forall i \in I$, the capacity of each SEZ $\forall j \in J$ - $d_{i,j}$ is determined, and for each product $\forall i \in I$ the maximum b_i and minimum f_i volume of release is determined.

For each SEZ $\forall j \in J$ and product $\forall i \in I$, the price of the product in this zone - $c_{i,j}$ is determined.

The sales volume of the product i in the SEZ j is an independent variable - $x_{i,j}$. In addition, it is assumed that for each product $\forall i \in I$ the capacity of all SEZ is greater than the possible volume of its production by cluster enterprises

$$\sum_j d_{i,j} > b_i \quad \text{for } \forall i \in I$$

Then the task of determining the optimal set of promising strategic management zones is to maximize revenue from the sale of cluster products in a given set of SEZ:

$$\sum_i \sum_j c_{i,j} x_{i,j} \rightarrow \max$$

The following restrictions must be met:

- based on the possibility of increasing the capacity of the cluster enterprises, there is a top restriction on the volume of output of b_i product type i , therefore, the sales volume in all SEZ should not exceed the volume of output for each product $\forall i \in I$

$$\sum_j x_{i,j} \leq b_i$$

- on the other hand, the volume of output i should be greater than dictated by the breakeven point with the volume of production f_i , i.e. the release of any product should be cost-effective

$$\sum_j x_{i,j} \geq f_i$$

- the sales volume of each product $\forall i \in I$ should not exceed the capacity of each SEZ $\forall j \in J$.

$$x_{i,j} \leq d_{i,j}$$

The solution to this problem allows one to obtain the optimal set of SEZ.

Another task determining the development of light industry clusters is to specify the vision (Zhemchugov, 2011), of enterprises, i.e. such a state of the enterprise that most closely matches the needs of the market in the volume and range of output of its products in accordance with the composition and capacity of strategic management zones. Using the concept of moving from the narrow specialization of cluster enterprises horizontally to vertical integration, existing ones through diversification and the creation of new cluster enterprises can be connected to the release of products, which are supposed to specialize in one of the value chain operations. The results of these operations should ensure the execution of subsequent operations of the value chain. From these positions, it is assumed that there are many enterprises in the cluster - J , which are necessary for the production of many products I . For each product $\forall i \in I$ at each enterprise $\forall j \in J$, its maximum $b_{i,j}$ and minimum $f_{i,j}$ output is determined. In addition, each product i is associated with a vector of costs $\{a_{i,j}\}$ required for the production of a unit, as well as a selling price c_i that is common for all enterprises in the cluster. The costs of each enterprise are limited. In addition, each product is associated with a vector of costs required for the production of a unit of production, as well as a selling price that is common for all enterprises in the cluster. The costs of each enterprise $\forall j \in J$ are limited d_j .

In this case, the task is to determine the maximum output of cluster products $\{x_{i,j}\}$, at which the output in value terms reaches a maximum, i.e.

$$\sum_i \sum_j c_i x_{i,j} \rightarrow \max$$

subject to the following restrictions:

- the planned volume of production is limited by the capabilities of each enterprise in the cluster, i.e.

$$\sum_i a_{i,j} x_{i,j} \leq d_j \quad \text{for } \forall j \in J,$$

➤ the output of any product i at enterprise j should be cost-effective, i.e. output i must be greater than $f_{i,j}$ which is determined by the breakeven point for a given enterprise j ,

$$x_{i,j} \geq f_{i,j} \quad \text{for } \forall j \in J, \text{ and } \forall i \in I$$

➤ the output of each type of product is limited from above, i.e.

$$x_{i,j} \leq b_{i,j} \quad \text{for } \forall i \in I$$

The solution to the problem allows you to determine the best range of products in terms of the use of resources available to the cluster enterprises.

Moreover, the ratio between the selling price c_i of products i and the costs of their production $a_{i,j}$ determine the profitability of products $\forall i \in I$ at the enterprise j . And the

difference between revenue $\sum_j \sum_i c_i x_{i,j}$ and production costs $\sum_i \sum_j a_{i,j} x_{i,j}$ characterizes the profitability of the cluster.

The third task is to determine such an investment and innovation policy that will ensure the evolutionary transformation of the enterprise architecture in accordance with the vision from the current state based on minimizing attracted investments. Suppose that there are many types of products I and many enterprises in the cluster involved in their production J .

The volume of output i at enterprise j $x_{i,j}$ is taken as independent variables. And for each type of product $\forall i \in I$, restrictions on the volume of output are set $b_{i,j,\min} \leq x_{i,j} \leq b_{i,j,\max}$, which are dictated by the effective use of the equipment designed for installation or continued use of existing equipment and technology at the enterprise $j \in J$.

In addition, for each type of product $\forall i \in I$, a vector is specified $\{a_{i,j}\}$ that characterizes the specific capital investments attributable to the organization of the production unit. The

task of determining the investment policy of the cluster is to determine the minimum investment for the organization of a given volume of output:

$$\sum_i \sum_j a_{i,j} x_{i,j} \rightarrow \min$$

In this case, technological restrictions on the volume of output of each type of product

$$b_{i,j,\min} \leq x_{i,j} \leq b_{i,j,\max} \quad \text{for } \forall j \in J \quad \text{must be met.}$$

Analysis and Results

The presented models of three tasks make it possible to interactively select an acceptable option for the development of enterprises of the cluster core.

The operability of the proposed model system was tested in the production conditions of enterprises of the PRC: LLC “Production Technology Company Mingjia (Guangzhou City)” and LLC “Minke for the Production of Leather and Leather Goods (Guangzhou City)”. For China, the creation of clusters is becoming one of the most important tasks for the effective development of cities. “Since the mid-2000s, cultural and creative clusters, especially arts clusters, have flourished across cities and towns in China as a result of local governments’ efforts to establish the cultural and creative sector for urban regeneration. Although many clusters arose organically without policy directives, some later encountered intense government interventions after being officialized as the city’s strategic cultural industry bases ” (Li & Liu, 2019).

The analysis of the processes of education and development allows us to propose a number of additions for clusters of light industry in China, which we will consider using the example of clothing production. Compared with existing ones, the proposed cluster (Figure 1) should have an expanded composition.

As part of the expanded cluster, it is proposed to include not only educational institutions, as implemented, for example, in the legislation of the Russian Federation (On industrial clusters and specialized organizations of industrial clusters Decree of the Government of the Russian Federation of July 31, 2015), but also banking institutions, as well as

engineering enterprises specializing in the production of equipment for the cluster. The proposed composition of the cluster allows to realize the entire value chain of clothing production, thereby integrating all the necessary production. Offered:

- - the core of the cluster is comprised of enterprises from several light industries that need to be integrated. Integration implies synchronization of production volumes and coordination of pricing policies in order to minimize costs and tax burdens while limiting the prices of final products;

- the interests of owners of enterprises producing raw materials and intermediate products can be satisfied by obtaining a share of ownership in the clothing industry and trade enterprises, which are highly profitable.

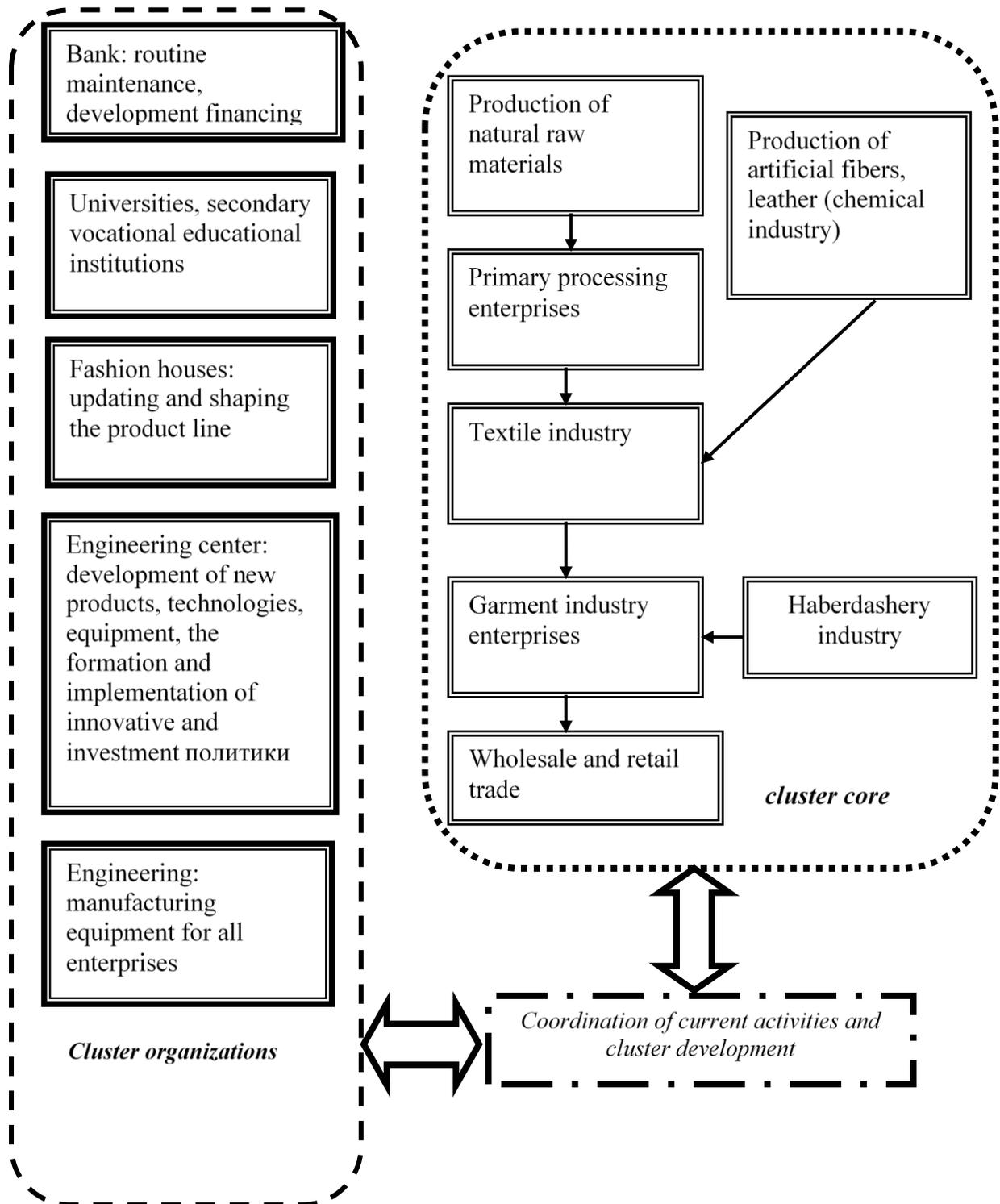


Figure 1. Model of a clothing production cluster

Thus, it is proposed to include the necessary participants in the light industry cluster that ensure its functioning and development:

□- a bank that provides financing for the current activities of all enterprises and organizations, as well as the implementation of innovation and investment policies;

□- universities and secondary vocational schools, the main function of which is training. Universities play a central role, as they train personnel for all enterprises, including their own needs. In addition, part, and maybe all of the scientific research and development work can be concentrated there;

- fashion houses perform the function of updating and forming a product line, develop and pick up fashion trends, advertise cluster products through the use of their brands;

- the engineering center is busy developing new products, technologies, equipment, carrying out scientific research in the technical and economic field, forms and leads the implementation of innovation and investment policies;

- engineering is directly involved in the implementation of investment policies. Equipment release is carried out within the time periods fixed in the cluster investment program for each enterprise participating in the implementation of this program.

In addition to the mentioned enterprises and organizations in the cluster, there should be a coordinating current activity and cluster development organization, maybe an informal one, which is designed to coordinate the activities of all cluster members to ensure competitiveness and sustainable economic growth.

A. Marshall (2007) identified two ways of industrial growth:

□ vertical integration of enterprises within the framework of one firm, which achieves cost minimization by increasing production volumes using the economies of scale on the scale of production, as well as by reducing the tax burden;

□ coordination of the activities of geographically closely located small and medium-sized enterprises that are effectively developing due to flexible specialization, and thereby increase output, achieving economies of scale.

In the modern economy, a sustainable competitive advantage is ensured through the use of innovations, including the development of new products, as well as the development of technologies, management systems and methods, logistic ties, the formation of enterprise and cluster architecture, which are most relevant to the volume and structure of output. REICE | 255
This is confirmed by studies of eminent authors (Marshall, 2007; Huang et al., 2017).

«The development of the fashion industry innovation base is actually affected by the actor network system. The actor network are composed of the human actors, such as clothing industrial cluster manufacturers, local residents, local government groups, industrial investors, consumers and non-human actors include fashion apparel, industrial cluster business environment, local characteristics of cultural landscape, innovative research and development base, the theme of marketing and campaign promotion, government counseling resources etc. To continue and expand fashion institute actor network, it constantly includes various provide industry innovation technology and services. Although each of the actors in the actor network of fashion innovation base influences one another. The process and outcomes shed light on the service innovation practices for fashion industrial innovation base, and their relations are not necessarily equal. According to the study, from the actor network to think, the government to help the traditional textile industry to upgrade the transformation of fashion industry innovation base through the promotion of service innovation, the future will be able to industrial network structure and relationship to effectively adjust and change» (Huang et al., 2017).

Combining vertical integration and a cluster approach, it is possible to provide a sustainable competitive advantage for light industry enterprises. Vertical integration is the concentration of value chain operations on products within a single enterprise. In this case, individual enterprises become workshops or production of one vertically integrated company. The consolidation of small and medium-sized enterprises and increasing their specialization is inevitable processes of concentration of production, with the aim of minimizing costs. And the coordination of the economic activity of the cluster enterprises also contributes to increasing their profitability.

The state, while stimulating the formation and development of clusters, plays a decisive role in the development of the cluster, since the creation of conditions for the emergence and development of the cluster depends on the state, on its legislative and executive bodies.

«We find that different clusters show great heterogeneity in innovation efficiencies and their determinants... the effect of government funding is considered in parallel with those of academia-industry collaboration. This allows us to empirically verify the thesis of the triple helix by teasing out the different effects of the three major actors on innovation efficiency» (Hou et al., 2019).

The cluster, regardless of industry, has a number of features from the traditional form of organization of industrial activity. Traditional forms presuppose centralization of ownership of all assets in the same hands on a fixed section of the value chain. In contrast, the cluster for each product represents a value chain in which the assets needed for production are dispersed among the cluster members. And each cluster member can make decisions on the use of their assets independently and independently.

The organization coordinating the current activities and development of the cluster is called upon to coordinate the activities of all cluster members in their interests (Wang et al., 2019). To be subject to approval:

□- in current activities, the volume and structure of output, as well as pricing on the entire value chain in order to achieve a deficit-free and balanced supply of finishing materials.

□- in promising activities, the formation and implementation of innovative and investment policies in the interests of all participants, minimizing the debt burden.

In their activities, the management and owners of the cluster enterprises rely much more on economic mechanisms of interaction than on administrative forms of management. The coordinated activity of cluster members on the value chain should improve the final results, first of all, of each owner, which is the main stimulus for the formation of the cluster.

The cluster provides the most favorable conditions for the development of highly specialized industries, both the core of the cluster, and ensuring their activities. Increasing the efficiency of enterprises developing and supplying equipment, technologies, and necessary components is carried out by expanding the market and securing it.

In this case, a transition is made from single deliveries to single enterprises to system support of the activities of a group of steadily functioning enterprises with a large volume of production, and, as a result, occupying a large market share.

Having great opportunities to pursue an active investment policy with less risk, the cluster enterprises are interested in high-performance equipment that best meets their needs. This equipment must meet the requirements of the technology that best matches the controlled section of the value chain, starting with the raw materials used. Thus, the functioning of the cluster creates a rather capacious, but complex market for its constituent highly specialized small and medium enterprises, pursuing an active innovation policy based on expanding investment opportunities, which ultimately becomes a source of additional competitive advantages.

In accordance with the principle of Le Chatelier, "in any system that is in equilibrium, when one of the factors controlling this equilibrium changes, compensating processes arise that tend to weaken the effect of this equilibrium." In relation to the results of the implementation of the investment policy, the renewed enterprises should ensure further expansion or, at least, the retention of cluster positions in the market. The cluster in this case is a single entity. The flip side is the emergence of other "bottlenecks" that hamper the development of enterprises (Molchanov, 1998).

Conclusions

Thus, a prerequisite for the creation and effective operation of a cluster is the creation of a mechanism for coordinating all aspects of its activity. The functioning of such an organization is possible on the basis of concluding an agreement defining rights, powers, and also necessary resources in a particular field of activity. As part of such an organization, owners who make all decisions and managers representing the interests of all enterprises in the cluster should be represented. The task of managers is to prepare and present to the owners how the problems arise and how to solve them. After the approval of decisions by the owners, managers implement these decisions in accordance with the allocated resources and their authority. Managers are responsible for implementing decisions on time in accordance with and efficient use of resources. REICE | 258

The definition of promising strategic areas of management (Ansoff, 2013), the forecast of their capacity, as well as the possible share, which the company expects. is a priority for the development of light industry clusters in China. The strategic economic zone (SEZ) is a separate market segment, characterized by the uniformity of consumer demands in terms of specific products on which the company sells or intends to sell its products. Approaches to solving the problems of industrial clusters of light industry in terms of the development and increase of enterprise efficiency are presented in a number of publications (Yuan, 2017a; Yuan, 2017b; Dmitriev et al., 2018).

The functioning of the coordinating organization should create an institutional field for the timely identification and creation of a mechanism for solving emerging problems. Thus, the coordinating role is assigned to the Council of the cluster, which includes the owners of all enterprises in the cluster. In addition, in the management system it is crucial to provide for the role of the executive body that prepares and implements the decisions taken with the involvement of the necessary performers, including cluster members.

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