

Innovative activity of industrial enterprises in the context of sustainable development

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Abstract. The relevance of the problem of innovative activity in industry is associated with the total coverage, rapid replacement and dynamics of the introduction of breakthrough innovations, information and digital technologies that affect the efficiency and productivity of labor. Industry, as the most important part of the economy (37% of GDP), generates results that increase the standard of living of the people and the well-being of the state. In this regard, it is industry that determines the intensity, effectiveness and focus of reforms. The importance of industry in an innovative economy reinforces the importance of studying the causes, conditions, parameters and risks that arise in the innovation-industrial environment, finding solutions to change conservative behavior, pessimistic attitudes, emphasizing tools and drivers to reach the level of sustainable development.

1 Introduction

The process of creating innovation is regulated, driven by demand and promoted through innovative technology and culture to benefit [1]. Therefore, activity is associated with the commercialization of innovations, which depends on the stages of the innovation process and is manifested in a number of aspects: technological, applied, organizational, market, marketing and logistics. The technological aspect is characterized by conditions when the first innovative result of scientific and practical activity is a new technology, reflecting the rhythm of scientific and technological progress in breakthrough innovations. The applied aspect, integrated with the organizational one, is distinguished by the resulting applications to technology in the form of new products and services introduced into the production process and accompanied by massive sales [2]. The market or marketing aspect of commercialization is manifested in the formation of new demand, optimization of supply, customer focus, full transfer of rights to the broadcast object and profit from translating an idea into a product or service during the transaction. The logistics aspect is associated with the creation of a value chain, managing the flow of distribution and implementation of innovation in space and time. When choosing the vector of innovative development in industry (fig.1), researchers point out that the dynamics of innovation are very unstable, the role of individual industries and activities is constantly changing - sudden leadership

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becomes a loser and an outsider, which indicates the instability and fragmentation of reforms. Even taking into account the inherently innovative nature of the electronics industry, its growth remains low (about 1%).

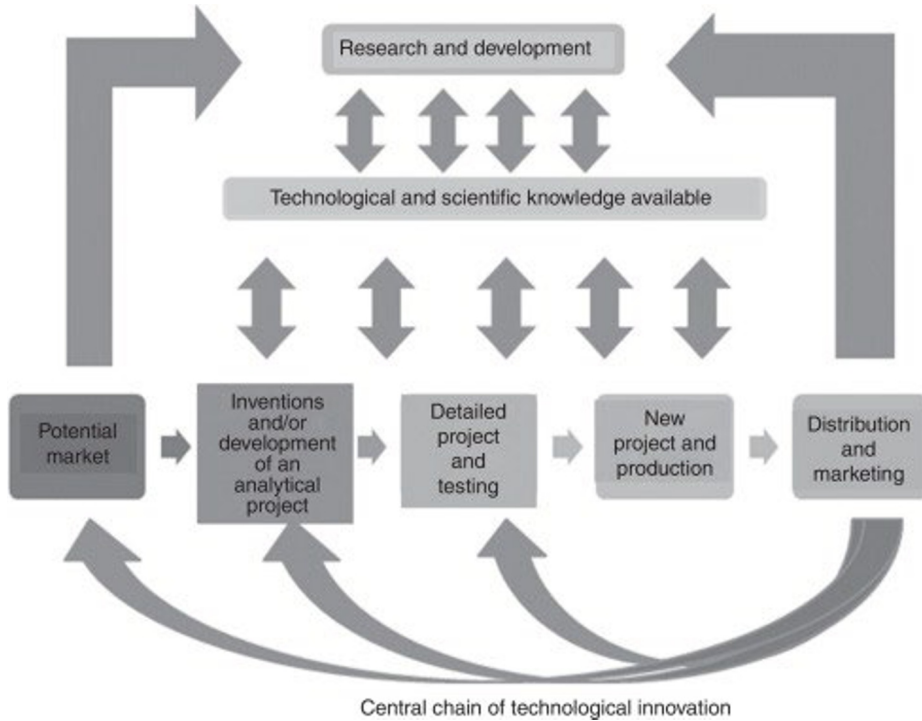


Fig. 1. Innovation development process in small and medium technology-based companies

2 Research Methodology

When assessing the level of innovation activity (fig.2), the results obtained by various experts are analyzed based on a combination of indicators. Thus, in the Global Innovation Index 2020, Russia reached 46th place, determined by experts as a result of assessing 129 countries based on 80 parameters [9]. The compilers of the index grouped countries with low and middle income, but rapidly developing innovative activity, including Russia, China, Brazil and Argentina in the group [5]. In the UNESCO ranking, Russia is among the top ten in terms of investment in R&D, which is a significant part of all investments in innovation. Experts identified significant investments in the amount of \$40.3 billion in purchasing power parity, but in terms of the ratio of investments to GDP they emphasized the low level in Russia - the country did not even make it into the top 15 countries. While the world average is 1.7%, UNESCO estimates the Russian level at only 1.1% of GDP. For the countries of North America and Western Europe, the ratio of investment to GDP reaches 2.5% [9].

2018 exceeded 1.1 billion rubles. (NIUIF), Over the past five years, the PhosAgro group has invested more than 150 billion rubles (\$2.5 billion) in R&D, or more than 50% of EBITDA. As a result, production increased 1.5 times and reached 9 million tons of fertilizers and feed phosphates, which made it possible to strengthen the company's position in the domestic and international markets. Innovative is the introduction of the best available technologies, innovative and digital solutions based on the Industry 4.0 platform at the stage of construction of new high-tech production facilities and modernization of existing ones [3]. In 2019, Severstal invested \$48.1 million in development investments, which is 3.32% of Severstal's planned capital investments for 2019. The world's largest pipe manufacturer, Pipe Metallurgical Company (TMK), invested \$15 million, or 5.5% of total capital expenditures, into new product development and qualification testing. A large manufacturer of solar panels in Russia, Hevel, invested more than 1.5 billion rubles in R&D in 2019. or about 2% of capital costs. The Russian petrochemical holding Sibur spent 151.4 billion rubles in 2018. , and in 2019 by 27.2 billion rubles. more [9]. In the first half of 2019, the company's revenue increased by 3.3% and amounted to 450.3 billion rubles. Potentially breakthrough technologies in our industry are often found not in accelerators, but in scientific organizations.” Large chemical companies such as Sibur do not completely outsource key strategic technologies to universities in order to maintain the level of expertise and speed of development. Radical or disruptive innovations are more effective for companies to select and apply open innovation tools. For this purpose, Severstal created the Severstal Ventures fund with a budget of \$25 million per year and a corporate accelerator for projects in the metallurgical industry [2]. In general, in industry by 2019 the level of innovation activity reached 9.6%; for high-tech and medium-tech industries the figure was noticeably higher (31.8 and 19.9%, respectively). In industry, traditionally the highest level of companies is in manufacturing, reaching 15.1% in 2017 for large and medium-sized enterprises [1]. The maximum share of innovative enterprises is noted in chemical production (23.1% in 2015, and 24.3% in 2018); 28.3% became active in the production of electrical and optical equipment (Table 1). The weight of innovative goods, works, and services for industrial enterprises in Switzerland and France is close to 25%, for Great Britain it exceeds 40% [1]. Pochukaeva O.V. notes the importance and necessity of adjusting and differentiating the methods used in international practice for assessing the effectiveness of innovation activities. To do this, it offers an assessment of innovative activity using an instrumental, activity and product index, a summary rating that includes the quality and speed of development of an innovation strategy, the level of mobilization of potential, attracted investments, reaction, behavior and dynamics in accordance with the environment and situation [5]. To increase the accuracy of the definition, a combination of quantitative assessment of innovations and expert assessments, that is, qualitative results obtained from the implementation of innovations, is valuable [5]. When moving from assessing the number of innovatively active enterprises to assessing the share of innovative products, the position of industries in the ranked series and the hierarchy of industries in the industrial system changes. In the assessment, complex parameters are important for the share and rate of output of innovative products, the sustainability of innovation focus, the intensity of innovation financing processes, the balance of conditions and resources, incentives and motives.

Table 1. Share of innovative enterprises in Russia

Indicator	Year						
	2014	2015	2016	2017	2018	2019	2020
Introduced new technological processes, % of the total	0.444	0.383	0.429	0.456	0.436	0.507	0.497
Underwent the production of innovative goods, % of the total	0.575	0.520	0.505	0.551	0.513	0.521	0.517
Distributed innovative goods, % of the total	0.856	0.842	0.792	0.786	0.756	0.786	0.774
GDP, billion USD	2056.58	1363.70	1282.66	1578.41	1630.66	1609.4	1557.9

When studying the processes of innovative development in the industrial sector in general, researchers recommend determining the scale of development of productive forces in the innovative sector of industry, measuring the results of innovation activity and realizing implementation opportunities based on an analytical comparison of the results of innovation activity with production and economic results.

4 Conclusions

Using the share of innovatively active enterprises and the share of innovative products in the industry's production volume as initial parameters, scientists recommend adjusting indicators for different industries using correlation coefficients, indexing, diagnostics and comprehensive econometric modeling to assess the scale of innovation activity. For manufacturing industries, it is permissible to use the share indicator of innovative products in production volume, since in these industries product innovations prevail over process innovations. In the fuel and energy complex and in metallurgy, process innovations occupy a significant place, and therefore additional indicators are needed that take into account the increased costs of management, production, organization and promotion of innovative products and resource saving. Thus, the innovative activity of industrial enterprises is a resource and motivational readiness to establish flexible integration and cooperation ties for the implementation of innovations, a comprehensive ability to mobilize innovative, intellectual, resource potential, implementing the tasks of intensity and vigor of activities for the development, implementation, diffusion and commercialization of innovations (open and breakthrough). A variety of indicators are used to assess innovation activity. In 2022, the level of innovation activity in industry reached 9.6%; for high-tech and medium-tech industries the figure varies from 19.9% to 31.8%. The parameters of sustainable development include an optimally structured system and relationships in the ecological and economic environment, a combination of a biocentric approach and optimal preservation of the socio-demographic, cognitive-creative, information content of production based on additive technologies, blockchain, Internet of things, artificial intelligence.

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