

# Interaction of Organizations of the Defense Industry Complex and High-Tech Civil Companies: Models of Cooperation

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## ABSTRACT

The article presents the results of a study of the systematization of models of cooperation between organizations of the military-industrial complex (MIC) and high-tech civilian companies, as well as identifying new forms of their interaction to intensify the processes of diversification. A systematic analysis of new forms of cooperation in the aspect of digitalization of the industry, including industry, logistics, infrastructure, was carried out, the state's capabilities were determined to include in the organizational processes of the formation of new forms of cooperation of defense industry organizations and high-tech small and medium-sized enterprises. The study of the directions of application of methods and approaches of artificial intelligence in the framework of the analyzed cooperation processes. The types of cooperation of defense industry organizations and high-tech civilian companies were structured and systematized by target forms of interaction, a case study of the possible inclusion of artificial intelligence technologies in several organizational tools, management procedures and electronic platforms for interaction of subjects of the diversification process was carried out. The proposed scientific approaches to the systematization of cooperative forms of interaction and the inclusion of artificial intelligence methods in the organizational processes of cooperation can underlie further research on the operational and strategic levels of management of the processes of diversification of defense organizations in the context of entering high-tech civil markets.

**Keywords:** *diversification, defense industry, small and medium enterprises, cooperation, digitalization, artificial intelligence*

## 1. INTRODUCTION

Various programs and systems of measures to support [1] the diversification of production of defense industry organizations have been formed to ensure the achievement of the benchmarks set in the Address of the President of the Russian Federation to the Federal Assembly of the Russian Federation on increasing the share of high-tech civilian and dual-use products (CIP and DUG) in the total volume of defense industry products by not less than 30% by 2025, by not less than 50% by 2030 (of the total production of the defense industry complex).

Innovative development and expansion of the export potential of organizations of the military-industrial complex (MIC) through the development of high-tech civilian industries in a highly competitive environment, the marketing specifics of civilian high-tech markets, "open innovation" strategies [2], broad international communication ties, and volatile requirements of counterparties is a difficult task that requires a systematic approach. The most significant tool for supporting the diversification of the defense industry organization now is government procurement of civilian products and the implementation of national projects. But it is

necessary to attract market resources to the development of defense industry organizations in the commercial civil sphere – finance, personnel, competencies, scientific and technical potential, investments.

Reforming such a science-intensive industry as the military-industrial complex and its organizational structures should be approached not only in the “top-down” paradigm, from the position of the subject of management [3] and the whole industry (complex, high-tech) as an object of management. This hierarchical and functional approach can work within the organizations themselves, and, possibly, lead to individual improvements in production and management processes, however, in modern market conditions it is not sufficiently adaptive and effective, it is necessary to maintain network and environmental interactions of organizations in certain infrastructural, innovative conditions. International experience shows that the strategies of mergers and acquisitions of defense industry organizations and commercial organizations, the creation of joint ventures and new start-ups together with research teams of universities, institutes, small and medium-sized businesses seem to be more winning long-term strategies for the development of high-tech civilian business by defense organizations.

## 2. MATERIALS AND METHODS

The aim of the study is to systematize models of cooperation between defense industry organizations and high-tech civilian companies, as well as to identify new forms of their interaction to intensify diversification processes.

The objectives of the study:

- assessment of new forms of cooperation in the aspect of digitalization of the industry, including industry, logistics, infrastructure, etc.;
- identifying opportunities for the inclusion of federal executive bodies (federal executive authorities) and specialized research institutes in the organizational processes of forming new forms of cooperation between defense industry organizations and high-tech small and medium-sized enterprises (SMEs);
- research of directions of application of methods and approaches of artificial intelligence (AI) in the framework of the analyzed cooperation processes.

This study is based on the scientific work of Russian scientists in the field of analysis of the diversification of defense industry enterprises, models of interaction between defense industry organizations and the civilian sector of the economy, innovation infrastructure, digitalization, and AI.

The research used a systematic approach, methods of comparative and multicriteria analyzes, synthesis. During the research, the types of cooperation between defense industry organizations and high-tech civil companies were structured and systematized by formal groups, a case study of the possible inclusion of artificial intelligence technologies in a few organizational tools, management procedures and electronic platforms for interaction of subjects of the diversification process was carried out. The results of the study can be applied in further studies of the present problems of the development of diversification processes.

## 3. RESULTS

There are a lot of cooperative models of interactions, but not all of them meet modern trends and requirements, both from the market and from the subjects of cooperation themselves. The technological platform as a communication form of cooperation seems promising. These sites provide an opportunity to attract resources from stakeholders of innovative development (business, science, civil society, the state), influence the change and improvement of the regulatory framework in the field of technology and innovation, and attract leading experts. More than three dozen technology platforms operate in Russia, but the effectiveness of these organizations can be higher and more efficient.

It is worth highlighting such forms of cooperation within the framework of public-private partnership, as:

- provision of licenses and (or) production experience;
- joint production, including research and development work (R&D);
- joint ventures;
- joint projects.

The granting of licenses is conditionally a form of cooperation between organizations of the defense industry and SMEs, since there are no guaranteed scientific and industrial or other ties between the subjects, cooperative ties are established only under the condition of joint activities. Joint production

provides for certain production obligations for the supply of units, assemblies, machine tools, etc. to the enterprise of one or both subjects of cooperation. Joint ventures (JV) are a systemic form of industrial cooperation, which presupposes the concentration of the advantages of each of the partners for joint benefits (technological or production improvement, cost reduction, acceleration of production cycles, export expansion, etc.). Joint projects involve various forms of cooperation (concession, joint venture) for the implementation of bilateral (or more) cooperation to fulfill the order of third parties. All the above types of cooperation of defense industry organizations and high-tech civilian enterprises have certain legislative restrictions in view of the specifics of the functioning of DIC organizations.

Outsourcing as a form of cooperation between defense industry organizations and high-tech SMEs has development prospects due to mutually beneficial conditions of cooperation: it can be carried out by defense industry organizations for high-tech business (scientific and production competencies and production activities), and vice versa (provision of services in design, engineering, production based on SMEs of several civil products).

Franchising as a method of industrial cooperation can be implemented in the civil market as the transfer of ownership of one organization (franchisor) to a trademark, service, idea, technological process, patent, business relations, etc. another organization (franchisee) under an agreement for a certain amount. The mechanism can be implemented in modern forms of PPP with a certain preparation of legal regulation.

A form of cooperation is implemented in the implementation of research and design work in the models of engineering and design centers. The customer of the work, as a rule, is large organizations, in this case the defense industry, the contractor is a high-tech SME, but the reverse form of placing orders is also realizable.

The format of special economic zones (SEZ) is relevant. In certain economic zones aimed at the development of petrochemical industries, aircraft and mechanical engineering, the interaction of defense industry organizations and high-tech business seems to be the most promising. SEZ provide:

- minimization of administrative barriers;
- tax incentives and customs preferences;

- minimum rental and redemption prices for land and real estate;
- assistance in the implementation of an investment project at the first stage of its development.

It is necessary to provide access to the SEZ not only for foreign investors, which is a priority in the development policy of these forms of economic development, but also for defense industry organizations and SMEs to equalize opportunities in the civil market and fair competition.

Cooperation of defense industry organizations and high-tech SMEs can be formed not only on material production bases, but also in the intellectual sphere, in the service sector. Both defense industry organizations and SMEs can provide access to programs, 3d files and layouts, offer service, provide facilities for design or data storage, provide services for collecting and/or analyzing data, etc. In the segment of services, the trend of the production “sharing economy” is developing – the provision of the opportunity to use a certain product or service for free, but with payment for certain conditions – for minutes of use, for analyzing and processing data from a metering device, etc. This model, under certain conditions, lowers the threshold for entry into certain high-tech markets – both for small businesses and for the defense industry organization, which wants to test a new product, a new market, but does not want to risk large sums by organizing production from scratch.

In view of the strategic priorities of the state innovation policy, technological and infrastructural institutions have been implemented in the country [4], which are also platforms for cooperation between defense industry organizations and high-tech SMEs – technoparks, business incubators, technopolises, etc. Since most of these institutional forms are built by the state according to the model “top-down”, the effectiveness of these organizational formats is often local.

Within the framework of the specifics of the digital transformation of the industry, Industry 4.0 initiatives [5], promising models of cooperation between defense industry organizations and high-tech SMEs in production formats are the following:

MaaS platforms (Manufacturing-as-a-Service), when organizations offer specific individual production modules (assembly, design) to their customers (in this study, defense industry organizations or high-tech private firms, this is a two-way mutually beneficial format of interaction

and cooperation). In the MaaS-model format, non-manufacturing high-tech SME companies can provide services for the provision of digital solutions, platforms, necessary software, manufacturing startups can place orders for the necessary production operations, large defense organizations can provide their capacities for the implementation of joint products (Figure 1).

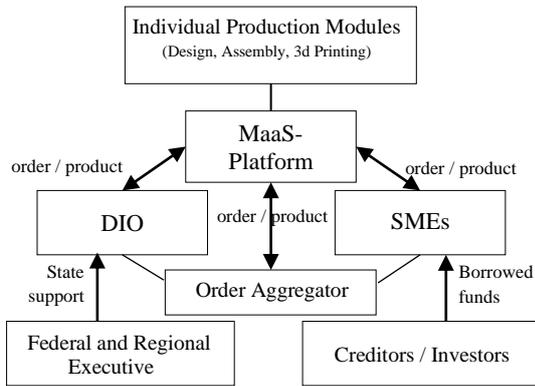


Figure 1. MaaS platform model

Source: Compiled by the authors

C2M cooperation strategies (Customer-to-Manufacturer) ensure the interaction of SMEs with consumers to generate demand for certain goods and services and receive orders, and then transfer orders to the production facilities of defense industry organizations. It will be possible to release more relevant products and services through the study of customer preferences, for example, in the electronics industry. It is not possible to implement this approach within the framework of cooperation between SMEs and defense industry organizations, the specificity of high-tech production is also not

adequate for this model, however, the very principle of ensuring the distribution of the production process of a high-tech product among several defense industry organizations has a high potential for development (Figure 2).

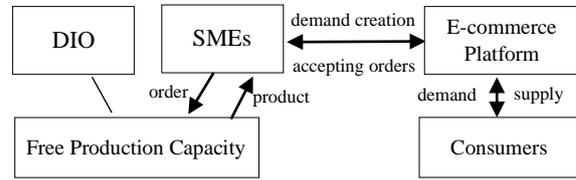


Figure 2. C2M cooperation strategy model

Source: Compiled by the authors

The model of technological hubs is relevant in the long term – in fact, it is an infrastructure model of cooperation like a technopark or a production laboratory. Defense industry organizations can act as a technological hub – provide production facilities, laboratories, equipment, personnel and experts, competencies, etc. SME organizations that are engaged in a similar profile of activity and plan to make experimental innovative product or service. Ideally, hubs are a community of entrepreneurs, inventors, engineers who unite in some kind of “studio” and are engaged in a creative innovation process. The model is difficult to implement due to secrecy, state secrets and other restrictions on the activities of defense industry organizations, however, with a certain improvement in legislation, it can be partially implementable.

One of the results of the study is a generalized classification of forms and organizational models of cooperation between defense industry organizations and high-tech civilian companies (Table 1).

Table 1. Classification of forms and organizational models of cooperation between defense industry organizations and high-tech civilian companies

Forms of Cooperation	Organizational Models of Cooperation
Production	Consortia, innovation-industrial, innovation-scientific clusters, research and production associations, corporate innovation and industrial platforms, forms of joint production, outsourcing of production capacities of defense industry organizations
Technological	Joint venture, technopark, technopolis, licenses
Infrastructure	Maas platforms
Service and Services	Business incubator, research cluster, technology platform, research and production concern, special economic zones, technology hub
Network	Design centers (industrial design), engineering centers, franchising, outsourcing – the provision of services to support the production processes of SMEs for organizations of MIC, C2M strategies
Ecosystem	Industry clusters, territorial clusters

Source: Compiled by the authors

One way or another, the implementation of modern forms of cooperation between defense industry organizations and high-tech civilian companies will require legislative changes, in particular, in the field of patent law and state secrets.

It is required to define broader forms of PPP interaction for the specifics of defense industry organizations – the possibility of private individuals financing R&D, redemption of patents, the use of capacities, new types of permitted financing. At the

first stage of the formation of cooperation ties and interactions, it is necessary to provide for state co-financing of joint research and development, production, marketing strategies.

The cluster approach can become one of the effective tools for cooperative interaction between defense industry organizations and high-tech civilian companies. Modern network cluster mechanisms in the future will develop not only as sectoral, territorial “horizontal” links, but also as a common environment for interaction. In the context of the development of modern science, the effectiveness of cluster mechanisms makes it possible to create not just associations of organizations, but an “ecosystem” [6] – the inclusion of the scientific, educational, cultural environment in innovative production processes, which allows developing common strategic interests that are not limited only to commercial frameworks. The formation of development environments (ecosystems) based on cluster forms of cooperation is seen as a promising way of developing interaction between defense industry organizations and high-tech civilian enterprises.

In the context of the need to create a digital control system for the diversification process [7], a “Single window” is presented as a promising tool for cooperation between defense industry organizations and high-tech private civil companies as a mechanism for providing standardized and non-standardized information between two or more business process entities in order to fulfill certain functions for the production of high-tech goods or services, or in order to create a new organizational form for innovation. A “Single window” can be implemented on electronic communication platforms, websites of federal executive authorities and specialized research institutes, on the websites of infrastructure projects and holdings, the defense industry organizations themselves to facilitate contact with interested organizations of high-tech SMEs. This technology allows speeding up and simplifying information flows, to discuss possible cooperation models and projects for joint implementation more effectively. The modern implementation of the “Single window” does not require the introduction of the most advanced information and communication technologies, however, in the near future, the module of this mechanism will include machine learning technologies, algorithms for data analysis, data processing, database correlation, automated distribution of calls to various groups of “priority”, “values”, etc., i.e. in fact, to include artificial intelligence technologies in the communication

process of interaction between defense industry organizations and high-tech civilian organizations.

The organization of the defense industry and SMEs needs to cooperate not only within the framework of technology platforms, market directions and technology clusters, but in the context of providing services for the implementation of AI algorithms in production processes from the standpoint of mutual prospects. The introduction of artificial intelligence technologies is seen as a promising direction within the framework of the “Single Window” mechanism. Mechanisms for collecting, transferring, and analyzing information are already being implemented with the inclusion of AI technologies not only as a management tool [8], but also as a security tool (the Palantir system in the USA, for example). Analysis and visualization of large data arrays from heterogeneous sources, allowing to find relationships between objects and subjects of analysis, algorithms for structuring databases and incoming information flows will allow more efficient implementation of cooperation mechanisms of defense industry organizations and high-tech SMEs, create consortia based on the history of organizations, directions of their development, available technologies etc. Such a promising tool will provide defense industry organizations with the opportunity to enter the high-tech market sectors more prepared, having counterparties that have been developing in the civilian market for a long time, coordinate research and production potentials, and create competitive global products.

#### **4. DISCUSSION**

The problem of interaction between defense industry organizations and high-tech civilian companies in various forms and models of cooperation is considered by several authors, either in the context of a comparative analysis of national and foreign experience [9-12], or in a highly specialized context [13, 14]. However, almost all authors note the importance of cooperation between defense industry organizations and private business.

#### **5. CONCLUSION**

The novelty of this study lies in the previously unused systematization of cooperative forms, institutions and processes, in the analysis of modern cooperative business models associated with the processes of digitalization of the industry, applicable both within the framework of the diversification of defense industry organizations, and in the study of

the possible inclusion of methods and tools of AI in the given processes.

## **AUTHORS' CONTRIBUTIONS**

The authors made an equal contribution to the study: collection and analysis of material; definition of goals and objectives, research methods; formulation and scientific substantiation of conclusions, registration of key research results in the form of an article.

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