

MECHANISMS OF INNOVATIVE DEVELOPMENT OF RUSSIAN ROCKET AND SPACE ENTERPRISES

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Abstract

The goal of the article is to present the results of the authors' study on the mechanisms of knowledge development of Russian rocket and space enterprises. The authors' study included an analysis of the activities of all 62 Russian rocket and space enterprises between 2013 and 2018. The analysis showed that most of the enterprises are state-owned and based on a model of vertically integrated structures. The enterprises showed unsatisfactory economic results, including a low level of process innovations and a decline in product competitiveness. The analysis discovered many problems that significantly limit the innovative development of the enterprises. Based on the results, mechanisms of innovative development of Russian rocket and space enterprises were proposed to strengthen strategic public-private partnerships, reduce the negative effects of the external environment, eliminate resource constraints, change unilateral dependence on cost factors, and modify the role of the state as a major consumer of rocket and space services.

Key words: innovative development, rocket and space industry, Russian Federation

JEL Code: K23, O32, D29.

Introduction

The changes of the global economy force rocket and space enterprises to adapt to global growth trends. Their development aims at the economic, scientific, technical or defense power of the country through system integration and innovative development (Sekerin & Gorokhova, 2018). The results of research and development allow creating competitive markets for innovative technologies and reducing the risk of investment diversification (Petrosjan, 2016). The changes in the global economy relate to higher labor productivity, more efficient use of resources or more effective management of private businesses as well as state institutions, which is particularly important for the Russian economy (Novikov, 2019).

Global economic trends include the rapid introduction of innovations, the development of innovative infrastructure, the evolution of new industries (Tikhomirova, 2018), and

the adaptation of traditional businesses to new economic conditions by applying the results of the research and development (Veselovsky, 2017). Rocket and space enterprises must also follow these trends, which is confirmed by the experience of European countries that systematically strive to increase the level of technological development (Payson & Davidian, 2015). These trends will lead to the development of science and technology as the main generators of high-tech production for the space industry (Sidorov & Artju, 2016). However, this requires the conceptualization of mechanisms of innovative development of rocket and space enterprises.

1 Goal and method

The goal of the article is to present the results of the authors' study on the mechanisms of knowledge development of Russian rocket and space enterprises.

The authors' study was based on the analysis activities of all 62 Russian rocket and space enterprises between 2013 and 2018 using data on their production and innovative activities and their accounting results published by Interfax (2019). However, complete information was found for 51 enterprises. In the case of 11 enterprises, some data were missing in different years. In 2018, complete information was found for 54 enterprises. The sample of enterprises with complete information for the analysed period was $51 / 62 \times 100\% = 82\%$. In the context of individual years of the analysed period: 2013 – 92%, 2014 – 97%, 2015 – 92%, 2016 – 93%, 2017 – 89%, 2018 – 87%. The high values of the weights of the analysed information in individual years indicate the representativeness of the sample of enterprises. Based on the results of the analysis of the analysed enterprises it was possible to assess the extent of the state's influence on their management, their financial and economic situation as well as to formalize the mechanisms of their innovative development.

2 Results

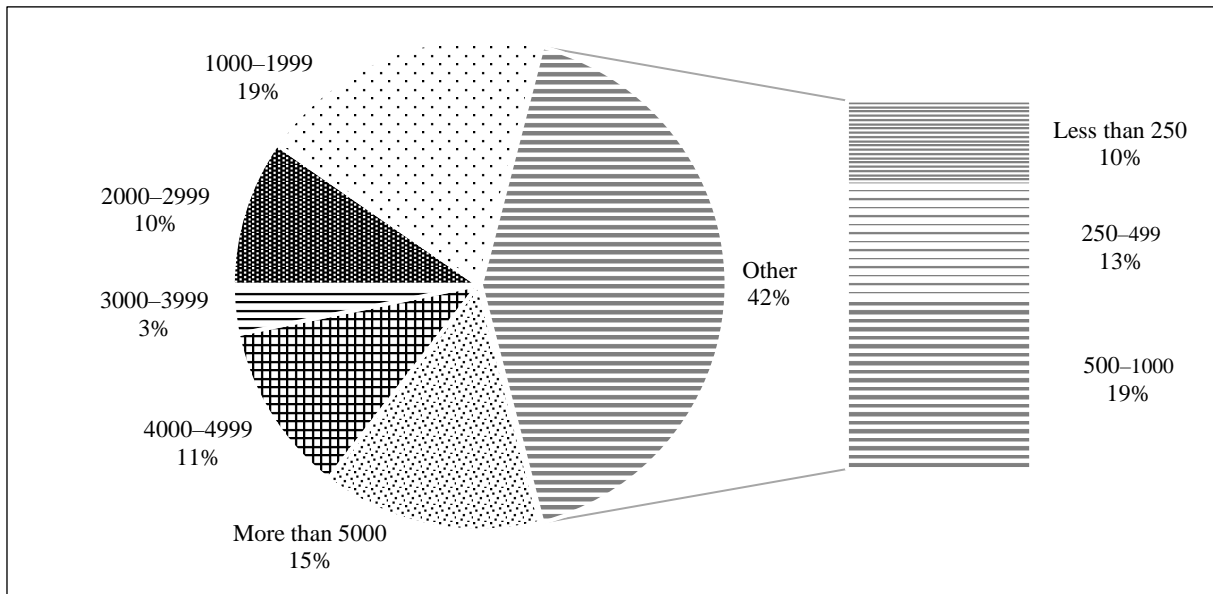
The authors' research results are presented in three aspects: 1) characteristics of the activities of Russian rocket and space enterprises; 2) analysis of their economic and financial results; 3) definition of mechanisms of their development.

2.1 Activities of Russian rocket and space enterprises

In total, there are 62 rocket and space enterprises in Russia. The analysis of these enterprises by number of employees showed that 42% of enterprises employ fewer than 1,000 people. 90%

of these enterprises are large enterprises and the remaining 10% are medium-sized enterprises. These are not small enterprises (see Fig. 1).

Fig. 1: Distribution of Russian rocket and space enterprises by the number of employees



Source: authors

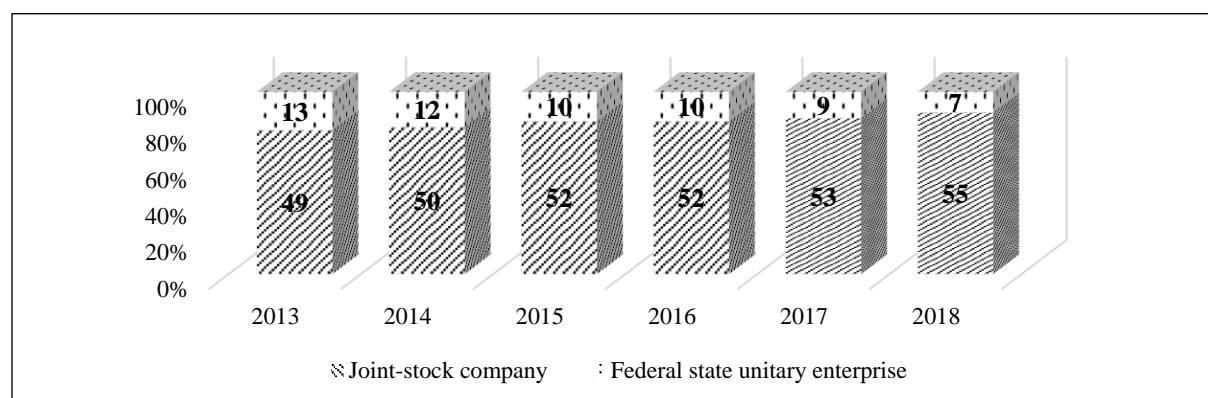
The analysis of main activities of Russian rocket and space enterprises showed that for 48 (77%) enterprises the main activity is the research and development in the field of natural and technical sciences, for 5 (8%) enterprises it is the production of flying machines, including space machines, for 4 (6%) enterprises it is the production of computer, electronic and optical devices, for 3 (5%) enterprises it is the production of control devices, and for 2 (4%) enterprises it is the production of special tools and hydraulic pumps.

Most Russian rocket and space enterprises (37 or 60%) are located close to Russian science and production centres, mainly in Moscow and the Moscow region. The active involvement of private investment in Russian rocket and space enterprises required restructuring of their legal form. There is a systematic transformation of federal state unitary enterprises into joint-stock companies. Currently there are only 7 federal state unitary enterprises, which is 11% of the total number of Russian rocket and space enterprises (see Fig 2).

In the case of 58 (93%) Russian rocket and space enterprises, the state is one of the owners (information on other owners is in many cases not public). The founder of 55 (89%) Russian rocket and space enterprises is the Federal Agency for State Property Management of the Russian Federation, either directly or through holding entities of the Roscosmos State

Corporation for Space Activities, the Khrunichev State Research and Production Space Center, the United Rocket and Space Corporation, the ISS-Reshetnev Company, the Russian Space Systems, or the Makeyev State Rocket Centre.

Fig. 2: Distribution of Russian rocket and space enterprises by the legal form



Source: authors

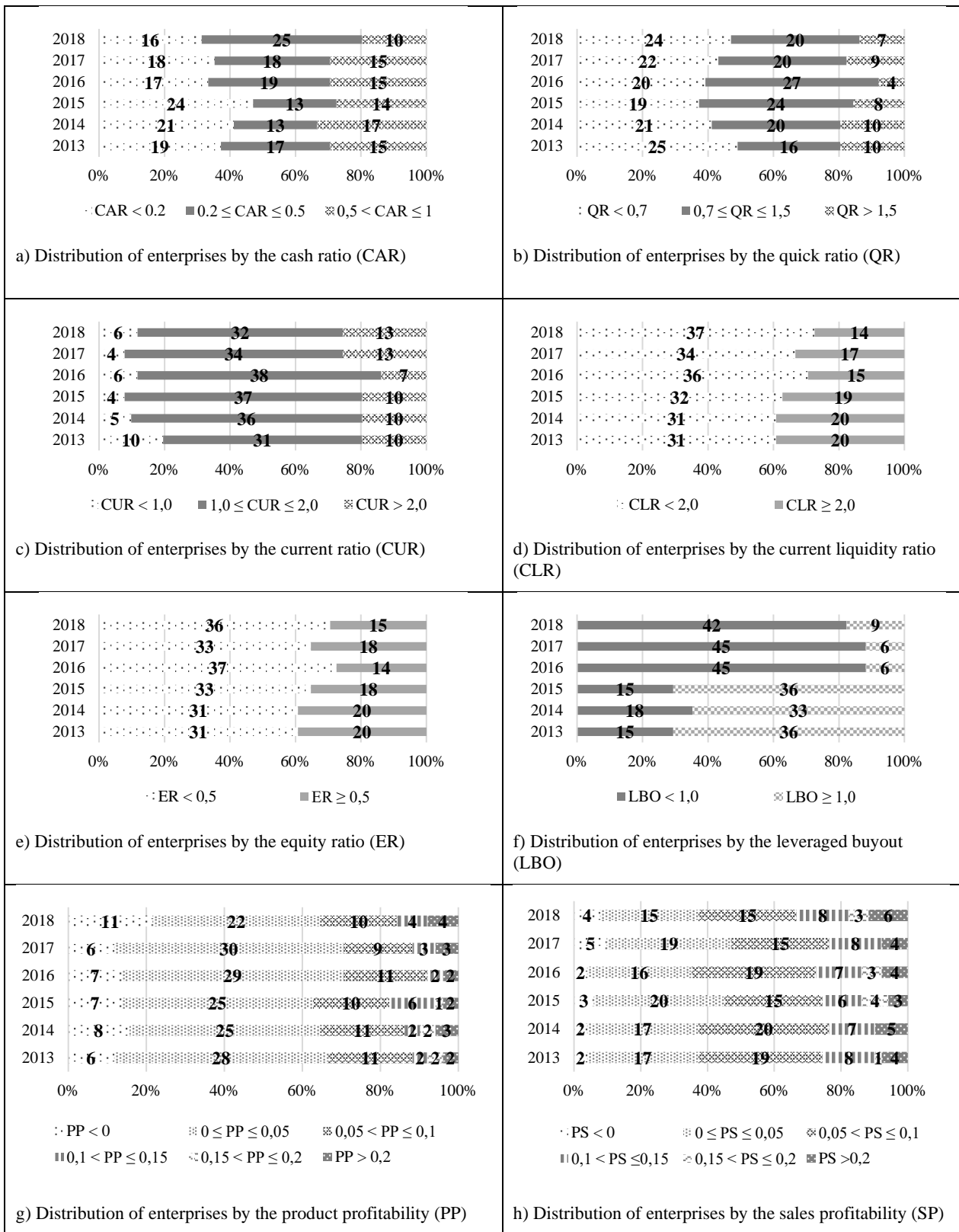
In the case of three Russian rocket and space enterprises, there is a mixed form of ownership. The Mari Machine-Building Plant is a part of holding structures with the participation of foreign partners. Only one Russian rocket and space enterprise is private – the United Space Device Corporation.

2.2 Economic and financial results of Russian rocket and space enterprises

The further development of Russian rocket and space enterprises requires achieving economic and financial stability of these enterprises. The following indicators were chosen to analyze economic and financial results of Russian rocket and space enterprises: liquidity to assess the financial stability of enterprises; profitability to assess economic activities and financial results; and research and development (R&D) expenses to assess the level of innovation activities. The analysis was carried out for 54 (87%) Russian rocket and space enterprises, for which it was possible to obtain complete information.

The results of the analysis are shown in Fig. 3. Distribution of analyzed enterprises by the cash ratio (CAR) showed that about 60% of analyzed enterprises had the cash ratio greater than 0.2, which means "immediate" solvency of enterprises (see fig. 3a). Distribution of analyzed enterprises by the quick ratio (QR) showed that between 31 and 39% of analyzed enterprises in different time periods had the quick ratio corresponding to the standard value (see fig. 3b).

Fig. 3: Distribution of Russian rocket and space enterprises by the solvency

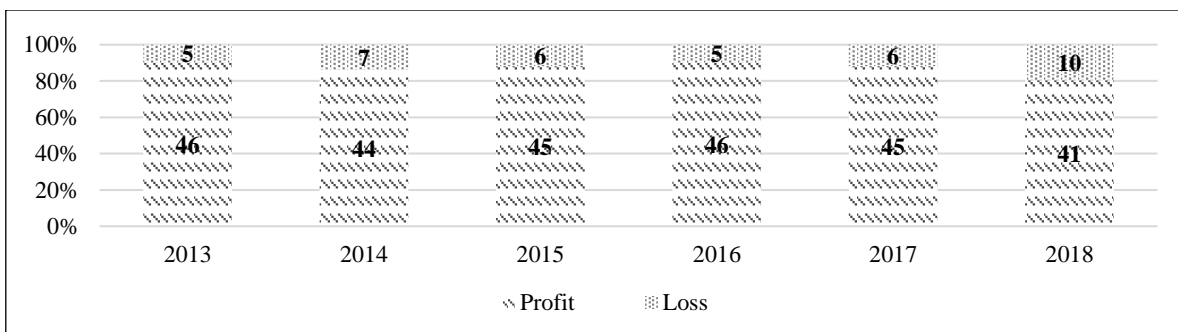


Source: authors

Distribution of analyzed enterprises by the current ratio (CLR) showed that 63% of analyzed enterprises had the current ratio corresponding to the standard value $1.0 \leq CUR \leq 2.0$ and 12% of analyzed enterprises had the current ratio less than 0.2, which indicates a high financial risk (see fig. 3c). Distribution of analyzed enterprises by the current liquidity ratio (CLR) showed that 28% of analyzed enterprises had the current liquidity ratio corresponding to the standard value and 72% of analyzed enterprises were facing solvency problems (see fig. 3d). Distribution of analyzed enterprises by the equity ratio (ER), which means the ratio of equity to total assets, showed that more than 39% of analyzed enterprises do not meet the standard $ER > 0.5$ (see fig. 3e). Distribution of analyzed enterprises by the product profitability (PP) showed that 84% of analyzed enterprises had the product profitability (PP) less than 0.1, which is less than the standard value $PP > 0.1$ (see fig. 3g). This indicates the inefficiency of production in analyzed enterprises. Distribution of analyzed enterprises by the sales profitability (SP) showed that 28% of analyzed enterprises had the sales profitability (SP) corresponding to the standard value $SP > 0.1$, 8% of analyzed enterprises had a negative value of the sales profitability, and 59% of analyzed enterprises were in the area of low sales profitability (see fig. 3h). It follows that the share of profits in the income of 2/3 of enterprises was not high. The remaining enterprises had the sales profitability more than 0.2. This indicates either an effective pricing policy or a monopoly on certain goods or services.

Inefficient management of Russian rocket and space enterprises is also reflected in negative financial results. In the analyzed period, between 5 and 10 analyzed enterprises reported annual losses (see Fig. 4).

Fig. 4: Distribution of Russian rocket and space enterprises by the financial results

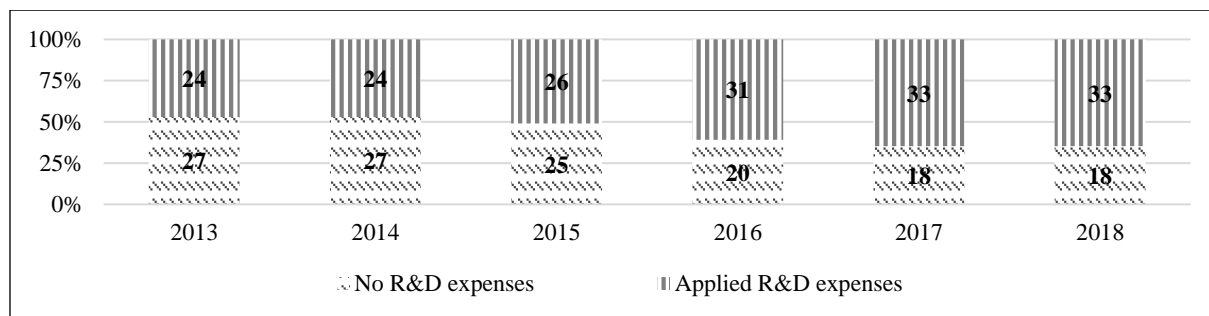


Source: authors

Fluctuations in financial results affect R&D expenses. The number of Russian rocket and space enterprises reporting R&D expenses increased from 24 in 2013 to 33 in 2018 (see Fig. 5). Since innovation contributes to business growth and development, in particular

by reducing costs and simplifying processes (Špaček, 2019), analyzed enterprises are showing a stable development trend. The decline in the scientific and technical level of Russian rocket and space enterprises is due to a cut of state subsidies and a reduction in government contracts.

Fig. 5: Distribution of Russian rocket and space enterprises by the R&D expenses



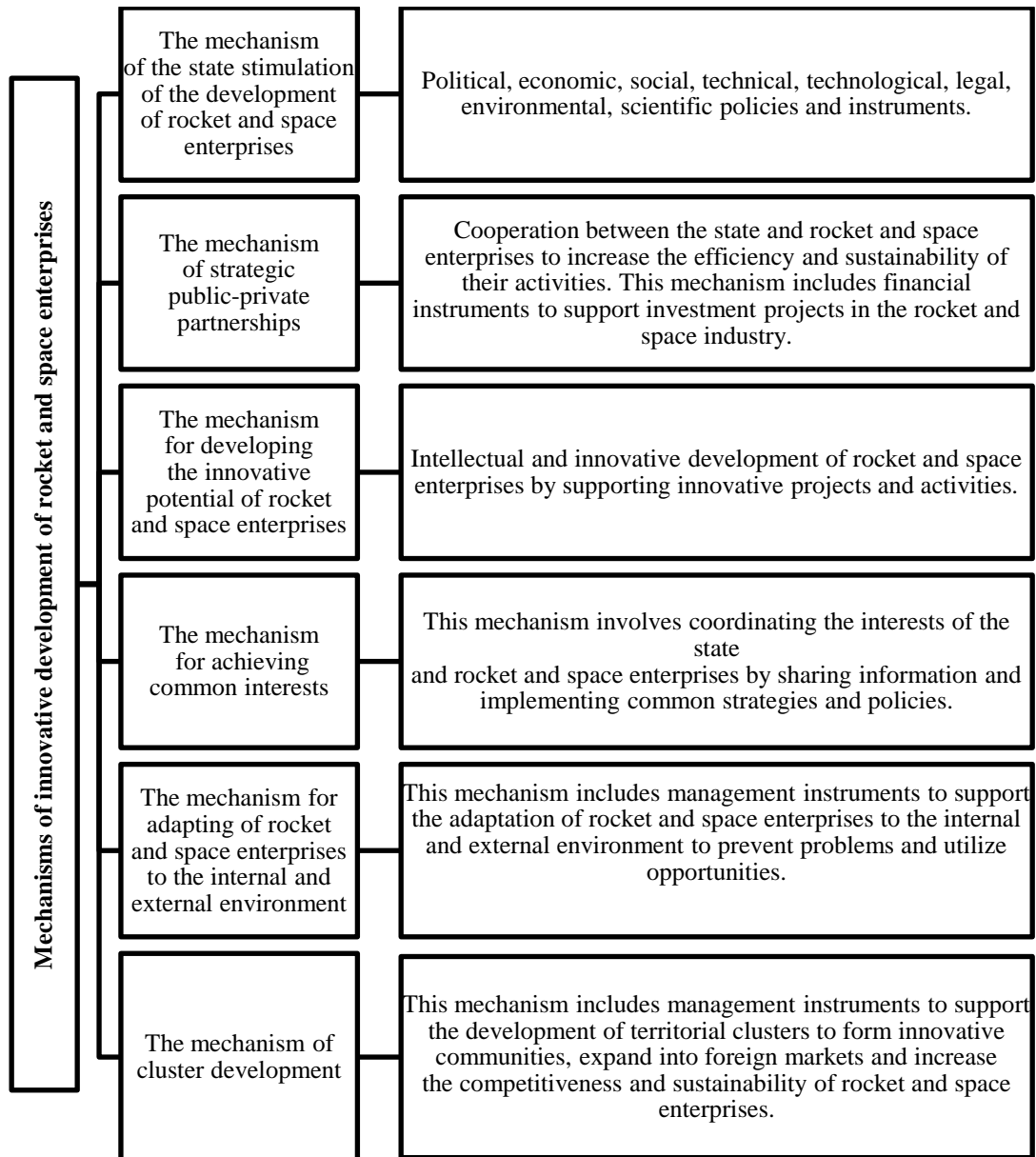
Source: authors

2.3 Mechanisms of innovative development of Russian rocket and space enterprises

A number of challenges hamper the innovative development of Russian rocket and space enterprises, including the lack of skilled employees, financing and investment problems, inefficient organization and management, or insufficient research and development (Antipkina & Shevcova, 2017). Solving these problems seems difficult without introducing new organizational and economic mechanisms of innovative development (Sekerin & Gorokhova, 2017). The authors have proposed such mechanisms with regard to the specifics of Russian rocket and space enterprises (see Fig. 6). The aim of their introduction is self-regulation and self-organization within the external environment leading to the development of new organizational and economic qualities of Russian rocket and space enterprises.

The importance of introducing these mechanisms is determined both by the state priorities and by the specifics of the enterprises themselves. Other countries' experience in managing space activities suggests the need for a strategic public-private partnership. The state should be active mainly in those segments related to national security (Weinzierl, 2018). On the other hand, rocket and space enterprises should be more focused on radical innovations (Van Burg, Giannopapa, & Reymen, 2017). However, large investments in large space projects go beyond the capabilities of commercial enterprises. The state's participation in the activities of these enterprises is therefore objective and necessary. A strategic public-private partnership in the rocket and space industry can effectively meet the needs of both the state and commercial enterprises.

Fig. 6: Mechanisms of innovative development of rocket and space enterprises



Source: authors

The state acts as the owner, consumer and regulator in the rocket and space industry. The development of the rocket and space enterprises requires setting forms and priorities of the state participation in their management. The state should be mainly a regulator in the rocket and space industry, because past experience shows that the state is not the best entrepreneur and as a consumer is mainly interested in military production. However, the rocket and space enterprises should also be involved in commercial projects.

Conclusion

Trends in the development of Russian rocket and space enterprises have been studied by analyzing their current activities. The predominant architecture of the economy and its relationships has been found to force Russian rocket and space enterprises to adapt to global economic trends and competitors. The innovative development of Russian rocket and space enterprises requires finding an effective way of cooperation between the state and enterprises and increasing R&D activities. The role of the state in the business of Russian rocket and space enterprises is high. On the one hand, the state is the main owner, on the other hand, the state is the key customer of Russian rocket and space enterprises. The prevailing share of the state in Russian rocket and space enterprises influences their goals and priorities. The importance of national security and space activities stands above commercial success. Russian rocket and space enterprises still apply a number of organizational and managerial approaches from the times of centrally planned economy. Therefore, the assessment of effectiveness of Russian rocket and space enterprises should take into account both internal effectiveness as the achievement of business goals and external effectiveness as the alignment of business goals with the needs of the external environment.

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