




# Methodological Approach to Justifying the Composition of Positions to Be Included in the Personnel Reserve of Science-Intensive Enterprises of the Defense-Industrial Complex

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Keywords: Enterprise, Military-Industrial Complex, Personnel Reserve, Composition

Abstract: The long-term nature of sanctions restrictions on defense industry enterprises necessitates ensuring their technological independence. A key condition for ensuring the technological independence of defense industry enterprises is the formation of a personnel reserve focused on working with the civilian and dual-use product markets. However, despite the sufficient degree of development of the problem, comprehensive scientific solutions have not yet been developed for defense industry enterprises, particularly in the area of technological independence, and the problem requires a substantiated scientific study taking into account new trends. The methodological basis consists of traditional methods of scientific analysis: economic and logical analysis, systematization, and ranking. In terms of the level of diversification and the share of new products, a matrix for classifying the competencies of positions subject to the provision of a personnel reserve and a methodology for substantiating the composition of positions to be included in the personnel reserve have been developed. The proposed methodological approach allows us to determine the composition of positions at defense industry enterprises subject to provision with a personnel reserve, based on the systematization of competencies and positions that generate the added value of enterprises, and their prioritization according to criteria that ensure the solution of problems of technological independence.

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## 1 INTRODUCTION

Regulatory documents defining the composition of positions subject to personnel reserve at defense-industrial complex (DIC) enterprises provide a fairly broad standard list, covering all possible industry-specific situations. Enterprises are faced with the task of selecting the optimal composition and number of positions to be provided by the personnel reserve, taking into account the specifics of a particular enterprise. This necessitates the development of a methodology for justifying the composition of positions to be included in the personnel reserve of specific DIC enterprises, taking into account the objectives of ensuring technological independence (Vinogradov, Pal'mov, 2015; Berkutova, Mahova, 2022; Bogomazova, Bogdanchikova, 2023).

The aim of the work is to develop a methodological approach to substantiating the composition of positions to be included in the personnel reserve.

## 2 MANUSCRIPT PREPARATION

It is generally accepted that when justifying the composition of positions to be provided by the personnel reserve, the following factors are taken into account:

- the composition of typical positions subject to inclusion in the personnel reserve in accordance with regulatory (including industry) documents;
- development strategies for defense industry enterprises;
- level of supply in the labor market.

An analysis of literary sources allowed us to identify typical positions included in the company's personnel reserve:

- managers at all levels;
- chief specialists;
- positions on which the company's performance directly depends;
- positions that require unique competencies;
- positions that are in short supply on the labor market (Bazueva, Oseyan, 2022; Balynskaya, Rahimov, 2019; Botvinnik, 2012; Vinichenko, 2014; Gegechkori, Useinova, 2016; Ginieva, Dolzhenko, 2016; Dzhabrailova, Magomadov, Magomadova, 2022; Dundar, 2008; Oparina, 2013; CHulanova, Mokryanskaya, 2017).

The composition of positions subject to provision by the personnel reserve at enterprises of the military-industrial complex is determined in accordance with the "Unified methodological materials for the formation and development of the federal personnel reserve of the management staff of the defense-industrial complex" by categories - "Managerial scientific and technical personnel" (clause 7.1), "Heads of organizations" (clause 7.2), "Independent directors and external heads of defense industry organizations" (clause 7.3), "Management staff of governing bodies of defense industry sectors" (clause 7.4).

In accordance with regulatory documents, the following are also subject to provision of a personnel reserve in the defense industry:

- heads of departments of subsidiary research institutes and design bureaus;
- heads of main workshops (procurement, processing, assembly), auxiliary workshops (repair and mechanical, tool, energy) and service facilities (transport, warehouse);
- heads of pilot production facilities;
- scientific directors of research and development,
- chief designers of experimental design work;
- heads of auxiliary units;
- project managers.

The selection of positions included in the personnel reserve is also influenced by the type of enterprise strategy, within the framework of which the need to develop new markets is determined; the rate of change in production volumes; the scale of modernization and the associated levels of change; the composition of products (military, dual-use, and civilian products); the level of technological advancement of products (high-tech products, products based on mastered technologies); the need to master new technologies.

In addition to the standard composition of positions subject to provision by the personnel reserve at defense industry enterprises, inclusion in the personnel reserve, First of all, the positions within which the greatest volume of added value is created are subject to this.

In the context of ensuring technological independence and meeting the needs of a special military operation, the volume of added value is maximized in the event of an increase in the production volumes of defense industry enterprises through the scaling of products within the framework of the state defense order and the production of high-tech civilian and dual-use products (HTCPs), which are replaced when foreign

manufacturers leave the markets, or as a result of the development and implementation of new high-tech products that surpass the tactical and technical characteristics of the enemy and/or ensure the replacement of foreign-made products.

In the first case, the key positions included in the personnel reserve include managers in the field of management and production organization, and in the second case - developers of new products, specialists in experimental design and technological work, positions in pilot production and small-scale production.

The composition of positions included in the enterprise's personnel reserve is determined by the degree of differentiation of types of activities and the corresponding differentiation of personnel.

The simplest and most common method for assessing a company's level of diversification is the calculation of the specialization coefficient (*SR*), which can be used in cases where there is a dominant core business area among the company's businesses. The company's headcount is used to calculate *SR*.

The calculation is made according to the formula:

$$SR = \frac{x_1}{x}, \quad (1)$$

where  $x$  is the total number of employees of the company;  $x_i$  is the number of employees who are employed in the main industry.

More informative than the indicators discussed above is the Berry Index, which allows for a more in-depth analysis of diversification. The Berry Index is calculated using the formula:

$$BI = 1 - \sum_{i=1}^N (x_i/x)^2 = 1 - \sum_{j=1}^K S_j^2, \quad (2)$$

where  $S_j = \frac{x_j}{x}$  is the share of the company's employees who are engaged in the  $j$ -th type of activity (industry).

the Herfindahl - Horshman index . Squaring in such indices compensates for the lower weight of secondary (small) activities (industries) of a company.

The Berry Index is lowest  $\min BI = 0$  if the company operates primarily in one area of activity, i.e., is specialized. If the company is evenly diversified, the Berry Index can reach its highest value:  $\max BI = (k - 1)/k$ .

The level of diversity determines the similarity of personnel skills and influences the number of positions in the talent pool. The higher the level of diversity, the lower the level of similarity of personnel skills and the larger the size of the talent pool.

In the context of technological independence, engineering and technical personnel capable of developing and implementing new products and technologies aimed at reducing the dependence of domestic military products (MP) and civilian and dual-use products (CDP) on foreign-made products play a significant role in generating added value for defense industry enterprises. In such a situation, the structure of the talent pool should be considered in terms of prevailing competencies in production and/or development, which depends on the share of new products in the enterprise's output.

## 4 CONCLUSIONS

In the context of the presented criteria – the level of diversification and the share of new products – a matrix for classifying the competencies of positions subject to provision by the personnel reserve was developed (Figure 1).

The first quadrant of the matrix includes enterprises with a low diversification coefficient and a low share of new products.

Such companies have a specific specialization and a homogeneous product range, which is updated within product groups. This situation can be typical for both highly specialized companies with mass and serial production, as well as niche market participants that meet the needs of a small segment of consumers.

Such companies typically have a low demand for new product developers. Overall, the need for personnel is driven by the need to maintain and/or expand existing production.

The staff that creates added value includes specialists in production unit management, quality management, and improving production efficiency.

For this group of enterprises, the personnel reserve will include highly specialized developers and specialists in the organization and management of production.

The second quadrant of the matrix contains companies with a high diversification ratio and a low share of new products. These companies are characterized by a heterogeneous product range and are most often in the growth stage of production, which is characterized by scaling challenges.

A significant portion of added value for such enterprises will be generated by personnel with skills in organizing and managing production. Moreover, the skills of such personnel will be differentiated depending on the type of product (product group).

The personnel reserve for such an enterprise should be dominated by specialists in production management, improving its efficiency, with differentiated skills depending on the various product groups and corresponding technological areas.

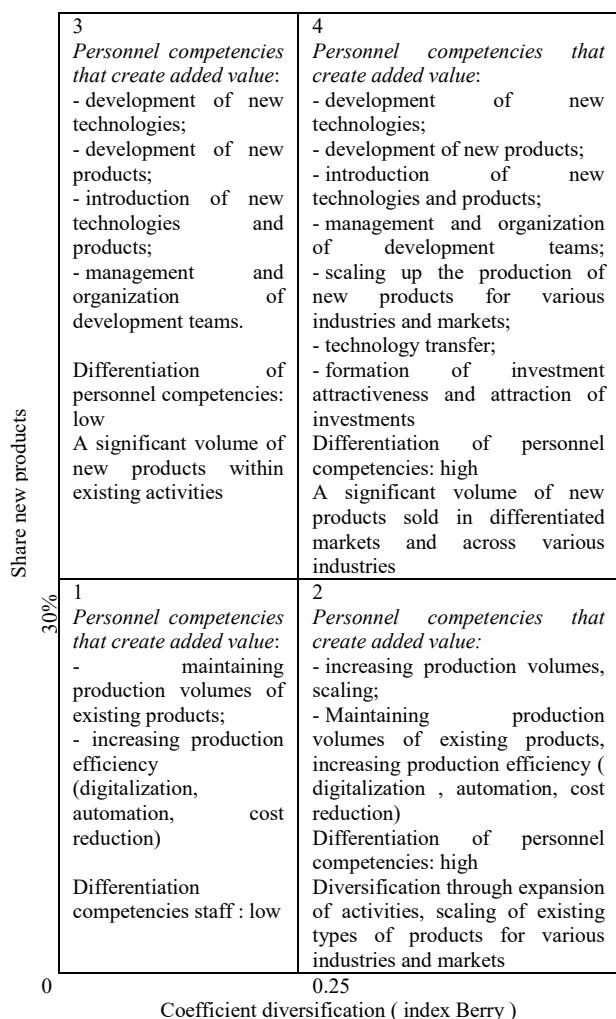


Figure 1. Matrix of classification of competencies of positions subject to provision by the personnel reserve in the context of the target strategies of the enterprise (developed by the authors).

The third quadrant of the matrix includes companies with a high share of new products in their production volume and a low diversification ratio.

These companies are developers of products within a specialized product range.

The main specialists creating added value for this group of enterprises are developers (designers, technologists), specialists – managers of development teams, possessing similar skills within a narrow range.

The fourth quadrant of the matrix includes enterprises characterized by a high diversification coefficient and a high share of new products.

The staff that creates added value includes both developers and specialists in the field of production organization and management, with significant differentiation in staff skills.

Thus, according to the classification of personnel creating added value, the following positions are proposed:

- focus of key skills of personnel creating added value - production and/or development.
- differentiation of the skills of personnel creating added value: insignificant at a low level of new products, significant at a high share of new products;
- identity of professional competencies: high/low.

Based on the identified composition of competencies that form the added value of defense industry enterprises, positions corresponding to the competencies are determined in order to determine the need to include them in the enterprise's personnel reserve (Table 1).

Next, it is necessary to prioritize competencies and positions based on their contribution to solving the problems of ensuring technological independence. Prioritization criteria:

- increasing the availability of domestic components for weapons, military and special equipment (VVST);
- development of domestic technology from the list of BKPT and BKVT;
- development of products to replace foreign-made products purchased from unfriendly countries;
- increasing productivity in the production of products used in military and special equipment samples.

The form for prioritizing positions and competencies for compliance with the tasks of technological independence and technological leadership is presented in Table 2.

Table 2. Form for prioritizing positions and competencies for compliance with the objectives of technology independence and technology leadership.

Key value-adding	Po sition	Analysis of positions and competencies for compliance with the objectives of technological independence and	Fi n al
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competency (in general terms)	s - be ar- wh ether the com- pte r ten de nci es	technological leadership				R a y - ti ng
		increasing the availability of domestic military equipment samples nymi set - ing	development domestic technologies	development of products to replace foreign-made products purchased in hostile countries - nykh countries	increasing productivity in the production of products used in military and special equipment samples	

Source: developed by the author

Based on the proposed methodological approach, a methodology was developed for substantiating the composition of positions to be included in the personnel reserve of defense industry enterprises (Figure 2).

## CONCLUSIONS

The proposed methodological approach allows us to determine the composition of positions in defense industry enterprises subject to provision with a personnel reserve, based on the systematization of competencies and positions that generate the added value of enterprises, and their prioritization according to criteria that ensure the solution of problems of technological independence.

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## APPENDIX

Table 1. Form For definitions positions corresponding to competencies that generate the greatest added value of a defense industry enterprise

Enlarged competencies	Key positions	Name of products/projects/topics/areas within the framework of the strategic approach of the defense industry enterprise					
		Scaling the PvP	Scaling up to industrial-grade PGDN	Scaling up into consumer-grade PGDN	Diversification in the military	Diversification into industrial PGDN	Scaling up into consumer-grade PGDN
Development of new technologies New product development	Supervisor center developments						
	Main constructor topics						
	Main technologist topics						
	Scientific supervisor topics						
	Design engineer						
	Process engineer						
	Engineer experienced production						
Introduction of new products into production	Supervisor experienced production						
	Leaders production divisions						
	Process engineer						
	Specialist By organizations production						
Transfer technologies	Specialist By debugging equipment						
	Design engineer						
	Process engineer						
	Patent specialist						
	Intangible Asset Commercialization Specialist						
Scaling production	Specialist By organizations production						
	Specialist in digitalization and automation of production						
	Specialist in attracting foreign investment (including government)						
	Process engineer						
	Standard setter						

Source: developed by author

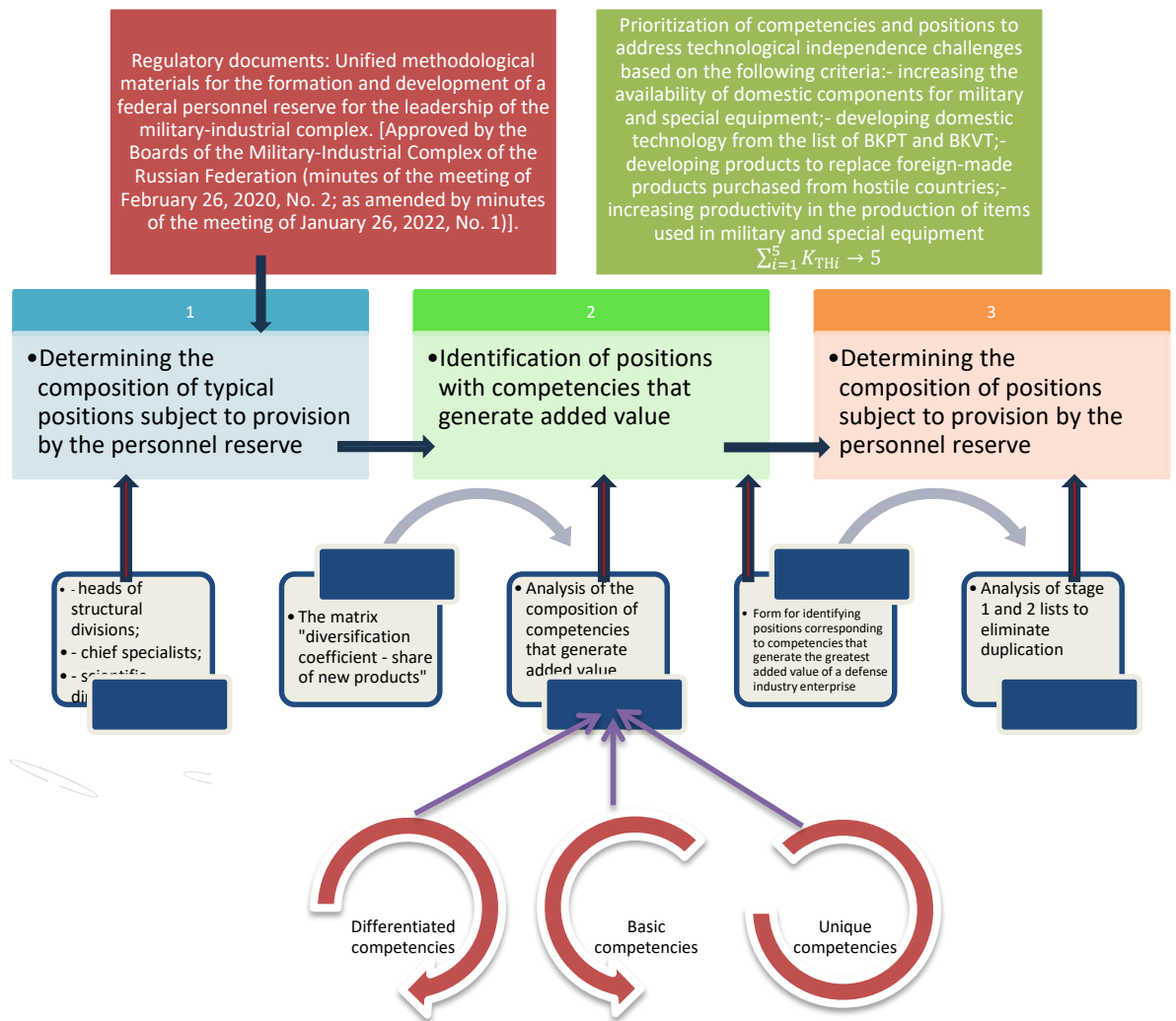


Figure 2. Methodology for substantiating the composition of positions to be included in the personnel reserve  
 Source: developed by authors