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To cite this article: A I Vinogradova *et al* 2019 *IOP Conf. Ser.: Mater. Sci. Eng.* **537** 042027

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## Directions for improving the innovative production of machine-building industrial enterprises

**A I Vinogradova, S V Strelnikova and Yu V Fomina**

Department of Advertising and Cultural Studies, Reshetnev Siberian State University of Science and Technology, 31, pr. Krasnoyarskiy Rabochiy, 660037 Krasnoyarsk, Russia

E-mail: vinogradova50@gmail.com

**Abstract:** Mechanical engineering is a generally recognized as main springboard for both innovative transformations in the economy and accelerating technological progress. Technological re-equipment of industrial enterprises cannot be implemented without a modern engineering industry. The competitiveness of the region economy and the country as a whole depends on how much this industry is able to generate and assimilate innovations. In connection with this, an important issue is the understanding of the obstacles to the innovative processes development in domestic engineering. The article analyzes the level of innovation development of joint-stock company "Krasnoyarsk machine-building factory", discusses the main strategic objectives of innovative development. Further development of economic activities related to the machine-building complex will continue in response to the implementation of investment projects aimed at expanding, modernizing, reconstructing and modernizing existing production facilities.

One of the key sectors of the Krasnoyarsk Territory economy is industry, forming about 50% of the Gross Regional Product (GRP). In terms of production, metallurgy, energy and mining are in the leading position. A close relationship is noted between the enterprises of the defense and industrial complex and the Reshetnev Siberian State University of Science and Technology [1]. The contribution of machine-building activities to the regional industrial production is 5.6%, providing machine-building fourth place in the industrial complex of the region [2]. The machine-building enterprises of the region produce a fairly wide range of products: rocket and space technology, technological equipment for the oil and gas industry and the fuel and energy complex; heat exchange and capacitive equipment; logging equipment; commercial and medical equipment and much more. At the enterprises of mechanical engineering work 4.7% of the total number of people employed in the regional economy, which is comparable to employment in the metallurgical and fuel and energy complexes, but the volume of production in mechanical engineering is several times less. The competitiveness of mechanical engineering is determined by such factors as the technological mode of production, the availability of highly qualified scientific and engineering personnel, the innovativeness of products, the geographical monopoly of the enterprise, the preservation of traditional markets, including export, the consumption of products in local regional markets, including and from the basic industries of specialization and public utilities.



The region machine-building complex was formed in the Soviet period, based on the needs of the economy and the country's defense. Since the transition to a market economy, there has been a long-term tendency to reduce the role of mechanical engineering in the economy of the region. In addition, it is this industry that is most susceptible to crisis phenomena. The first significant decline in production and decline in competitiveness occurs in the 1990s. The overall decline in physical production in 1998 compared with 1990 was almost 80% [3]. The financial and economic crisis that began in 2008 most affected the machine-building complex in 2009. The current situation makes it possible to single out a whole complex of reasons.

The high degree of depreciation of fixed assets, not only physically but also obsolete fixed assets, do not allow machine building enterprises to meet the modern requirements of a market economy. Thus, the degree of depreciation of fixed assets increased from 41% in 1985 to 52% in 2004 [4]. In 2013 The depreciation of fixed assets of machine-building enterprises amounts to 80%. [5]. Technical support and production technologies, inherited from the Soviet period, do not imply the possibility of producing high-tech and competitive products and, thus, cannot ensure compliance with modern market requirements.

In addition, the physical and moral depreciation of fixed assets entails such a problem as the inefficient workload of most of the production capacity. At the same time, enterprises of the machine-building complex continue to bear the costs of their maintenance.

The lack of working capital of the enterprises of the machine-building complex does not allow not only to modernize the existing production, but most importantly, there is no possibility of developing and introducing new technological solutions to improve the competitiveness of both products and the enterprise and the region as a whole. The innovation and technological potential of all industries of the Krasnoyarsk Territory is formed precisely by the machine-building complex. And in this case it is necessary to take into account the development time of technological solutions, their implementation, cost and payback period.

The volume of investments in the machine-building complex of the Krasnoyarsk Territory in 2009 amounted to 1.4 billion rubles, which is much higher than in previous years. However, this amount is less than 1% of all investments in the industry of the region. A significant period of return on investment limits enterprises in attracting borrowed funds, respectively, machine-building enterprises could focus more on their own finances, which were far from sufficient for all of them to be running expenses.

Import of engineering products exceeds exports. The gap is gradually increasing, so in 2005, imports exceeded exports by 1.7 times, in 2009 by 3.4 times. 53% of products imported to the region are machinery, equipment, vehicles, devices and devices. The share of engineering products in exports does not exceed 3%. A steady tendency has been formed to meet the domestic demand of machine building mainly due to import [6].

One of the strategic objectives of the socio-economic development of the region and the country as a whole is the maximum possible development of the engineering industry, because It is precisely engineering that is designed to provide key sectors of the economy with production equipment of appropriate quality and technological level, which will provide an opportunity to gain competitive advantages not only in the domestic market, but also in the world. The implementation of this task is impossible without the technological and innovative development of the entire machine-building complex of the region.

Based on their development prospects for machine-building enterprises, three main segments can be distinguished:

1 Enterprises of high-tech and knowledge-intensive sectors, whose products are in demand in the all-Russian and in the global market in some cases. This group includes JSC "Reshetnev Information Satellite Systems", public company "Radiocommunity", public company Central Design Bureau "Geophysics", JSC "Kras mash", both in terms of military production, and for a number of civilian products. Enterprises of this group, as a rule, are part of large Russian integrated structures. Taking into account the existing backlog and high competitiveness of these enterprises in a strategic

perspective, the task is to preserve and strengthen their positions as leaders in the Russian and world markets.

2 Enterprises of traditional engineering, for which, in the new economic conditions, the strategic task is to modernize and diversify production, expand sales markets for the purpose of integration into the modern economic system - public company Krasnoyarsk Refrigerator Plant "Biryusa", public company "Krasnoyarsk Shipbuilding Yard", and JSC "K&K", JSC Foundry-Mechanical Plant "SCAD".

3 New service enterprises, repair and tool enterprises specializing in the development and production of innovative types of machinery and equipment for the regional specialization industries - "Krasnoyarsk Electrical Repair Plant", JSC "Variant-999", JSC "TAIGAMASH", JSC "Hencon Siberia", JSC "Bogotol Wagon Repair Plan", JSC "Borodino Repair and Mechanical Plant", JSC "NT-Service", JSC "Aviatechcenter". The specificity of these organizations is that they work in direct contact with the basic industries and are able to quickly solve emerging problems, including the repair of non-standard equipment, the development and manufacture of new equipment and instruments, new technological and hardware solutions to solve specific industrial tasks. In the future, the development of this group of enterprises should provide a significant part of the needs of the basic branches of the region in specialized engineering products [7].

Of particular interest are the enterprises of the first group, especially those related to the defense industry complex of the region, which are traditionally characterized by a concentration of high-tech technological engineering.

One of the representatives of this sector of enterprises is JSC "Krasmach". The main activity of the plant today is the production of rocket and space technology. In 1983, the plant was entrusted with the production of the upper stage 11S861, the manufacture of individual components and parts of the DM block was started, which were supplied to the "Experimental Machine Building Plant ". In 1989, "Krasmach" began the development and production of basic modules for the accelerating blocks of "Proton" and "Zenit" launch vehicles designed for launching spacecraft into high-energy orbits, and in 1997 for the base module of the DM-SL accelerating unit for the launch vehicle "Zenit-3SL" under the "Sea Launch" project. Over the years of work in this direction, the company has mastered the production of 14 modifications of the upper stages. In the 28 of the April, 2008, the first launch of the "Zenit-3SLB" space rocket with the upper stage DM-SLB No. 1TL, which basic module was manufactured at "Krasmach" enterprise and was held within the framework of the "Land Launch" international program from the Baikonur cosmodrome.

And today the plant is focused on the production of defense products, the volume of which in the total production is 95-97%. Currently, "Krasmach" is completing the serial production of the RSM-54 rocket. When evaluating the work of the enterprise, as part of the development program for the development up to 2010, the management noted that if the Ministry of Defense does not decide to extend the order in the near future, the plant in 2017-2019 can expect a "failure" in production volumes. The issue of production diversification and the orientation for not only government orders, but also civilian products remain relevant for all enterprises of the military-industrial complex. The solution to this problem is possible only with the active innovation of the industry.

Analysis of the cost structure of the innovative activity of the enterprise (see table) allows us to conclude about the orientation on the acquisition and assimilation of the results of Research and Advanced Development performed by third parties. So, if the share of research and development costs from 2009 to 2011 slightly decreased from 51.8% to 40.8%, the share of expenditures on the purchase of machinery and equipment decreased to 8.4%, then the share of expenditures on the purchase of software increased from 9 to 50.4% over the same period [8].

Table 1 shows changes in the cost structure of technological innovations (as a percentage of 2009).

**Table 1.** Changes in the cost structure of technological innovations (as a percentage of 2009).

Indicators	2009	2011
The cost of technological innovation, thousand rubles.	<b>100</b>	<b>100</b>
Including		
Research and development of new products, services and methods of their production (transfer), new production processes	<b>51,6</b>	<b>40,8</b>
Industrial design, design and other developments (not related to research and development) of new products, services and methods of their production (transfer), new production processes	<b>20,4</b>	-
Acquisition of machinery and equipment related to technological innovation	<b>19</b>	<b>8,4</b>
New technologies acquisition	-	-
Of these, the rights to patents, licenses for the use of inventions, industrial designs, utility models	-	-
Software acquisition	<b>9</b>	<b>50,4</b>
Other types of pre-production for the release of new products, the introduction of new services or methods of their production (transfer)	-	-
Innovation education and training	-	<b>0,4</b>
Marketing research	-	-
Other technological innovation costs		

For the task implementation of the diversifying production and ensuring the efficiency of work at the enterprise, the following priority innovative development tasks were identified:

- improving energy efficiency of production;
- implementation of programs aimed at improving the production environmental performance;
- fulfillment of Research and Advanced Development plans (development of new technologies in production);
- implementation of measures to develop a quality control system;
- creation and implementation of information technology and modern data management methods;
- implementation of measures to improve the innovation management system;
- implementation of activities set to meet the needs of JSC "Kras mash" in highly qualified personnel, prepared to work in an innovative environment.

As part of the conversion program, the company mastered the production of:

- heat exchangers and separators;
- boiler and tank equipment;
- growth plants for growing crystals of polysilicon;
- non-standard equipment, etc.

To ensure production capacities and employees maximum utilization of the enterprise under the import substitution program, it is planned to launch production of equipment for oil production in the Arctic shelf together with the Zenit Design Bureau. Negotiations are underway on the production of technological equipment for powder plants and for the Cosmodrome "Vostochny". At the same time, it should be noted that the import substitution policy does not imply a complete rejection of import in

general. At present, it is not possible to replace a number of high-tech imported goods, given the fulfillment of the priority task - the production of high-quality and competitive products. Therefore, initially it is necessary to focus on ousting low quality foreign products from the domestic market, after which, taking into account the development of domestic production capabilities, create alternative productions that could replace high-quality goods and components of foreign manufacturers. The course on import substitution is very important to conduct as an integral part of the national policy of improving the competitiveness of the domestic economy.

As part of the innovative development program implementation, it is planned to create a number of basic departments of higher education institutions in key areas of personnel training within the framework of the Research and Education Center "Rocket and Space Technologies" of Reshetnev Siberian State University of Science and Technology established in 2012.

The main activities of the Research and Educational Center "Rocket and Space Technologies" are:

- preparation of engineering personnel for the creation of a new generation of rocket-technical systems;
- determination of promising areas and specializations for the training of highly qualified personnel for the enterprise, other enterprises of the military-industrial complex, scientific institutions and universities;
- development of new methods and forms of educational activities, including on the basis of project-oriented and integrated learning technologies;
- improvement of the qualifications of teaching staff and personnel of the enterprise, improvement of career guidance;
- coordination of the university departments work and other departments to ensure the educational process with the enterprise department, in accordance with the need for targeted training and effective use of the scientific, human and industrial university potential and the enterprise, including coordination in the organization and internship of students and employment of graduates, the organization of specialized practices, the implementation of research, coursework, theses and master's theses, training graduate and doctoral students in promising scientific and technical areas of enterprise development;
- obtaining new scientific knowledge, carrying out joint developments and using them in the educational process in the preparation of highly qualified specialists;
- conducting joint research, innovative scientific implementation, technical and educational projects, participation in the industry and federal target programs implementation, Russian and international funds competitions.

Being one of the leading enterprises of the machine-building complex, JSC "Krasmach" is an active participant in innovative associations of the region and the Russian Federation: it directly participates in the development and implementation of cluster initiatives in the region within the framework of the program "Enhancing the global competitiveness of the innovation territorial-production cluster of Krasnoyarsk Krai Technopolis" "Yenisey", the goal of which is to create a system of integrated support for cluster projects aimed at developing and bringing to the market of high-tech products in order to achieve the world level of investment attractiveness and competitiveness and economic development of the Krasnoyarsk Territory.

As a result of the study, the main directions for improving the innovative production of the machine-building activity of "Krasmach" are identified. They allow to create a structure that provides high-performance activities, which is an ordered set of functions and processes, the basis of which is the formation and implementation of innovative production technologies, creation and commercialization of innovations to ensure efficiency growth production. The prospect of development of economic activities related to the machine-building complex is connected with measures to promote the diversification of production of organizations of the military-industrial complex, the development of cooperative ties and the provision of organizations with highly qualified

personnel. The expansion of the range of products manufactured and the improvement of the quality characteristics of already manufactured products are planned to be achieved through scientific, technical and innovation activities.

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