

# Strategic planning of integrated development in the field of science and technology of the enterprises of the machine-building production

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**Abstract.** The problems of the development of the national technological base and specific engineering industries, requiring a radical change in the approach to the organization of scientific and technological development in the Russian industry. The focus of the pool of Sciences (scientific and engineering disciplines) allows to structure the organizational core of scientific (innovative) associations, which allows to raise the question of the layout of the long-term structure of organizational relations and support of leading scientific, as well as educational, design, industrial, etc. organizations. Structuring the "functional core" of enterprises and organizations concentrating key digital technologies in the total mass of economic entities determines the need for the formation of matrix scientific and industrial structures as a kind of associations [on the basis of an information network using elements of artificial intelligence] within the relevant management strategies implemented by machine-building enterprises.

## 1. Introduction

In the present period both in the world and in the Russian economy the nature of the formation of key factors of competitiveness due to the dynamic development of the national technological base and specific engineering industries, requiring a radical change in the approach to the organization of scientific and technological development in the Russian industry, is changing. It is necessary to form a systemic organizational and informational structure that can realize the functions of the intellectual and informational center for strategic planning of the national technological base development, maintaining an appropriate scientific and technological environment through network concentration of scientific and technical ties in key areas of science and technology of machine-building enterprises. The following tendencies, factors, and organizational and informational structures underlying the most effective mechanisms for the development of science and technology in the world economy are the strategic foundations for the formation of such a structure.



A qualitative leap in the development of information and telecommunication technologies and information and computing services has been superimposed on the many-times accelerated processes of changing generations of high-tech science-intensive products. The need for a corresponding change of equipment, technological solutions and engineering approaches based on fundamental and applied research has determined the need for proactive development of key areas of knowledge with a dynamic change in the package of basic technologies.

At the same time, there is a pronounced convergence of research processes, processes of formation and introduction of new technologies and production processes. The development of a new industrial base is based on digital strategic trends of scientific and technological progress (NTP), which are determined by the strengthening of interconnections between various branches of science, which are then translated into industrial production through research and development (R & D) and innovation.

## 2. Statement problem

As part of the digital revolution, we can distinguish a well-formed core of technologies, which defines the strategic trends of NTP: CPM, BPM, EPM, GIS, CPS, IOT, BIG DATA, Smart City, PLM, cyber-physical systems (CPS), building information modeling technology (BIM), RFID technology, Industry 4.0, managing production intelligence (MI), “web values” (Value Web), etc.

The clustering of scientific and engineering disciplines allows us to identify groups of interrelated areas of scientific and engineering knowledge with the unifying centers in the face of the most important technologies that determine the success of the country's advancement in this scientific and technical sphere of the world economy.

Focusing the pool of sciences (scientific and engineering disciplines) allows structuring the organizational core of scientific (innovative) associations, which allows us to raise the question of the layout of the perspective structure of organizational ties and support of leading scientific (as well as educational, design, production, etc.) structures. The task of these structures is to implement the policy of occupying leading positions in certain areas of the NTP, and hence the branches of industrial production with the occupation of key markets for highly profitable, knowledge-intensive products of machine-building enterprises with the highest profitability and value added.

The concentration of strategic trends of various technologies and their interconnection allows us to identify promising areas of scientific and technical activities, both already mastered and still unexplored.

Links between different technologies form a functional structure of scientific cooperation, which can be specified as a territorial structure with the corresponding organizational centers (nodes).

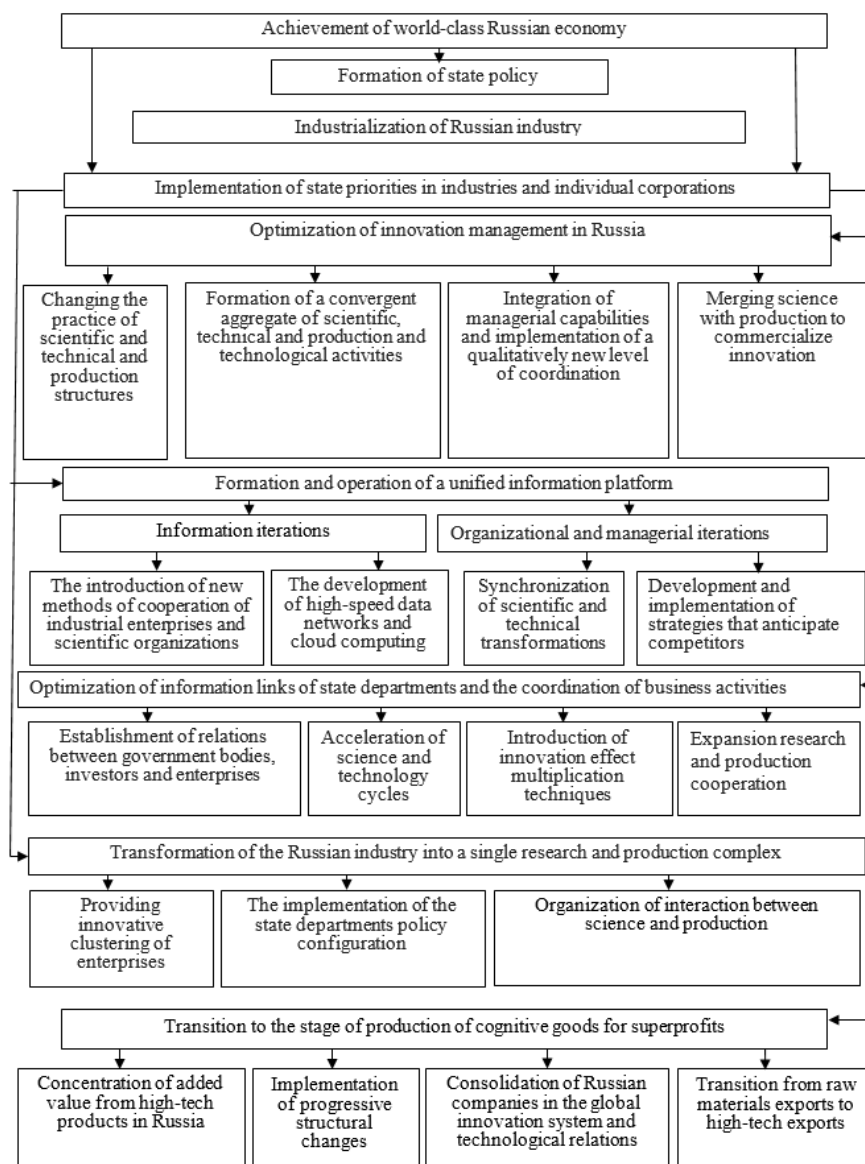
## 3. Solution method

The results of the scientific and technological development of Russia, taking into account the above-listed most effective mechanisms for the development of science and technology in the world economy, have shown the need to form in our country a central structure of organizational associations based on network principles for network concentration of scientific and technical links in key areas of science and technology of machine-building enterprises. Such a network concentration of scientific and technical links in key areas of science and technology of enterprises of machine-building production for integrated management, including strategic planning of integrated development in the field of science and technology can be most effectively implemented by machine-building enterprises based on the formation of a distributed information network using elements of artificial intelligence. It is necessary to optimize scientific and technical relations in relation to different levels of the hierarchy of management of scientific and industrial alliances for the further implementation of the cluster integration processes of scientific and industrial structures within technological platforms and other forms of state structuring of scientific and technological development priorities.

Structuring in the total mass of economic entities of the “functional core” of enterprises and organizations concentrating key digital technologies determines the need for the formation of matrix scientific, production structures as a kind of associations [based on the information network using

elements of artificial intelligence] within the framework of relevant management strategies implemented by machine-building enterprises.

Optimization of interaction between government bodies and economic entities should allow them to carry out the necessary group tasks of different-purpose core activities of specific business units with a limited number of forces, means and resources at the scheduled time (Figure 1). Such actions require the use by machine-building enterprises of the system-forming element of such a structure — a polycentric system with data exchange in real or close to real time, including distributed access and exchange of information with relevant telecommunication services and information and computing services [1-3] . The network should solve the problems of collecting, summarizing and analyzing information from any possible sources for developing control actions in relation to conducting fundamental and applied scientific research, implementing experimental development, introducing new technologies and organizing individual and mass production with parallel training, re-training, advanced training of relevant personnel at the level of world standards [4, 5].



**Figure 1.** Outline of the strategy for the implementation of state priorities by integration of available government capabilities.

That is, a transformation of the management mechanisms of economic and organizational processes in the system of scientific and industrial projects of business and the public sector, which determine the pace of scientific and technical development of the national economy, is required. Such a transformation should be implemented not on the basis of the market demand of the market at the present and the next stage, but the macro-strategic outlines of scientific and production development with a perspective of 15-20 years [6-8]. At the same time, it is necessary to rely on the fundamental and applied developments developed by the Russian science, allowing in 15-20 years to break away (be ahead) of potential competitors by 8-12 years in the production and mass use and sales of new equipment [9, 10].

#### 4 Conclusions

Relationships between business entities and government bodies should be optimized for the further development of scientific and technological developments as the basis for modernizing production by improving the planning system, ordering and implementing R & D programs with the introduction, production, marketing and further support of new technological solutions. These relationships are bilateral, interdependent, due to their active interaction in a market economy.

The requirements of the scientific and technological “breakthrough” must be satisfied by concentrating efforts on the development of the engineering complex in the industrial sector of the Russian economy due to a significant expansion of specialized information and organizational services within the framework of organizing system-network management of target programs, step-by-step audit and improvement financing processes and procedures in the scientific and technical environment implemented by the machine-building enterprises.

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