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**TYOLOGY OF FIXED ASSETS REPRODUCTION OPTIONS OF  
ROCKET SPACE INDUSTRY ENTERPRISES**

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***Abstract***

The article presents reproduction options of fixed assets of enterprises by reproduction type and durability, and classification of reproduction options of fixed assets by innovative features. The concept and the strategy of development are a difficult task for the enterprises of the rocket and space industry to ensure the strategy of innovative reproduction of fixed production assets. The necessity of implementing this task under the economic environment and the high level of uncertainty of the decisions explains the need for the classification of reproduction options of fixed assets of enterprises and the allocation of those options that have an innovative component. Typification will determine the existing types of reproduction of fixed assets of enterprises of the rocket and space industry, and their classification by innovative features will determine options that implement the strategy of innovative reproduction. The created classification of innovative types of reproduction of fixed assets has a significant practical significance because the classification contains a detailed understanding of the innovative characteristics of options. Also carried out typing allows proceeding to solve the problem of improving the methodology and developing a methodological tool for strategic planning of innovative reproduction of fixed assets of enterprises of a rocket-space industry.

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**Keywords:** Reproduction of fixed assets, depreciation, sources of financing, the depreciated strategy.



## 1. Introduction

In the Concept of Long-Term Social and Economic Development of the Russian Federation until 2020, the goal of the state policy in the rocket and space industry is the creation of an economically sustainable, competitive, diversified rocket and space industry that will increase the volume of industrial output 1,8 times by 2025 compared to 2015.

One of the priority directions of the state policy outlined in the concept is the modernization of the technological level of the rocket and space industry: technical and technological re-equipment of industrial enterprises, the introduction of new technologies, and the optimization of the technological structure of the industry.

According to provisions of the Concept of long-term social and economic development of the Russian Federation until 2020, the Strategy of development of the space rocket industry until 2025 has been developed.

## 2. Problem Statement

One of the goals of the strategy is to overcome the "significant technological gap from the developed countries," which means that by 2025 the share of new industrial equipment (up to ten years) in the industry should increase to 33-35% from the current 3%. Serious problems are available in the technological field at enterprises of the rocket-space industry. They are noted in the strategy:

- the annual rate of updating fixed assets has decreased to a level less than 1% (at the norm of 7-10%), their depreciation was 65%, and for the active part - up to 75%. These are the average figures. At the same time, in fact, the updating is carried out only at enterprises connected with foreign contracts;
- unique technologies of space engineering are at risk of loss. At 14 enterprises out of 580, basic and unique technologies require modernization of 300, under the threat of loss - 100, completely lost - 80;
- the structure of production equipment deteriorated significantly: only ~ 2.2% of equipment is operated up to 10 years, The share of morally and physically obsolete equipment, exploited for more than 20 years, has reached 70%.

The state of fixed assets, their conformity to modern scientific and technical achievements are formed in the process of their reproduction. This process defines the choice of forms of compensation for wear, methods, and rates of reproduction of fixed assets, as well as the effectiveness of their use (Ye, 2017; Stolyarova, Shulgatoy, Dzagoeva, Bestaeva, & Kaitmazov 2015).

The concept and the development strategy set a difficult task for the enterprises of the rocket-space industry to ensure a strategy of innovative reproduction of fixed productive assets. The necessity of implementing this task under the economic environment and the high level of uncertainty of the decisions explains the need for the classification of reproduction options of fixed assets of enterprises and the allocation of those options that have an innovative component (Oliylyk, 2015).

Typification will determine the existing types of reproduction of fixed assets of enterprises of the rocket and space industry, and their classification by innovative features will allocate options that implement the strategy of innovative reproduction.

### 3. Research Questions

At first, we will consider the existing types of reproduction. There are 2 types of reproduction: simple and extended (Gissel, 2016; Vertakova, Klevtsov & Klevtsova, 2015). The size and quality of the product stay unchanged in each subsequent cycle in the simple form of reproduction. The size of the product is increasing in each subsequent cycle through count and (or) product quality in the extended form of reproduction.

Unity and differences of processes of production and reproduction affect the types of reproduction. Every production is a process of creating material goods. Reproduction is a constantly renewed process of production. Both these processes merge in a real economy. The difference between them is that the product is produced, and the elements of the production process that were spent for the production of the product are reproduced. The process of product production is also a process of consumption of elements of the production process. Continuity of production requires compensation of reproduction of consumed elements.

### 4. Research Methods

Differences in quality and quantity of reproduced elements of the production process stipulate additional characteristics of the types of reproduction: intensive or extensive character of production expansion. The quantitative growth of the individual production forces of the enterprise is the determining sign of the extensive expansion of production and in intensive - their qualitative changes.

The extensive growth of production is due to the quantitative growth of the elements of production (the means of production and labor), the intensive growth is due to a qualitative change in the elements of production and the links between them, accompanied by the improvement of technology and production technology, the growth of workers' skills, the improvement of organization and working conditions (Kukartsev & Gorlevskiya 2013; Gorlevskiya, & Kukartsev, 2014).

### 5. Purpose of study

Types of reproduction suggest a change in the quantitative and qualitative parameters of the products (figure 01). This circumstance allows allocating different types of reproduction on the basis of a Venn diagram (figure 02).

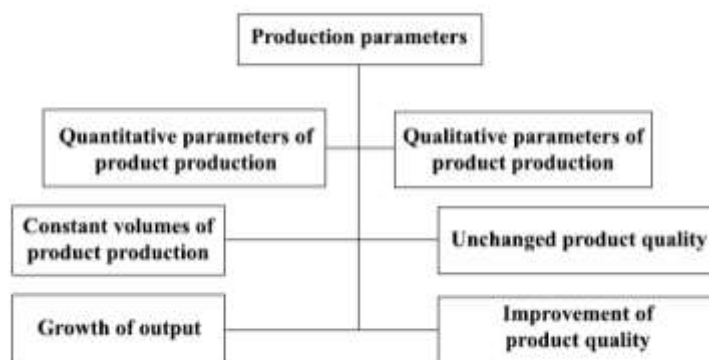
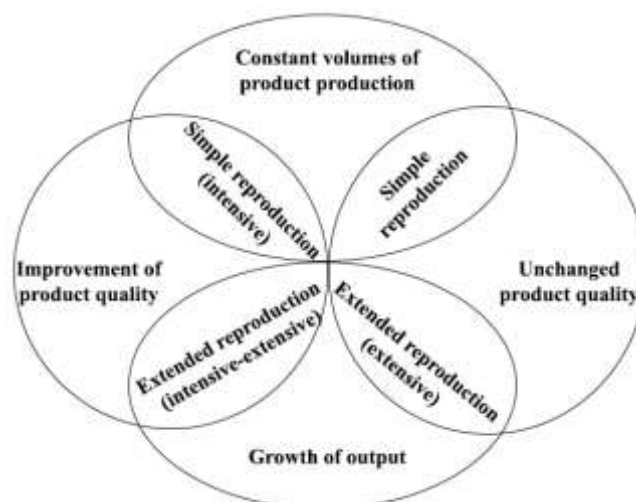


Figure 01. Production parameters



**Figure 02.** Venn diagram of types of reproduction

The unchanging quantitative and qualitative parameters of the produced products characterize a simple type of reproduction. Reproduction of elements of the production process is limited to their recreation in the same quantity and quality. The growth of output with its unchanged quality allocates the first type of extended reproduction. This type is associated with the extensive growth of individual reproduction because it requires the modification of only their quantitative parameters.

The third type of reproduction (the second type of simple reproduction) is characterized by a change in the quality parameters of production while maintaining constant volumes. The increase of qualitative parameters of production is provided with attraction in the reproduction process of more qualitative elements of manufacture. The quantitative growth of attracted production resources is almost impossible to solve this problem. The fourth type of reproduction implement with simultaneous growth of qualitative and quantitative parameters of production. Reproduction of the consumed elements of the production process is accompanied by a mixed intensive-extensive growth in the parameters of the production resources involved.

The Process of individual reproduction (reproduction within the enterprise) exists within the social reproduction and, unlike it, it is more dynamic and receptive to the movement of consumers and scientific and technological progress. Individual reproduction is influenced primarily by the characteristics of the product lifecycle: the presence of a product at one or another stage of its existence reflects trends in the movement of the market or social needs, determining the tendencies of the product of individual reproduction and the type of reproduction. And the types of individual reproduction can replace each other after the movement of the product through the stages of the life cycle.

For individual reproduction, the situation is aggravated by the influence on the production parameters of the competitive environment like the market share occupied by the enterprise and its dynamics. Taking this remark into account, let us consider the features of the reproduction of fixed production assets in the system of individual reproduction. Reproduction of fixed assets is associated with the peculiarities of their participation in the production process: they take part entirely, and the transfer of their value to the cost of the finished product occurs in parts as it wears out.

It is known that deterioration is carried out in two forms: physical and moral. Obsolescence means the loss of fixed assets of their consumer value in case of their use as well as under the influence of the forces of nature. Obsolescence is a consequence of the movement of consumer preferences, when using these fixed assets, it is impossible to provide the required product quality, as well as scientific and technological progress when there are competing types of technical means of production.

The existence of two types of depreciation leads to a separation of the service life of fixed assets into physical and economic and their relatively independent existence.

The physical service life of fixed assets is determined by the retention of technically sound values of the use-value parameters of fixed assets, the output of actual parameters beyond their limits means that the fixed assets are unfit for further use. The physical service life is connected with the functioning of fixed assets in the production process as a material unit of means of labor.

Economic service life is determined by the process of transferring the value of fixed assets in the amount of initially advanced fixed capital (renovation). The period of depreciation (renovation) depends on the size of the parts of the value of fixed assets carried on the cost of production, that is, it is associated with the organization of the transfer process. Economic service life is associated with physical service life. It normalizes the duration of the process of reproduction of fixed productive assets. At the same time, the above-mentioned dependence of individual reproduction on the dynamics of the external environment leads to the fact that the economic service life expectancy differs from its normative value, primarily due to factors of moral obsolescence:

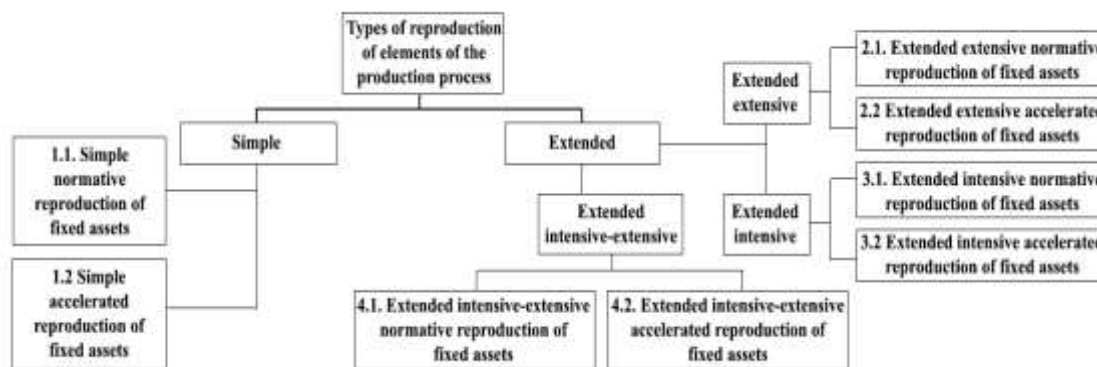
- the discrepancy between the consumer qualities of available fixed assets and the changed requirements to the quality of the product;
- changes in the technology of product production and technology to meet the needs;
- cost depreciation due to inflation, increased the productivity of social labor, etc.

At the present time, moral aging has a priority in the development and implementation of the strategy of innovative reproduction of fixed assets of enterprises of the RCP.

Depreciation is not only a process of transferring the value of fixed assets to the value of the finished product, but also a process of accumulating money (an amortization fund) for partial and full compensation. Full reimbursement of fixed assets occurs at a certain point in time provided that the size of the renovation fund, capitalized profit and attracted third-party funds resources. For the planning of reproduction, it is important that the accumulation is carried out in parts and for a certain period accumulated allocations exists in the form of temporarily free funds and a complete restoration requires a one-time cost to advance a new reproductive cycle of fixed capital.

That is why options for the reproduction of fixed productive assets are formed on the basis of a combination of two characteristics type of reproduction of elements of the production process and term of reproduction (service life) of fixed productive assets. The period of reproduction of fixed assets in a competitive economy tends to decrease due to a significant dependence of the service life on factors of economic depreciation. The requirements of ensuring the consumer qualities of the basic production assets in the conditions of a continuous increase (preservation) of the competitiveness of the enterprise result in shorter service lives and, accordingly, the reproduction of fixed assets.

In this way, we obtain eight options of reproduction of the fixed production assets that differ in the target, economic and technical aspects of their implementation (Stupina, Shigina, Shigin, Karaseva & Ezhemanskaja, 2014) (Figure 03). Let us consider the differences in options, taking into account such important characteristic of fixed assets as production capacity - the potential of the basic production assets for the production of products.



**Figure 03.** Reproduction options of fixed assets of enterprises

Option 1.1 is implemented in conditions of production of Constant volumes of product production with its identical qualitative parameters. Reproduction of fixed assets provides unchanged production capacity. The terms of physical and economic obsolescence coincide. But the stages of the life cycles of products and technologies may require accelerating the return of the advanced fixed capital. There is a need for realization of option 1.2 which is different from option 1.1 by a deviation of economic service life from physical towards reduction. Option 1.1 extends to many cycles of reproduction of fixed assets, option 1.2 is limited to frameworks of one reproduction cycle.

Option 2.1 is characterized by an increase in production with its unchanged quality parameters. The production capacity of the enterprise grows in direct proportion. This option is implemented in many cycles of reproduction of fixed assets in the conditions of evenly increasing demand, which allows preserving the normative equality of physical and economic service life. In the short term, a situation may arise when the market needs to ensure the growth of production, but the need to return the advanced capital requires reduced terms of reproduction of fixed assets. In this case, Option 2.2 is implemented.

Option 3.1 is implemented, when the quality parameters of production change while maintaining constant volumes. The production capacity keeps the quantitative parameters unchanged and changes the qualitative parameter. It, in certain cases, can lead to a decrease in the number of natural units of fixed assets. Updating the fixed assets on a qualitatively new basis generates need of the accelerated return of the capital invested in the active funds. Option 3.2 is implemented for the satisfaction of such requirement because he has reduced reproduction terms.

Options of extensive-intensive reproduction of the fixed assets 4.1 and 4.2 are the most difficult in all aspects when quantitative and qualitative parameters of the products of production capacities are changing. This process cannot effectively proceed in the conditions of equality of physical and economic terms of reproduction. In this case, the advanced capital is "frozen" in fixed assets, which is not used because their consumer properties do not correspond to the changed requirements for the parameters of production. The fixed assets are waiting for a qualitatively different reproduction after the expiry of the

physical service life. The efficiency of reproduction of option 4.2 in the aspect of the return of advanced capital is higher than that of option 4.1.

In conclusion, a set of reproduction options 1.1, 2.1, 3.1, 4.1 for its implementation requires long-stagnant or evenly developing economic (market) conditions. Options with reduced terms of reproduction of fixed assets: 1.2, 2.2, 3.2, 4.2 - are typical for unstable market conditions. The tendency of general growth of instability of the economic environment leads to a growth of the use of the accelerated options of reproduction of fixed assets in the economic policy of the leading powers of the world. Implementation of options with reduced terms of reproduction is doubly important for enterprises of the Rocket Space Industry. There are two reasons for this. Firstly, fixed assets physically and morally have already become outdated. Secondly, the accelerated return of the advanced fixed capital will allow enterprises to solve partially a problem of sources of investment of competitive productions in options of expanded reproduction.

Next, we will classify the types of reproduction defined above by innovative features. Analysis of literature sources (Kukartsev & Gorlevskiya, 2014; Ogurchenok, Gorlevskiya, & Kukartsev, 2014; Gorlevskiya, Ogurchenok, & Kukartsev 2014) showed that there are various classifications of innovations that differ in the principles of grouping and the methods of organization. The following types of classifications of innovations and innovative products are allocated in the theory of innovative management as follows: general (traditional) classification and classification of innovations, taking into account the development of technologies based on "subversive" innovations; one-criteria and multi-criteria classification; narrow - technological innovation and broad - technical, technological, organizational and managerial, information, social, etc.

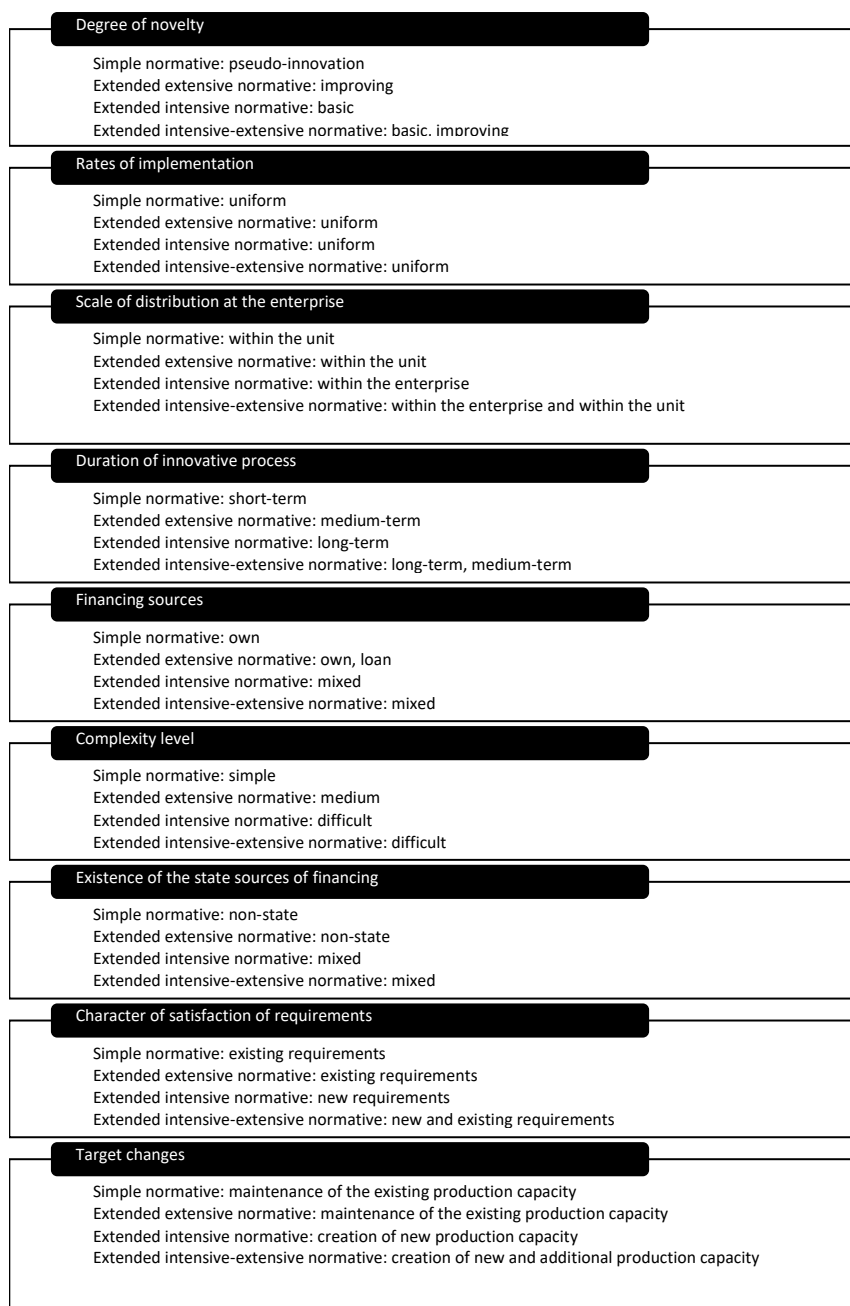
## 6. Findings

Nine major innovative classification features were identified as a result of the analysis. They take into account the characteristics of innovative reproduction (Ogurchenok, Kukartsev, & Gorlevskiya, 2014). Some features partially overlap, the separate types of innovations, based on them, duplicate. The proposed features as a whole make it possible to give a volumetric characterization of the studied set of types of reproduction (figure 04).

1. according to the degree of novelty, innovations are:
  - basic, directed to development of new generations of machine and based on essentially new technologies;
  - improving - affect the innovations associated with the introduction of significantly improved production methods. These innovations disseminate and improve established generations of technology;
  - pseudo-innovation - imply minor technical or external (design, decor, etc.) changes in technology (technology).
2. on rates of implementation: uniform, fast;
3. on the scale of distribution at the enterprise: within the unit, within the enterprise;
4. on the duration of an innovative process: short-term; medium-term; long-term;
5. on financing sources: own, loan, mixed;

6. at a complexity level: options simple and difficult;
7. on the existence of the state sources of financing of an innovation: the public, non-state and mixed financing;
8. on the character of satisfaction of requirements: for the satisfaction of new requirements; for the satisfaction of the existing requirements;
9. on target changes: maintenance of the existing production capacity, creation of additional production capacity, a creation of new production capacity.

Based on the characteristics of the classification obtained, it can be concluded that only the options for expanded intensive and extended extensive-intensive reproduction have a truly innovative potential.



**Figure 04.** Reproduction options of fixed assets of enterprises



## 7. Conclusion

The created classification of innovative types of reproduction of fixed assets has a significant practical significance because it gives a detailed description of the characteristics of options. Also, the typification allows passing to a solution of the problem of improvement of methodology and development of methodical tools of strategic planning of innovative reproduction of fixed assets at the enterprises of rocket-space industry.

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