

## MTSDT 2019

### Modern Tools for Sustainable Development of Territories. Special Topic: Project Management in the Regions of Russia

#### STRATEGIC MANAGEMENT OF ENTERPRISES OF ROCKET AND SPACE ENGINEERING

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#### *Abstract*

The current organizational and economic architectonics of space rocket engineering enterprises (hereinafter SRE) is not perfect and requires a reorientation of approaches to the management of research and production systems, the effectiveness of which can be achieved in the aggregate due to the synergistic effect manifested in intraorganizational and interorganizational integration, which will allow assessment of the overall effectiveness of their development. Based on an analysis of the activities of 58 enterprises of SRE, a practice-oriented methodological approach to their strategic management is proposed, consisting in the exclusive role of the state, which acts as the customer and consumer of rocket and space technology products (hereinafter SRT), the owner and subject of state regulation and the creation of economic conditions for their development which allows introducing the system-forming elements of streamlining the industry as a system on the one hand, and, on the other hand, in identifying intense factors of production, which preserve and increase the accumulated scientific and technical backlog and provide an increase in the reproductive potential. The paper proves that most of the high-tech enterprises of SRE are focused on horizontal diversification, which implies growth in the existing market due to new products, which is associated with the cost of R&D. It has been established that the strategies for opportunities for goods and markets due to the development of deep market penetration strategies have the greatest implementation potential due to high R&D costs and improving the properties of existing products and increasing their competitiveness.

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**Keywords:** Mechanical engineering, space rocket engineering, space rocket industry, strategic management.



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## 1. Introduction

SRE is a mechanic engineering industry, part of the Russian defense industry and the rocket and space industry, specializing in the scientific and technological development and production of rocket weapons and space technology. In this sector of the country, more than 90 enterprises operate employing more than 200 thousand people.

SRE enterprises are heterogeneous in terms of technical and economic organization and at the same time have similar forms and development potentials. The business entities of the SRE inherited from the planned economy were adapted to market forms in the 90s. Adaptation processes are not yet complete. SRE enterprises are subject to a restructuring system. In general, the state of SRE enterprises is determined by the general condition of the space and rocket industry (hereinafter SRI). Historically, SRI is one of the most complex and research intensive sectors of the national economy. SRI is very closed, so its activities are not reflected in open media (Machairas, 2014). Received trophies of German ballistic missiles “Vau-2” and Decree of the Council of Ministers of the USSR No. 1017-419ss “Issues of rocket armament” of May 13, 1946 became the basis for the development of the USSR SRI, which launched the first artificial Earth satellite, the first manned flight in space. In total, the missile defense systems of the USSR and Russia launched over 1800 rockets into space belonging to the R-7 family starting in 1957. Russia is one of the three leaders in successful orbital launches, along with the United States and China. The leader in the production of spacecraft is the United States, and then Russia and Europe are on an equal footing (Kamolov & Sholokhov, 2019). The development of SRE is determined by the development of SRT, which is carried out in the following areas: 1) promising means of removing space apparatus and infrastructure; 2) space propulsion engineering; 3) spacecraft and orbital stations; 4) manned spacecraft.

In the space and rocket services market, competition between space technologies and alternative “ground-based” solutions is intensifying. The conditions of turbulence of the economy have little effect on these processes. As before, satellite communications and broadcasting from geostationary orbits remain commercially viable types of space services. However, even despite the positive scientific and technical indicators, over the past 5 years, the share of the Russian Federation in the global space services market has not practically changed and amounts to about of 11 % (Tsisarsky, 2014).

SRE enterprises are characterized by high innovative properties. The effectiveness of R&D is determined by the effectiveness of the structures, processes and projects of SRE enterprises (Sikyr, Abrashkin, Sekerin, & Gorokhova, 2018). In general, the SRI of Russia is significantly behind the level of NASA and the European Space Agency (ESA), including the availability of R&D and finished products in the field of automatic systems for functional diagnostics of liquid rocket propulsion systems and systems for bench tests of propulsion systems, laser technologies, and production equipment for vacuum coatings, technological equipment (TE) for the manufacture of SRI, etc. (Tsisarsky, 2014). The paper (Abrashkin, 2018) carries out a high-tech analysis of SRE enterprises, which showed that 27 out of 58 SRE enterprises lacked R&D expenses (Appendix 2), i.e. almost a third are not involved in creating innovation. There is the potential for wide involvement of SRE enterprises in innovation and R&D.

It is advisable to carry out R&D and innovative activities at SRE enterprises in the form of project management; however, an appropriate project management culture has not been formed. There is the potential to increase the efficiency of space activities invested in R&D by reducing unit costs in the practical use of space and diversified products, including civilian ones. The solution of these problems makes it necessary to search for a theoretical and methodological justification for improving SRE development strategies taking into account the current situation and future development potentials.

SRE enterprises have all the organizational and economic properties that are characteristic of enterprises in other industries. Given the specific characteristics of the industry and the priorities of the state space exploration policy, the question of changing approaches to strategic planning and introducing new strategies for their development is obvious.

All SRE enterprises have development strategies. They organically fit into the general state strategy for the development of space and do not fully meet the priorities for the commercialization of space services. The United States, controlling the share of over 74% of the space services market, systematically involving business in the space industry, was able to abandon the use of the institution of state-owned contractors (“Strategic development of the State ...”, 2017).

In the domestic SRE, the growth of commercialization and the attraction of private investment is not a priority, the state takes all the burden of organizing space exploration, giving a smaller role to state regulation and reorientation of this industry to market relations. Cluster initiatives as the basis for strategic development (Dyrdonova, 2016), as well as infrastructure support for enterprises (Melnik & Dyrdonova, 2014) are relatively rarely used in the Russian Federation. An imbalance of commercial success and national security priorities disrupts the goal-setting function, replacing market relations with direct state directorate management. In this regard, corporate governance also does not meet the performance criterion (Veselovsky, Izmailova, Bogoviz, Lobova, & Alekseev, 2018). Development of new management approaches to the development of SRE enterprises is required.

Enterprise development strategies require streamlining the priority areas of activity, forms, methods, means, resources, and potentials in space and time for cost-effective management decisions and maintaining the competitive advantage of enterprises (Boyko, 2016). An important role is given to R&D and innovations in their development (Lubnina, Shinkevich, Yalunina, Gaidamashko, Savderova, & Komissarova, 2018). The space development strategy of the Russian Federation (“Strategic development of the State ...”, 2017) offers a number of tools for the development of regional cash services and sets the goal of “creating an economically sustainable, developing along an innovative path, competitive, diversified, strategic rocket business, which can occupy a rightful place in the global space market”, however, the state’s functions include the formation of a product policy taking into account state needs for a given number of types of space systems, engines, equipment and services which are suitable to be offered on the world market on their own or in cooperation with foreign partners. SRE enterprises are not given restrictions on the production output, but it is specified that the production of products for other consumers can be carried out purely at their own risk and responsibility. Thus, SRE enterprises have a slogan interest in product diversification and the search for new consumers; there is practically no motivation for these actions. Therefore, there is a need to justify the development strategies of SRE enterprises, taking into account their knowledge-based backlog and the needs of the state as a consumer of products, a regulator of economic relations and the owner.

Currently, all enterprise strategies can be combined into three groups: offensive strategies, defensive strategies, and reduction strategies. The offensive strategy is the most attractive. It has four varieties: a sharp breakthrough to the market, a quick and unexpected breakthrough to the market, a change in the technical and economic characteristics of the product, the capacity of the market or industry. A defensive strategy involves maintaining a market share for enterprises and maintaining existing market positions. The reduction strategy involves a regrouping of existing forces, a reorientation of the enterprise's activities to increase efficiency in a period of recession, and changes in the economy. Businesses can implement one or more strategies. Diversification strategies, opportunities strategies for

goods and markets, integration growth strategies, and a product strategy are also distinguished depending on the classification attribute. Based on the analysis of the activities of 63 SRE enterprises presented in (Abrashkin, 2018), the authors evaluated 58 enterprises, information on which was publicly available, their strategies, and also assessed the reorientation of strategies taking into account the research intensity indicator (Figure 01).

## **2. Problem Statement**

It is difficult to overestimate the role and potentials of the scientific rethinking of the economic development of the Russian Federation. The problems of the formation of a new infrastructure for the innovation system of the industry, the intensification of innovative processes, commercialization and transfer of scientific and technical tasks and developments are the primary tasks of the SRI. There is a need to improve the methodological tools for assessing the level of strategic development, which allows identifying promising areas in the economy, and managing them, as well as increasing competitiveness, implementation and effective use of modern technologies in SRE, as the locomotive of SRI.

Ensuring the further development of SRE enterprises is possible only if the efficiency of managing these processes is enhanced. Intensified competition in the space services and aircraft manufacturing market reinforces the need to identify the competitive advantages of these enterprises and the increment in the capitalization of R&D returns and the innovations in their activities, which are manifested in the growth of high-tech production. Data on the current state of the space and rocket industry show that according to the main technical and economic indicators, the situation is deteriorating in dynamics, that is, in general, the scale of inefficient management of SRE enterprises is growing. The author's analytical assessment shows that over 30% of them are unprofitable at present, more than 40% of products are unclaimed abroad, and the research intensity for more than 80% of enterprises is critically low. All this, in turn, testifies to the inefficiency of the state policy pursued with respect to SRI, which is designed to express the interests of the sovereignty of outer space, national security and economic returns from its development projects. Therefore, the main problem of the study is the problem of identifying areas of strategic development for SRE enterprises, taking into account the global agenda for the development and exploration of space, the priority of state interests, the dynamism of the external environment and the strengthening of the internal potentials of enterprises.

## **3. Research Questions**

The search for optimal management strategies for organizations in various industries is the subject of research for both Russian and foreign scientists and practitioners. The industry specifics of SRE enterprises, the availability of proprietary materials and information representing state secrets lead to a vacuum of scientific applied research in this area. It requires specification of strategic groundwork for SRE enterprises, their refinement and formalization taking into account state interests in the context of global trends in space exploration.

## **4. Purpose of the Study**

The purpose of the study is to justify the development strategies of SRE enterprises, taking into account their research intensity backlog and the needs of the state as a consumer of products, a regulator of economic relations and an owner in the context of global trends in space exploration and available

internal organizational potentials for their development. Given the fragmented strategies of SRE enterprises in the overall development model of SRI of the Russian Federation, it is extremely necessary to develop theoretical and methodological tools to justify their development, taking into account various signs of development and criteria for their justification.

## 5. Research Methods

The theoretical and methodological basis of the study was the scientific works of domestic and foreign scientists, devoted to both finding ways to rationalize approaches to managing research intensive enterprises of SRE, and general management issues. In the course of the study, such methods as a systematic approach as a general methodological principle of research; scientific abstraction, logical analysis, and comparative analysis were used. Analysis of the current state of SRE enterprises was based on the work of one of the authors of the article and on the assessment of the research intensity of SRE enterprises (Abrashkin, 2018).

## 6. Findings

It was possible to establish that most of the SRE enterprises fit into the general strategy of Roscosmos, focused on the development of human resources, including by attracting young specialists, optimizing industry potential and organizational structures, increasing labor productivity, commercializing new products and improving the regulatory framework.

The possibilities of reorienting diversification strategies are not great (Figure 01 a, b), since diversification involves re-profiling products for new markets in order to reduce financial risks, but avoiding the direct dependence of a particular SRI market seems difficult given the general role of the state in their activities, the high role of investing in R&D of an already formed assortment of products for high-tech enterprises, low interest in civilian products.

Most of the research intensive enterprises of SRE are focused on horizontal diversification, which implies growth in the current market due to new products, which is associated with R&D costs, and a small part on concentric diversification, which involves finding new customers for improved products and a very small number of conglomerate diversification, where products are sold in new markets that are not technologically related to previous ones.

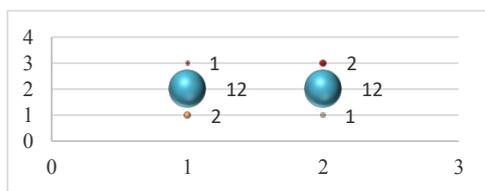
Opportunities strategies for goods and markets involve the implementation of deep market penetration strategies (for markets that are developing but not yet saturated), market development strategies (developing new markets due to globalization processes), and product development strategies (operating in the same market for modification account).

Development due to the strategies of deep penetration into the market seem to be the most optimal among the strategies of opportunities for goods and markets for research intensive SRE enterprises, which is due to the high costs of R&D and improvement of the properties of existing products and growth of their competitiveness (Figure 01 c). For non research intensive enterprises - due to market development strategies that allow expanding the boundaries of the SRT market and their components and after-sales service (Figure 01 d).

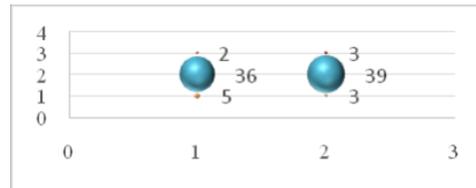
Integration growth strategies include regression integration strategies (accumulation of supply, creation of subsidiaries), progressive integration strategies (accumulation of distribution and sales systems) and horizontal integration strategies (absorption of competitors or their tight control). The

degree of applicability of these strategies to SRE enterprises is not high Figure 01 e, f), since a vertically integrated structure has already been formed in the industry and only point-based options for implementing these strategies are possible.

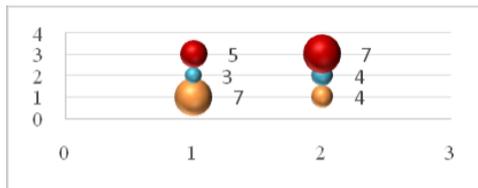
Product strategies include differentiation strategies (focus on unique products), low cost strategies (large-scale production), and concentration and narrow specialization strategies (focus on key products). These strategies are not fully implemented (Figure 01 g, h). There is the potential for introducing concentration and narrow specialization, which will increase the competitive advantages of the products of SRT, which is the locomotive of the enterprise.



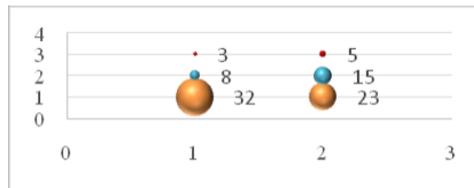
• concentric diversification strategies;  
 • horizontal diversification strategies;  
 • conglomerate diversification strategies.  
**a) Diversification strategies of research intensive enterprises of SRE\***



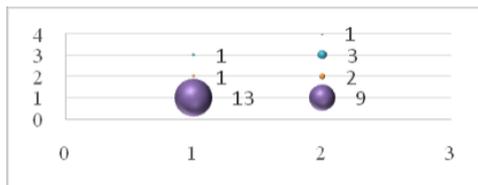
• concentric diversification strategies;  
 • horizontal diversification strategies;  
 • conglomerate diversification strategies.  
**b) Diversification strategies of non research intensive enterprises of SRE**



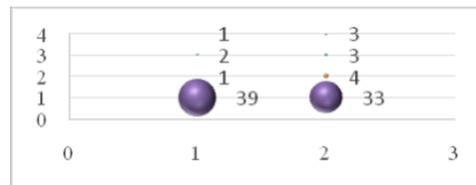
• deep market penetration strategy;  
 • market development strategy;  
 • product development strategy.  
**c) Opportunity strategies for goods/markets of research intensive enterprises of SRE**



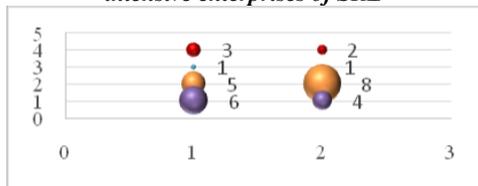
• deep market penetration strategy;  
 • market development strategy;  
 • product development strategy.  
**d) Opportunity strategies for goods/markets of non research intensive enterprises of SRE**



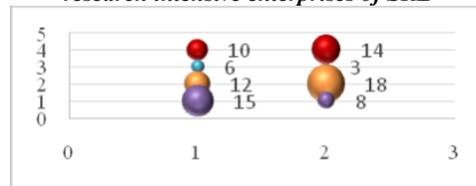
• regression integration strategy;  
 • progressive integration strategy;  
 • horizontal integration strategy;  
 • lack of these strategies.  
**e) Strategies for the integration growth of research intensive enterprises of SRE**



• regression integration strategy;  
 • progressive integration strategy;  
 • horizontal integration strategy;  
 • lack of these strategies.  
**f) Strategies for the integration growth of non research intensive enterprises of SRE**



• differentiation strategy;  
 • low cost strategy;  
 • concentration and narrow specialization strategy;  
 • lack of these strategies.  
**g) Strategies for the product of research intensive enterprises of SRE**



• differentiation strategy;  
 • low cost strategy;  
 • concentration and narrow specialization strategy;  
 • lack of these strategies.  
**h) Strategies for the product of non research intensive enterprises of SRE**

\* image on the left is the assessment of the current strategy; right is a proposed strategy

**Figure 01.** Evaluation of strategies of SRE

Thus, the priority is the reorientation of SRE enterprises' strategies, which can be implemented in the conditions of a state monopoly on their management and organizational design, and which includes narrowing the diversification of specialized science-intensive products and expanding markets and product lines of SRE enterprises that are not related to research intensive ones according to the cost principle.

## 7. Conclusion

An analysis of the strategic management of SRE enterprises showed that most of the research intensive enterprises of SRE are focused on horizontal diversification and a smaller part on concentric diversification; strategies of opportunities for goods and markets also have the greatest potential for implementation. For non research intensive enterprises, market development strategies that allow expanding the boundaries of the market should be considered optimal. It has been revealed that there is a potential for implementing differentiation strategies, including areas of concentration and narrow specialization, which will increase the competitive advantages of those SRT products that are the locomotive of SRE enterprises. The findings can be used in subsequent studies of economics and enterprise management of SRE.

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