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**CLUSTER DEVELOPMENT IN THE CONTEXT OF**  
**DIGITALIZATION OF THE ECONOMY**

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**Abstract**

Today, international global competition boils down to competition between individual regions based on emerging digital platforms. In the modern world, the potential and competitiveness of the national economy are becoming derivatives of the competitiveness of regional economies. The unit of global economic space is a region that acquires strategic importance for the development of the country's economy. This makes a strategic approach to regional development based on digital platforms and its integration into the system of national priorities and digitalization of the economy important. The digital cluster approach can be defined as forms of territorial-sectoral organization of production. These forms facilitate the implementation of various entrepreneurial projects of economic development using digital technologies. They also lead to a synergistic effect of interaction with scientific organizations and with the interested participation of state and municipal governments. Modern competitive advantages are almost entirely due to the capabilities in production, management, organization of production and the provision of services based on the introduction of digital business models. The effective development of the competitiveness of the economic system is possible with the integrated use of the cluster mechanism and modern concepts of innovative digital development. The world practice of the most advanced economic systems proves this. The drivers of new digital technologies provide high competitiveness and sustained economic growth. In this regard, many countries are increasingly adopting a cluster approach in support of the most promising areas and forms of entrepreneurial activity, as well as in the formation and regulation of digital industrial systems.

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## 1. Introduction

Today, the challenges of digital development and economic efficiency in resource-constrained environments are becoming more pressing for industrial enterprises. The optimal concentration of public funds is necessary to achieve high rates of scientific and technological development of the region's industry. These funds should be concentrated on promising areas for the development of knowledge-intensive and digital technologies. Ensuring the growth of industrial potential through the digital development of the economy and the creation of clusters of economies becomes an important task. It is necessary to change the structure of the economy, the introduction of cluster and digital approaches in improving the activities of industrial enterprises and the development of the economy as a whole. It is necessary to create conditions for the formation and development of the digital potential of industrial enterprises in modern market conditions. Today, competitive advantages are almost entirely due to digitalization in the technologies of production, management, organization based on a cluster economy.

## 2. Problem Statement

The challenges of maintaining and strengthening the competitive position of business structures are constantly exacerbated by the following conditions:

- continuous and development of processes of conceptual, institutional changes of the model of reproduction activity;
- continuous change of process stages.

There is a compelling argument for changing the nature of economic growth and the sources of modern enterprise competitiveness. This makes it necessary to identify modern forms of organization of entrepreneurship and industrial activity, to find factors of their successful implementation in conditions of rapid development of modern "subversive" technologies. The economies of developing countries have come to the forefront of the world by no accident. In these countries, entrepreneurs are not burdened with obligations in relation to previous strategies. They effectively change the structure of global production chains and accelerate major changes in the balance of economic capacities of states.

## 3. Research Questions

This study considers theoretical and practical aspects of digital development of industrial enterprises. The issues of improving the digital potential of industrial enterprises through the development of industrial clusters are being studied. Application of theoretical and methodological provisions and practical recommendations of the study will allow to make informed decisions in the field of innovation-technological and digital development of industry industrial enterprises. This will allow to more effectively solve the problems of formation and interaction of regional industrial clusters. The practical significance of the study is that the main results can be used by state and municipal authorities, business in developing priority directions for increasing the efficiency digital development of industrial enterprises. Further research in this area will expand the understanding of the possibilities of applying theoretical and methodological provisions and practical recommendations in the field of increasing innovation,

technological and digital potential of industrial enterprises, including through the influence of cluster forms of industrial industry development.

#### **4. Purpose of the Study**

The world processes of large-scale modernization of science and production based on the achievements of Industry 4.0 require research in order to identify promising sources of competitive advantages of entrepreneurial structures. It is necessary to consider questions of creation of innovative infrastructure for the industrial research and development realized in each region of the country according to the state program «Digital economy».

The following objectives and objectives are defined according to the issues and questions of the study:

- study the formation of digital clustering of the economy based on the introduced industrial digital platforms;
- consider the organization and management of cluster development through the implementation of digital business models;
- analyze clustered digital systems using digital innovation;
- evaluate the effectiveness of digital cluster regional policy for business.

#### **5. Research Methods**

The research approach was based on the following methods: theoretical and methodological (analytical, factor); diagnostic (factor analysis, process modeling, forecasting of the situation in the economy, expert methods); empirical (observational, comparative). The complex of industrial enterprises of the Samara region, including oil and gas and aircraft clusters, served as the basis for the study. Methodological approaches in the ongoing study were applied in stages. In the course of using theoretical and methodological approaches, the formation of clusters of modern enterprises of the industrial sector of the economy based on industrial digital platforms was investigated. The practical part of the study was based on the analysis of the state and development of the petrochemical cluster in the Samara region. As a result, the author's methodology for managing the development of petrochemical clusters is proposed. The methods used made it possible to study and implement:

- study the formation of digital clustering of the economy based on the introduced industrial digital platforms;
- consider the organization and management of cluster development through the implementation of digital business models;
- analyze clustered digital systems using digital innovation;
- evaluate the effectiveness of digital cluster regional policy for business.

#### **6. Findings**

Today, international global competition boils down to competition between individual regions based on emerging digital platforms. In the modern world, the potential and competitiveness of the national

economy are becoming derivatives of the competitiveness of regional economies. The unit of global economic space is a region that acquires strategic importance for the development of the country's economy (Cavallo et al., 2018). This makes a strategic approach to regional development based on digital platforms and its integration into the system of national priorities and digitalization of the economy important. Today, the cluster development of the territory based on the formed industrial digital platforms is an innovative approach to the development of the region in the modern conditions of economic organization. The clustering of the digital economy makes it possible to comprehensively assess the state policy of regional development in this aspect, namely:

1. Improve business productivity, efficiency and competitiveness through digital services;
2. Increase opportunities for innovative digital development;
3. Optimize interaction in the field of digitalization of economic processes between various subjects of economic development of the region: the state, large and small businesses, the scientific and educational community and the public (Phillips & Linstone, 2016).

The concept of a cluster is concentrated in the sectoral and geographical affiliation of the totality of enterprises included in its composition. Emphasis is placed on the factors of territorial proximity, the presence of common interests of cluster members. This naturally affects the resulting cooperation in order to achieve synergies at the intersectoral level. A group of geographically interconnected enterprises and organizations in a cluster should operate in a certain complementary industry environment.

The practice of a cluster approach in the context of digitalization of the economy provides for 4 groups of participants:

1. The main product enterprises around which the rest of the participants are centered form the core of the cluster.
2. Companies whose operations are concentrated in ensuring the activities of the main producers carry out supporting (complementary) activities.
3. Service companies provide service services to the main manufacturing enterprises of the cluster using digital services: financial, marketing, information, consulting, repair and other services.
4. Enterprises and organizations that ensure cluster success, but are not a mandatory element, belong to support members. Companies for cooperation, organization and coordination of digital processes of clustering of the economy can be assigned to this group of participants (Sedera et al., 2016).

Scientific and educational departments, scientific schools and laboratories are the core of digital clustering of the economy. They form a set of competencies in a certain subject area of science and technology, the organization of production. The Digital University platform is aimed at building scientific, educational and technological trajectories, forming communications in resource management for this activity. The restructuring of educational and research processes is expected. The goal of such a digital transformation in the field of education and science is the development of various technological and engineering centers on the basis of the university, the creation of a professional environment for the development of the maximum number of competent specialists. At the same time, it is important to give new knowledge not only to current students in the broad sense of this concept, but also to those specialists who now work at traditional enterprises undergoing digital transformation. The formed digital platforms can support scientific services - supporting publication activity; business planning, research information

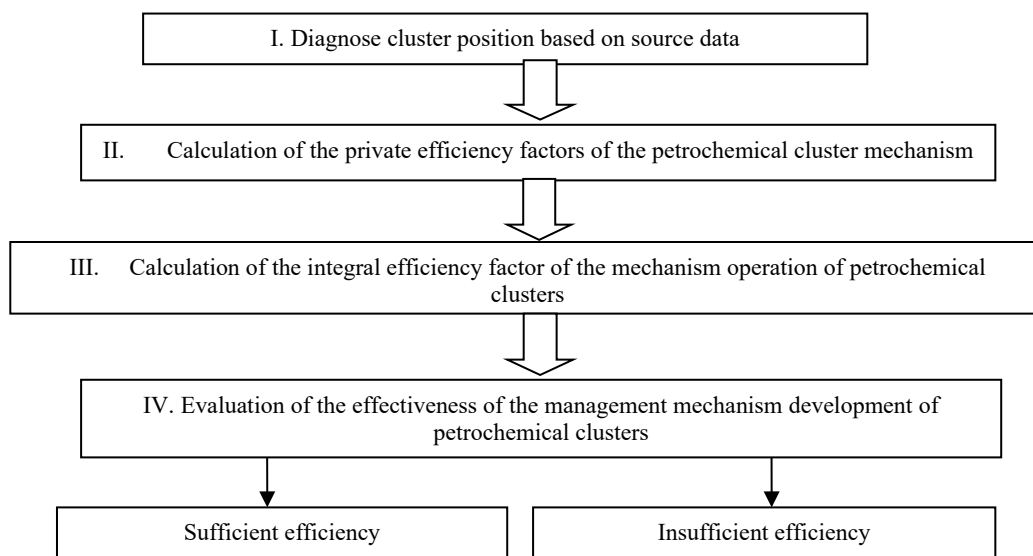
support; platform for joint development. They can also support educational services, library services for searching, access and obtaining information from a wide range of electronic libraries in different countries, as well as computing services for scientific calculations (Kraus et al., 2018).

It is worth noting that the industry becomes a unit of analysis in the sectoral organization of economic management at the regional level, and this forms a static picture of the economy. The cluster approach offers an alternative form of institutional organization of the region's economy. Such an economy of the region is based on a constant, self-replicating interaction of industries and individual economic agents. The nature and depth of the links between them become decisive in the analysis of the regional economy. Within the cluster concept, the unit of analysis and management is a cluster as an inter-sectoral entity. This lies in the variety of its forms, internal dynamics. This is also determined by the intensive multidirectional interaction of its constituent entities. Digital clustering creates the conditions for the interpenetration of various industries and the creation of new markets based on industrial digital platforms as a result of these processes (Srinivasan & Venkatraman, 2017).

As part of the development of the digital cluster economy, modern concepts of market relations between suppliers and consumers of goods and services are carried out on the so-called platform business models. The efficiency of platform business models is achieved through:

- reduction of time and resource losses for interaction between participants;
- cooperation and collaboration without borders to create new products and services;
- opportunities to build appropriate ecosystems through end-to-end technologies.

The formation of conditions for qualitative changes in the field of science and education is the main goal of creating platform business models. The goal is to increase the ability of the state to effectively respond to the so-called large challenges - a set of problems and threats of great scale and complexity that cannot be solved only through a quantitative increase in resources. It should be noted that progress in this area is a crucial factor in the successful development of the nation and is a supplier of sovereign-forming technologies. In particular, a new positive development trend was formed in the petrochemical industry of the Samara region, when enterprises in the field of oil refining and chemistry began to consolidate into a single petrochemical cluster. The program for the development of oil and gas chemistry until 2030 at the first stage provides for the formation of six large interregional petrochemical clusters, one of which is Volga. The implementation of the program allows us to find an opportunity to integrate industries based on an industrial digital platform and create complexes with very compact geography. These complexes allow you to maximize the optimization of logistics, financial, digital processes. Efficiency of petrochemical cluster development in Samara region should be determined using author's methodology of petrochemical cluster development management (Figure 1).



**Figure 1.** Methodology of management of organizational development of petrochemical clusters

The digital cluster approach can be defined as forms of territorial-sectoral organization of production. These forms facilitate the implementation of various entrepreneurial projects of economic development using digital technologies. They also lead to a synergistic effect of interaction with scientific organizations and with the interested participation of state and municipal governments. The functioning of cluster digital systems involves the following elements:

- enterprise as an element of the system that determines the innovative, investment and other strategies of the entire regional economic system based on an industrial digital platform;
- territorial localization of the main economic entities involved in the formation of the cluster digital system;
- coordination of cluster digital system elements within existing regional investment, innovation and digital development programmes;
- enterprise systems for managing and controlling digital business processes (Zastupov, 2019).

Competitiveness through cluster initiatives is becoming a core element of development strategies in many countries around the world. Today, the concept of cluster development based on industrial digital platforms is effectively applied in a number of foreign countries. So, in particular, industrial territorial clusters were fully formed in the countries of Scandinavia. Multi-sectoral territorial clusters in the United States and China are in the process of development. For example, leading enterprises in the Shanghai Zone of the PRC work according to a special production model, when cluster enterprises are in the same region, but the natural and personnel potential of neighboring regions is used to the maximum. An analysis of more than 500 cluster initiatives implemented over the past 10 years in 20 countries shows that the high competitiveness of these countries is based on the strong positions of individual clusters - locomotives of competitiveness. Support for digital clustering in Europe with economies in transition was demonstrated at the EU Eastern Partnership Summit in Prague in 2009. The main goal of the adopted documents is to increase the "critical mass" of clusters, which can influence the growth of competitiveness of EU countries as a whole. Modern competitive advantages are almost entirely due to the capabilities in production, management, organization of production and the provision of services based on the introduction of digital

business models. The effective development of the competitiveness of the economic system is possible with the integrated use of the cluster mechanism and modern concepts of innovative digital development. The world practice of the most advanced economic systems proves this. The drivers of new digital technologies provide high competitiveness and sustained economic growth. In this regard, many countries are increasingly adopting a cluster approach in support of the most promising areas and forms of entrepreneurial activity, as well as in the formation and regulation of digital industrial systems. According to experts, about 50 percent of the economies of the leading countries of the world have been clustered in recent years. In the US, more than half of enterprises operate in clusters, and the share of gross domestic product produced in them exceeded 60 percent. There are over 2,000 clusters in the EU, employing about 40 percent of its workforce (Table 1).

**Table 1.** Structure of the cluster economy of the leading countries of the world, 2019

Economies of the world in a digital transformation	Number of clusters, including those based on industrial digital platforms, units
USA	389
Great Britain	174
Germany, EU	37
France, EU	102

The state, represented by federal and regional authorities, has a direct impact on the development of digital industrial cluster platforms. Institutional and legal conditions are being created for the implementation of cluster initiatives, a universal platform for dialogue and coordination of the interests of participants is being formed, including financial support for individual cluster initiatives. It is worth noting that most clusters are dependent on state funding, while such dependence can decrease over time. The state is strategically oriented and links the cluster with the development of the region's economy as a whole, assimilates it with other economic structures and focuses on solving important socio-economic problems. The role of regional authorities can be to support and initiate the activation and digital transformation of clusters. For example, this is the participation of authorities in cluster meetings and decisions related to cluster development in the implementation of targeted programs and the digital economy. The regional government can actively work to build interaction between the various actors in the cluster development, and can also deal with various cluster issues between other levels of government. The digital development of clusters reduces dependence on individual business groups. The grounds for the diversification of the regional economy and the digital transformation of the territory are being formed (Zastupov, 2020).

The business benefits of digital cluster regional policy are:

1. Improvement of personnel component.
2. Involving specialists and scientists in joint work with universities in the region.
3. The emergence of digital industrial infrastructure for research and development.
4. Reducing costs using digital technologies.
5. Opportunities for more successful entry into international markets for innovative products.

However, regional and cluster development strategies need to be harmonized for effective implementation. It is necessary to take into account key growth points and opportunities for digital business transformation when developing a regional strategy. At the same time, the framework of regional strategies must be taken into account

when identifying promising clusters based on industrial digital platforms and when planning their development. This indicates the need to develop consensus between the business and administrative elites of the region, the need to develop a particular cluster in the context of digitalization of the economy.

## 7. Conclusion

The article presents the main results on the development of digital forms and approaches in the context of clustering of regional economies. Conclusions and recommendations on the problems of improving innovative forms and cluster approaches in the regional economy are presented. The scientific results of the study are fundamentally complementary to the existing approach to the problem of increasing the digital potential of enterprises in the industrial sector and the effectiveness of regional industrial policy. At the same time, the development of industrial clusters will contribute to the formation of digital innovations in the region. Digital industrial platforms will ensure the qualitative development of the cluster economy. Important goals of intensification of scientific and technological development of Russia require introduction of modern methods of organization of research and development. They can be achieved with the active participation and interaction of departments of management, scientific and educational organizations, industrialists and entrepreneurs.

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