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INCREASING INNOVATION, TECHNOLOGY AND DIGITAL POTENTIAL OF INDUSTRIAL ENTERPRISES

A. V. Zastupov (a)*
*Corresponding author

(a) Samara State University of Economics, 443090, Soviet Army Str. 141, Samara, Russia, oiler79@mail.ru

Abstract

Under conditions of the digital economy, ensuring the industrial potential growth on the basis of the innovative digital development becomes an important task. Nowadays, it is important to change the economy structure by applying innovative approaches (among them also digital ones) to improve activities of industrial enterprises. The author emphasizes the necessity to create favourable conditions for the formation and development of a new potential of industrial enterprises (in innovative, technological and digital aspects) in modern market conditions. This article covers issues on formation, development and management of regional economy on examples of petrochemical and aircraft clusters. A model for evaluating the effectiveness of the mechanism for managing the development of industrial clusters has been developed on the example of the aircraft cluster of the Samara region. The author proposed a mechanism for generating potential (digital) innovations based on the cluster development of the regional economy. Today, competitive advantages are almost entirely due to digitalization in production, management, production organization and service delivery technologies. Efficient development of a regional economic system is possible with using the cluster mechanism and modern concepts of innovative digital development. This paper contains the main research results, conclusions and author's recommendations on the issues of increasing the innovative, technological and digital potential of industrial enterprises.

Keywords: Innovation and technology potential, enterprise, digital potential, petrochemical cluster, aircraft cluster, innovation.

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1. Introduction

At present, the challenges of achieving innovative digital development and economic efficiency in a resource-constrained environment are becoming increasingly relevant for industrial enterprises. An important task today is to ensure the industrial potential growth through innovative economic development based on modern digital technology. In our opinion, it is essential to change the economy structure at the current development stage, applying new approaches for improving the business activity of Russian enterprises and developing the domestic economy as a whole, forming necessary conditions for further efficient development of innovative, technological and digital potential of Russian industrial enterprises.

2. Problem Statement

The need to ensure the innovative digital development of industrial enterprises and the economy as a whole is becoming an important problem in modern economic conditions. The creation of appropriate scientific approaches and practical mechanisms for enhancing innovative, technological and digital potential of industrial companies is becoming a priority.

Issues on increasing the innovative and technological potential of industrial enterprises, application of digital approaches to the economic development, creation and development of industrial clusters are important research objects of Russian and foreign scientists. These issues are consideren in works by Zastupov, Streltsov, Tatarskikh, Poluyanov, and Murtazova, (2016), Duranton, (2011), Gawer, (2014), Phillips and Linstone, (2016), Sedera, Lokuge, Grover, Sarker, and Sarker, (2016) etc.

The author's analytical review on these aspects has shown that issues on formation of the innovative, technological and digital potential of modern industrial organizations are not sufficiently investigated in the scientific literature. The impact of cluster forms of industrial development on the formation of potential innovations has not been carefully studied.

3. Research Questions

The main research questions of this study include some theoretical and practical aspects of the current development of industrial enterprises in Russia, improvement of their innovative and digital potential through the formation of industrial clusters. The author proposes that the application of theoretical conclusions and practical recommendations made within this research work will enable real business representatives to make justified decisions in the sphere of innovative and technological development of industrial enterprises in the modern digital reality.

The study results are practically significant as they may be used by different business entities, state and municipal authorities, development funds and other organizations in the process of development of ways and tools for increasing the efficiency of innovations, technological and digital development of industrial enterprises.

Further research of these aspects could expand the range of application possibilities of achieved research results in the field of forming industrial enterprises potential (innovative, technological and digital), and the impact of cluster forms on the industrial development.

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4. Purpose of the Study

In accordance with the problematic and issues of the study, the following objectives are defined:

- to study theoretical aspects of formation of innovative and technological potential of modern industrial enterprises under conditions of economy digitalization;

- to give an analysis of organizational and economic directions on formation of digital system of industrial complex development;

- to explore practical aspects of implementing digital forms of activities of economic entities by forming and developing industrial clusters;

- to develop proposals for managing the development of industrial clusters through digital innovations.

5. Research Methods

Solving the main research questions, the author used theoretical methods aimed at analysis and synthesis the relevant scientific information, diagnostic methods including factor analysis, modelling, forecasting, empirical methods, and method of the expert assessment. The experimental research base was the industrial sector of the Samara region, namely, oil and gas enterprises, as well as companies of the regional aircraft complex.

The research work was carried out in 2 stages:

1. Theoretical:

- research on issues of formation of innovative, technological and digital potential of modern industrial enterprises of.

2. Practical:

- analysis of organizational and economic directions on formation of digital system of industrial complex development;

- analysis of implementation of digital forms of activity of economic entities in formation and development of industrial clusters;

- development of proposals for digital development management of industrial clusters through formation of digital innovations.

6. Findings

Recently, the technical equipment of industrial production in the Samara region has been increasing very slowly. This makes it difficult to address the digital transition to new products, decreasing the technical and organizational level of industrial production and its efficiency.

In practice, the frequent reorganization of enterprises does not solve those economic problems that are related to the improvement of their material and technical base. For example, the R&D reduction at some industrial companies has significantly decreased the level of their technological equipment. This has led to a decrease in readiness for new products. In addition, there is no necessary state support for scientific, technological and digital development in many enterprises.

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Some experts note that issues of formation of innovative, technological and digital potential of industrial enterprises are not sufficiently studied (Voronkova, Kurochkina, Firova, & Yaluner, 2016). So far, the industry of the region does not have a system of marketing new digital technologies, which determine development conditions for the leading directions of further technological progress based on innovations.

The lack of an effective system for application and promotion of modern digital technologies that largely determine the modern industrial development can be explained by the low level of personnel and information support of this process and inefficient usage of foreign experience. In modern conditions, we need an optimal placement of state financial resources for the most promising development directions (industrial branches penetrated with advanced digital technologies) to achieve high indicators of scientific and technological development of the region (Gawer, 2014).

The indicators show that over the last 10 years the technological structure of investments in fixed assets of industry is not economically optimal. Now in modern economic conditions at the level of regions producing relatively large volumes of knowledge-intensive products, it is necessary:

- to assess the effectiveness of the public sector participation in R&D activity;

- to develop measures of organizational and economic nature for creating a digital forecasting system for long-term prognosis of scientific and technological progress (Alguezaui & Filieri, 2014);

- to modernize the system of implementation of scientific and technical programs to improve modern digital technologies;

- to use the innovative and technological potential of enterprises more effectively.

In this regard, in the modern digital conditions of economic organization the most progressive and innovative approach to the development of regional industrial policy becomes the formation of industrial clusters. This will allow building a new vector of the regional development in a comprehensive manner, namely:

1) to improve the business productivity, efficiency, and competitiveness;

2) to expand development opportunities for business using innovative digital tools;

3) to optimize the interaction between various actors of the regional economy: business entities, state authorities, academic community and other representatives of the regional society;

4) to improve the employment level and life quality of the population in the region, thereby forming a regional brand and its positive perception by the external environment (Phillips & Linstone, 2016).

The formation of clusters in the region is based on factors of territorial proximity, existence of common interests of cluster members. As a result, cooperation is naturally established to achieve synergies at the cross-sectoral level. In a cluster, a group of geographically interconnected enterprises and organizations must operate in a certain complementary industry environment.

Today, competitive advantages are almost entirely due to digitalization in production, management, production organization and service delivery technologies (Sedera, Lokuge, Grover, Sarker, & Sarker, 2016). Efficient development of the regional economy is determined by efficient use of the cluster mechanism and modern concepts of innovative digital development. Practice shows that the drivers of the diffusion of new technologies ensure high competitiveness and stable economic growth (Duranton, 2011).

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In this regard, the implementation of the cluster approach in support of the most promising directions and forms of business activity, as well as in the formation and regulation of innovative digital systems becomes the most relevant (Ilin & Anisiforov, 2014). It is also important to create a mechanism for managing the formation and development of high-tech industrial clusters in the region, in particular petrochemical, aircraft and others.

The Government of the Russian Federation developed and signed by in 2012 a development plan of the oil and gas chemical industry of Russia until 2030. This document provides for a cluster development model for this branch. Thus, the Volga petrochemical cluster has been formed in the Volga Federal District. Its part is the Samara petrochemical cluster, capable of providing significant development of production capacities (table 01).

Table 01. Dynamics of projected phased development of oil production for the period up to 2030

	2008 (fact)	**The 1st stage (2013-2015)**	**The 2nd stage (2016-2025)**
Oil production Russian Federation, million tons	487.6	486-495	505-525
Oil production In Volga region, million tons	54.1	49-50	44-45

According to the industry development strategy, the Volga petrochemical cluster should provide the following planned indicators:

- The volume of ethylene production by 2030 should be 3.8 million tons;
- Polymer consumption and processing will increase 3.1 times;
- By 2030 large-scale polymer production will provide 5.1 million tons;
- Annual consumption will reach 3.16 million tons.

The core of the oil production and oil refining industries of the petrochemical cluster of the Samara region is the company of PJSC "NC" Rosneft. " The company "Samaraneftegas" JSC (PJSC "NC" Rosneft ") controls the oil production market in the Samara region on 80-85%, serves the 181 field, including the 131 field in the Samara region, and works in 26 municipalities of the Samara region, as well as in 2 districts of the Orenburg region (Zastupov, Streltsov, Tatarskikh, Poluyanov, & Murtazova, 2016).

According to the results of 2018 JSC "Samaraneftegas" reduced the volume of oil production by almost 4%. The reduction in hydrocarbon production is due to the terms of the international agreement signed by Russia to limit oil production. However, it was possible to achieve a successful result for the company due to the increase in the resource base, the increase in the volume of operational drilling, the introduction of innovative production methods and effective geological and technical work. Thus, in 2018 four new deposits and 33 new oil deposits were opened with total reserves in the category of AB1C1 B2C2 more than 19 million tons of oil (table 02).

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Table 02. Dynamics of oil production and refining indicators by the enterprises of the Samara region, 2016-2018

Technical and economic performance indicators of enterprises	2016	2017	2018
Oil production, million tons (JSC "Samaraneftegas")	12.2	12.3	11.8
Oil production, million tons (Region as a whole)	16.5	16.3	15.6
Oil refining volume, million ton (Region as a whole)	19.7	19.5	18.8
Depth of oil refining, %	70	73	77
Volume of investments in oil production, billion rubles	32.4	48	42.6
Volume of investments in refining production, billion rubles	35.6	44.3	68.1

Table 02 shows, that there has been a decline in oil refining over the past three years. This slight downward trend is common throughout the country 's refining industry. However, this trend does not affect the volume of production of "light" oil products, as the depth of oil refining is increasing. In 2018, the depth of oil refining has already risen to 77%, it will be more than 90% after the completion of the modernization.

However, there has been an increase in investment in oil and oil refineries. Thanks to the investments, the program of geological and technical measures was successfully implemented, as well as the program of reduction of well downtime. Additional production is possible due to the following activities:

1. Commissioning of new oil fields and more than 50 new wells exceeding the planned production rate.

2. Optimization of well operation mode. In particular, wells were drilled in the amount of 200 thousand meters of rocks, including exploration drilling amounted to 10 thousand meters.

3. Application of modern technologies to increase oil recovery. In particular, the company carried out 13 operations to gouge side wells, the company submitted 2 applications for inventions to introduce new methods of development of oil deposits.

4. Licenses have been obtained for the right to use five subsoil plots - Uspenskiy, Ryabinovsky, Bockarevskiy, Chernovsky and Novo-Zhelyabovsky. Due to this, the growth of reserves of JSC "Samaraneftegas" amounted to 3.8 million tons in 2019 (Zastupov, 2019).

Active technical re-equipment, introduction of new technologies and technologies, introduction of digital approaches in production management are provided for by the program of innovative development of JSC "Samaraneftegas". In 2017 alone, 247 tests of new equipment and technologies were conducted under this program. Additional production of more than 1.5 million tons of oil was provided to the enterprise and the region as a whole, in complex with the implementation of an extensive program of geological and technical measures (Zastupov, 2020).

Ensuring the competitiveness of refinery products (compliance with Euro-6 European environmental class), increasing the volume of gasoline and diesel fuel production, increasing the depth

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of oil refining and reducing the negative influence on the environment are promising directions of development for the oil refining industry. These directions are determined within the framework of the large modernization program for oil refineries of the Samara region.

Studies have confirmed that IT-technologies allow to restore effective production of light low-viscosity oil at fields that have entered the late stage of development. IT-technologies also allow to prolong life of large deposits, to revive regions of oil and gas production due to development of hard-to-recover reserves. This is typical primarily of the regions of Western Siberia and Ural-Volga region. Thus, TATNEFT-Samara Company is working out the method of geological-hydrodynamic modeling of the process of oil field development. In particular, the following criteria should be mentioned:

- Optimization of well arrangement taking into account actual distribution of extracted reserves;
- Structure and stage of development of a particular deposit;
- Profitability of production at the moment of time, etc.

Rosneft Company has put into experimental and industrial operation the information system on the basis of Ilishevsky field of Bashneft Company. The system covers all the main processes of oil production and logistics. Implementation of this project will allow to revive the long-term operated field, and the economic effect will be 1 billion rubles per year.

Speaking about the development of the aerospace cluster in the region, it is important to note that key aerospace enterprises of the Samara region should enter the core of crystallization on the formation of such a cluster (table 03).

Table 03. Characteristics of the aerospace cluster of the Samara region

Indicators	Samara Aircraft Cluster
Cluster kernel	JSC «Aviakor - Aviation Plant», Rocket and Space Center «Progress» (Roscosmos)
Participants of the second level	JSC «Aviaagregat», JSC «Hydroautomatics»
Participants of the third level	Samara University, Samara State Technical University, Research Institute of aviation structures
Profile of activity of a cluster	civil aircraft construction
Approximate number of workers in the cluster, people	15,500

Here the development of the aerospace cluster of the Samara region is presented in cooperation with the state authorities, the expert community, aviation production enterprises, scientific and educational institutions. At the same time, the development of the aerospace cluster in the region seems effective through the assessment of the effectiveness of the mechanism of operation of aircraft clusters. The methodology for this assessment is presented below (figure 01).

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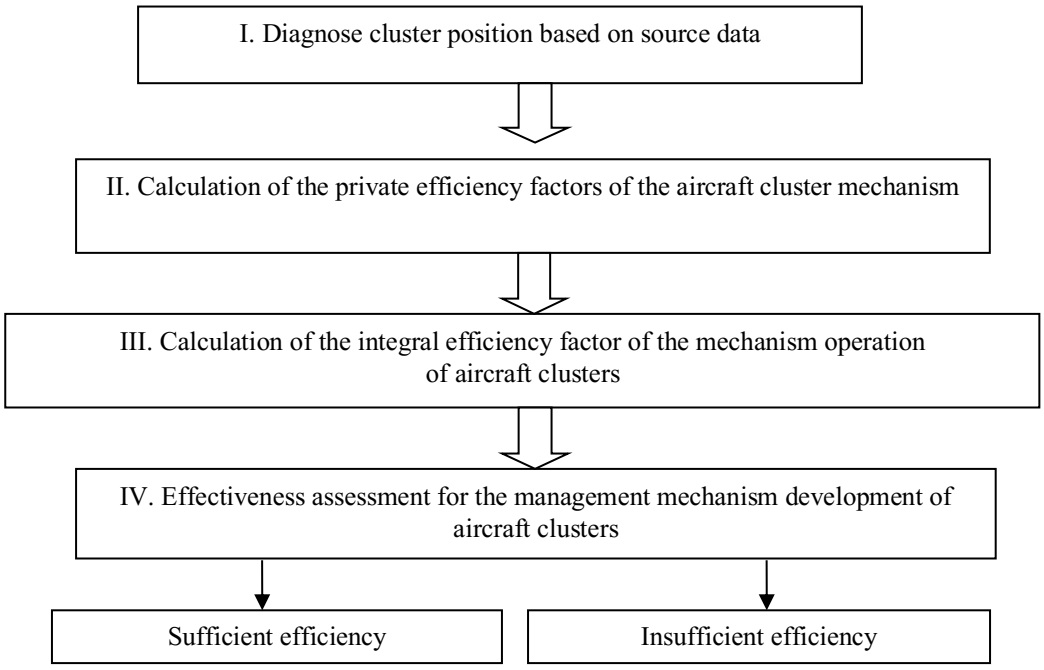

Figure 01. Method of assessing the effectiveness of the mechanism for managing the aircraft clusters development

Thus, the model of management of development of aerospace, petrochemical, as well as machine-building and other clusters is to form potential (digital) innovations in the Samara region. Digital innovations should be shaped and developed in cooperation with innovative technology centers, scientific and educational institutions. Such a mechanism can form a complex of interacting and competing elements of the business environment of the Samara region. This will allow to recreate the active competitive business structure of the region, including creation of industry clusters at the level of small and medium-sized businesses or clusters of potential (digital) innovations.

7. Conclusion

The realization of investment projects and digital innovations in petrochemical, aerospace and other clusters of the Samara region will ensure the production of innovative products, the creation of new working places, the increase of tax revenues to all levels of the Russian budget system. It will also give impetus to the development of related industries: automotive industry, mechanical engineering, production of electronic and optical equipment and other important industries for the Samara region and Russia.

This paper contains the main research results, conclusions and author's recommendations on the issues of increasing the innovative, technological and digital potential of industrial enterprises, developing and improving digital innovative forms and approaches in the context of clustering the economies of the regions. The research results contribute to the further development of the existing approach to increasing the innovative and technological potential of industrial enterprises and the

effectiveness of the regional industrial policy. The formation of industrial clusters will in turn contribute to the expansion of regional potential of digital innovations.

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