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# Typology of innovation strategies for petrochemical enterprises

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**Abstract.** The article defines the role of the petrochemical industry in the development of the economy as a whole. The key problems of innovative development of the Russian petrochemical complex that are typical for the current stage are identified. The purpose of the study is to analyze the organizational and economic processes of formation and implementation of innovative strategies for the development of petrochemical enterprises and practical recommendations for improving their performance. To achieve this goal, the role of the components of the innovative potential of enterprises in the development of the economy is determined; the analysis of directions of development of innovative activity of the main foreign players in the market of petrochemical is carried out; strategies of innovative development of petrochemical enterprises are formed. It is concluded that in the era of digitalization of industry, the priority strategy for the development of the petrochemical complex is resource conservation.

## 1. Introduction

In the context of globalization, national security, economic growth and technological development cannot be achieved without the petrochemical industry. This industry, along with the chemical complex, has a significant impact on the main industries, construction, agriculture, being the base for the production of various types of products and materials. A specific feature of the petrochemical industry from other industries is the high level of labor automation and technological development, which is due to the intensification of the use of petrochemical products in all sectors of the economy.

The fundamental provisions that reveal innovative processes as the basis for sustainable economic development and growth are presented in the works of the founders of the theory of innovation in Russia – Schumpeter, B. Santo, N. D. Kondratiev, etc. [1]. Theoretical issues of formation of strategies for innovative development of enterprises and organizations are reflected in the works of many domestic and foreign scientists such as V. M. Anshin, M. Porter, A. I. Shinkevich [2, 3, 4].

Issues related to the research of innovations and innovative activities of industrial enterprises, including the problems of developing innovative strategies that are part of various types of economic



activity, were considered in the works of such domestic scientists as Hmeleva G. A., Shinkevich A. I., Kudryavtseva S. S., and others [5, 6, 7, 8].

The analysis of theoretical, methodological and practical approaches to the study of innovative activities and innovative strategies of business entities indicates the existence of a significant number of approaches to the study of these problems.

The purpose of the study is to analyze the organizational and economic processes of formation and implementation of innovative strategies for the development of petrochemical enterprises and practical recommendations for improving their performance, combining theoretical and methodological issues of their evolutionary genesis, methodology of formation, and methodological tools for managing innovation activities.

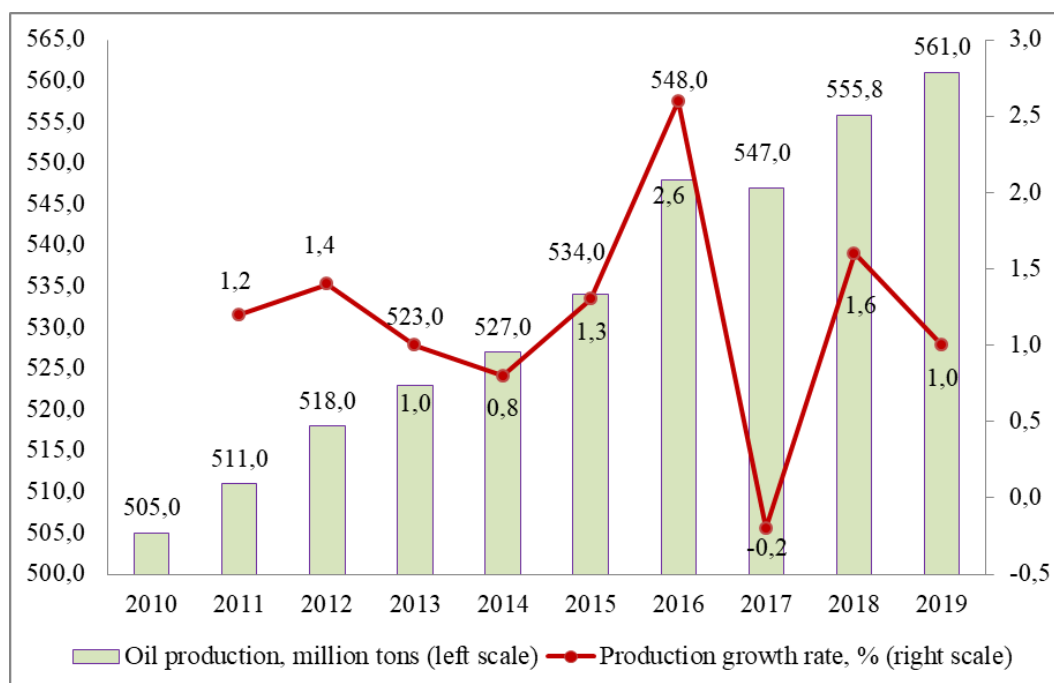
## 2. Materials and methods

The main features of the Russian petrochemical industry are as follows [9]:

- outdated technologies and high depreciation of fixed assets, which directly affects the competitiveness of products. In order to improve production efficiency, many companies have carried out large-scale modernization in recent years;
- maximum capacity utilization. Existing monomer production plants are loaded by more than 85%, which is almost the maximum, taking into account natural infrastructure restrictions and one-time plant stops/repairs;
- the inability to increase the production of many types of petrochemical products due to the lack of basic monomers at sites not integrated with pyrolysis, etc.

Innovative technological systems, providing the organization of resource-saving production processes, improving product quality, high economic efficiency, are a condition for successful technological modernization of industrial production at the present time.

The primary indicators that determine the role of revenues of petrochemical enterprises in the Russian economy are production indicators in the field of oil production (figure 1).



**Figure 1.** Dynamics of oil production in Russia (compiled by the author on the basis of data [9]).

The solution to many problems of the petrochemical complex lies in the implementation of "breakthrough" innovative projects in the chemical and petrochemical industry, which will remove

structural restrictions on the development of the industry and enter the production of completely new (consumer properties) types of products based on cost-effective, environmentally friendly and resource-saving technologies.

### 3. Results and discussion

Traditional technological leaders in the petrochemical market are the countries of the European Union, the United States, and Japan. The largest market and producer of petrochemicals, a relatively new player in this industry is China. Over the past thirty years, South Korea, Saudi Arabia, Iran, Singapore, and India have also become new major players in the petrochemical market. Strategies for the development of petrochemicals in these countries are presented in table 1.

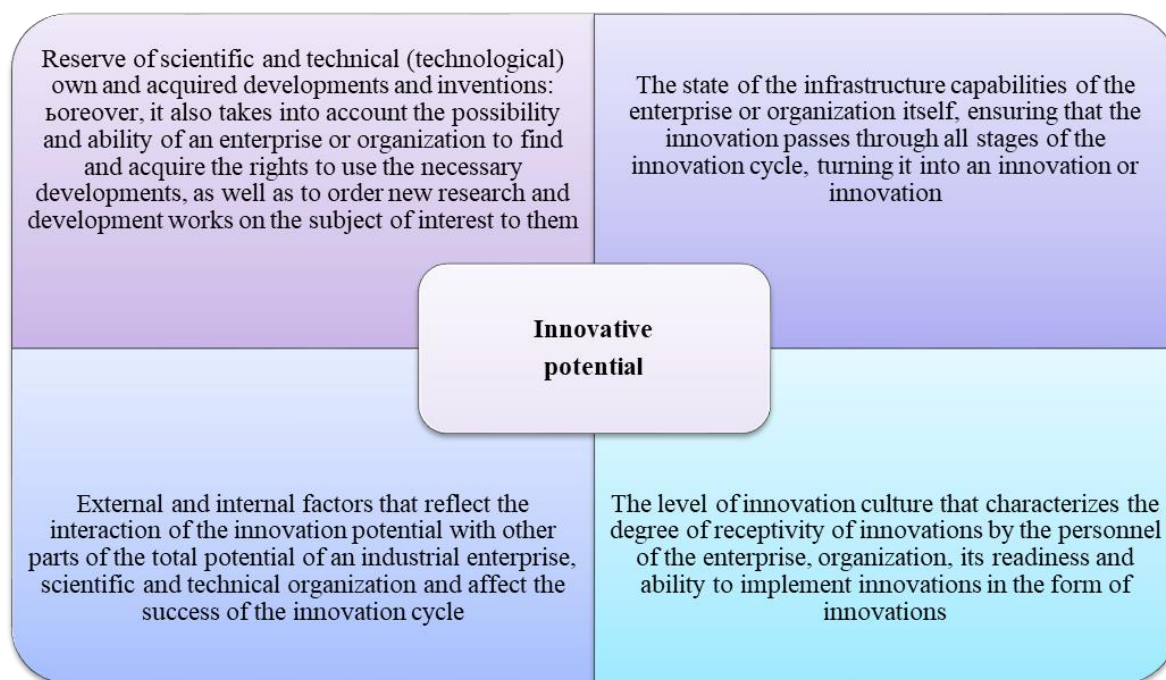
**Table 1.** Strategies of the main players in the petrochemical market (compiled by the author on the basis of [10]).

Characteristics of the countries	Implemented strategies
The largest markets and manufacturers of petrochemical technology leaders	<ol style="list-style-type: none"> <li>1. Taking advantage of the "shale revolution" and developed infrastructure (USA).</li> <li>2. Closing of basic production facilities. Transition to other market niches (high value-added products – special chemicals, biotechnologies) (EU, Japan).</li> <li>3. Development of petrochemical industries to meet domestic demand. Active expansion of the use of coal, methanol and natural gas for the production of olefins (China).</li> </ol>
The country is successfully implementing the development strategy of the petrochemical industry, allowing them to be among the world leaders in 1990-2010 years	<ol style="list-style-type: none"> <li>1. The strategy of industrial development. Processing of imported raw materials into industrial export products. Specialization in the high-quality segment for basic products and transition to market niches. A large domestic market of petrochemical industry (South Korea).</li> <li>2. Monetization of its own oil and gas resources, increasing the added value of hydrocarbons, diversifying the economy, and solving social problems. Development of export-oriented petrochemicals (Saudi Arabia, Iran).</li> <li>3. Processing of imported raw materials into industrial export products, attracting foreign investment.</li> <li>4. Industrial development in the interests of a potentially huge domestic market, import substitution, and solving social problems.</li> </ol>

Considering the organization's development strategy, which provides for the formation of sustainable growth and functioning, we note that it is also based on the application of scientific and technical innovations in the field of management, organization, and technology, i.e. it is based on a set of innovations.

Enterprise development strategy is the main part of strategic management and is a solution to the issues of planning, management and implementation of implemented projects, organizing the processes of changes in the economic activity of firms, search and implementation of large-scale changes that ensure it functioning, growth and sustainable development due to future success factors.

Innovative development of enterprises in the world is considered the most profitable, since it ensures the competitiveness of the basic sectors of the economy. Therefore, being aware of the need to implement systemic measures in this direction, enterprises should actively implement a set of measures to form their innovation infrastructure (figure 2) [11].



**Figure 2.** Components of innovative potential of enterprises [11, 12].

The main goals in the scientific, technical and innovative development of petrochemical enterprises will be to stimulate innovative activities aimed at developing and implementing new resource-saving high-performance technologies; increasing demand for scientific and technical innovations; developing human resources in the research field and comprehensive technical re-equipment of the petrochemical complex.

The experience of petrochemical enterprises in the Republic of Tatarstan is indicative in this area. It has an exceptionally favorable combination of resource, production and scientific potential for the high-tech development of the petrochemical industry. The development, implementation and transfer of new products and technological processes are becoming key factors for the growth of production, employment, investment, and foreign trade turnover, which means increasing the competitiveness of enterprises, the petrochemical industry, and the economy as a whole.

Currently, one of the main approaches to improving the efficiency of enterprises is lean production. The use of lean production methods – the workplace organization system, the organization of a single production flow, visual management and control, the use of the "just in time" system, the system of continuous improvement-contributes to achieving the goals of implementing modern forms of enterprise management. In order to implement lean production technologies at enterprises, it is necessary to use strategic decisions at the highest level and continuously improve production and product quality [13, 14]. Only when using a set of tools is it possible to achieve positive effects from lean production measures and increase the competitiveness of enterprises. Thus, taking into account the peculiarities of production processes at petrochemical enterprises, the system of lean production organization creates opportunities to improve the efficiency of the existing production system of enterprises of the petrochemical complex, using interrelated, mutually reinforcing and complementary tools and methods.

The priority of organizing resource-saving production systems in the era of digitalization of industry is not in doubt. The competitiveness of chemical and technological systems at different levels of management depends directly on the intensity and efficiency of resource-saving processes occurring within the system, as well as on the ability to build external processes for the exchange of innovations, digital competencies, research and development outside the production system. Undoubtedly, the key factor in the development of production in the era of the fourth industrial revolution is not so much the available raw materials and production base, material and human resources, as the ability of production

and economic systems to optimally use them in the design of the supply chain of petrochemical products, taking into account the achievements of digital technologies in the industry.

#### 4. Conclusions

When choosing priority areas for accelerated development, attention should be paid both to the advanced development of fundamentally new high-tech sectors and markets, and to the deep technological modernization of traditional industries. Combining these areas can ensure the launch of a technological revolution in the medium term.

Effective state support is a necessary condition for the advanced development of the petrochemical industry. The main instruments of such support are state financing of infrastructure projects and public-private partnership in the implementation of industrial and infrastructure projects.

Thus, in order to increase the level of competitiveness of industrial enterprises, labor productivity, product quality, and speed up the process of entering the market for new products, the key condition becomes:

- switching to a resource-and energy-saving production system;
- use of digital technologies and implementation of strategic tasks facing the country in the context of economic transformation;
- modeling flexible production and renewable resource sources, improving the reliability and sustainability of production, forming integrated supply chains for petrochemical products and production sharing, digitalization of production processes;
- transformation of management and chemical-technological systems in order to increase their efficiency and competitiveness through the organization of rational use of available resources using modern methods of production organization (intensification of technological processes, synthesis of optimal resource-saving systems, development of new high-performance devices of chemical technology, etc.).

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