

# Development of human capital in the military-industrial complex of Russia in the context of digital transformation

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**Abstract.** The paper formulates the main areas of human capital development in the Russian military-industrial complex in the context of digital transformation. To remedy the current situation, it is necessary to change the system of training of employees of the defense industry, including scientific and pedagogical personnel and specialists. To do this, it is necessary to change the regulatory framework that determines the training of personnel for the defense industry enterprises, to develop methodological recommendations for a comprehensive assessment of the state of human resources in the defense industry; to develop new training programs that take into account the needs of the digital economy, to ensure a close connection of educational institutions with the employer of the military-industrial complex, to form a system of corporate training, a knowledge management system.

## 1 Introduction

The need for staffing the national defense capability in the context of the introduction of digital technologies determines the need to improve the organizational and structural mechanism for managing corporations of the military-industrial complex of Russia, to ensure its effective functioning as a high-tech, science-intensive and diversified sector of the country's economy, which is able to meet the needs of the Armed Forces in modern new weapons and also to ensure the strategic presence of Russia in the world markets of high-tech products and services [5].

The scale of the defense industry's activity, the main areas of its development and the nature of this activity cannot be determined only by market mechanisms. Maintaining the military-economic potential of the country at the required level requires purposeful, systematic and qualified state regulation.

The introduction of digital technologies at defense enterprises of the military-industrial complex requires a set of measures to develop human capital in the face of changing business models of enterprises, changes in organizational structures. At the same time, digital technologies lead to technological changes in production processes, while

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contributing to an increase in labor productivity, and the creation of new highly efficient jobs [3].

At the same time, the demand for new competencies of personnel is being formed, the personnel policy of the enterprise is changing in the direction of ensuring the growth of human capital of high-tech and science-intensive enterprises of the Russian military-industrial complex [9].

New capabilities of advanced production technologies contribute to a significant increase in the role of technological competencies that are able to create innovative technologies and products, actively develop mechanisms of open innovation, which requires the formation of new technological competencies at the enterprise, as well as the use of third-party ones, that ensure the solution of problems and tasks in the context of the digital transformation of the economy.

Artificial intelligence, new methods of information processing (text mining, Big Data), the arrival of new generations of workers in business will require accelerating the rate of development of the human capital of defense enterprises [10].

The introduction of digital technologies into production is preferable, first of all, in science-intensive and high-tech industries, which are the most developed in the technical and technological equipment of production, have a highly qualified staff. Lagging industries that do not have the necessary digitalization skills can experience a powerful destructive effect when digital technologies are introduced [8].

## 2 Methods

To assess the impact of the introduction of digital technologies on the growth of the human capital of high-tech enterprises, a survey was conducted, as well as meetings of working groups on assessing the impact of staffing on the effectiveness of the implementation of digital technologies and analysis of opinions.

The research methodology is based on existing theoretical developments in the field of competence approach, personnel management, corporate governance. In the course of the study, methods of system analysis, expert assessments, dialectical approach, forecasting, etc. were used.

When writing the paper, the authors used methods of strategic management of high-tech industrial enterprises, where digital technologies were introduced, producing science-intensive, high-tech and innovative products.

The hypothesis of the study was that the development of the human capital of defense industry enterprises through the management of unique technological competencies will ensure the achievement of advanced innovative development of high-tech enterprises in the Russian military-industrial complex.

## 3 Results

The stock of human capital in Russia is estimated by the human capital index (World Economic Forum). Russia ranks 16th out of 130 countries. Russia has one of the highest rates of school enrollment. At the same time, there is a low quality of institutions, which prevents the increase of the competitiveness of our specialists [6].

The main approaches to the development of the human capital of defense enterprises for staffing the processes of introducing digital technologies in the digital economy are presented in Figure 1.

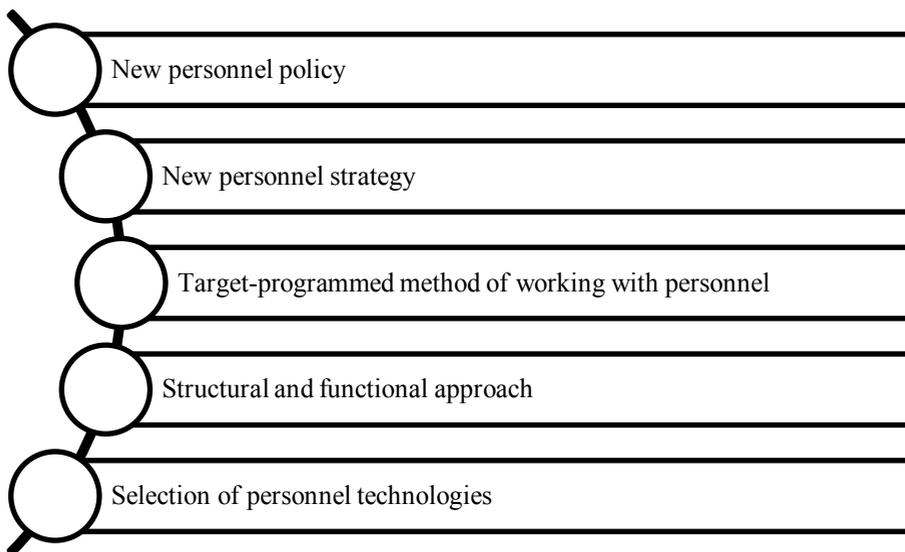


Fig.1. Main areas of human capital development in the digital economy.

### 3.1 New personnel policy

In the conditions of Russian reality, the most important task on the path to reviving the defense industry is to preserve the main part of scientific and technical personnel at the enterprises and organizations of the industry, of whom today there are more than 2 million specialists. Personnel policy, as well as human capital, should be focused on sustainable development and attracting professionally trained, entrepreneurial people with innovative creative aspirations and motives to the central and regional structures of the defense complex [1].

Therefore, in its basic settings, personnel policy should be:

**complex**, based on the unity of goals, principles, forms and methods of working with personnel, taking into account various aspects of solving personnel issues (economic, social, political, moral, socio-psychological, etc.);

**single** and at the same time (due to the specifics of the industry) *multi-level* (central and regional), covering the entire personnel corps, many personnel processes with various mechanisms and the degree of impact on them;

**promising**, having a proactive and anticipatory character, designed for the formation of personnel taking into account social progress, including changes in the content and nature of workers' labor;

**democratic** in terms of goals, social base and mechanism for solving personnel problems;

**spiritual and moral**, fostering philanthropy, honesty, conviction of righteousness, civil responsibility for the task entrusted, and personal behavior in every worker;

**legal**, implemented within the framework and on the basis of the law, which creates legal guarantees for an objective and fair solution of personnel issues.

It is these features that should become meaningful principles of the personnel policy of state organizations and institutions in modern conditions. They will give it unity and essential certainty in the ongoing work with personnel, and also act as the basis for the interaction of all subjects of personnel management [2].

When developing the personnel policy of an organization, it is necessary to take into account the following factors: economic, social, political, legal and environmental factors.

Important factors are the existing level of the structure of team management (by profession, qualifications, categories, age, etc.) and optimization of the number of personnel [7].

Personnel losses over the past twelve years have been associated primarily with the fact that the state has almost ceased to finance this area of activity, especially applied research, as it does not correspond to market forms of national economy management. At the same time, during the period of reforms, it was possible to preserve the leading sectoral scientific institutes, giving them the status of State Scientific Centers (SSC), which made it possible to preserve the scientific infrastructure and support leading scientists in their research.

The qualitative differences between the personnel of the defense industries consisted in the specific conditions of their formation - from training, selection of specialists to the formation of highly effective and capable teams with a high level of motivation. Within the framework of the planned economy, there was a state system to solve this problem, but in the new conditions, an adequate state-regulated market model was not created. The latter should cover the labor market, capital market, product market and the market for educational services.

### **3.2 New personnel strategy**

Any enterprise that is focused on successful existence and development plans its activities not only for the nearest period of time, but also for the future. The personnel strategy of the organization plays a very important role in this.

The personnel strategy should be long-term (the formation of a motivation system, psychological attitudes, personnel management system, personnel structure takes a lot of time); has a connection with the strategy of the enterprise as a whole.

The development and implementation of the personnel strategy is continuous. This is reflected in close relationship with the solution of the strategic objectives of the enterprise in the short and medium term, as well as in the long term. This kind of concretization of the personnel strategy is embodied in a strategic plan, which contains tasks and specific measures for its implementation, deadlines, responsible persons for each individual task, the amount of resources required for implementation (financial, informational, etc.).

The developed strategy should contribute to: strengthening the capabilities of the enterprise to resist competitors in the labor market, to use its strengths and weaknesses in the external environment as efficiently as possible; increasing the competitive advantages of the enterprise by creating conditions for the effective use and development of labor potential, the formation of competent and qualified personnel; disclosing the abilities of employees for innovative, creative development in order to achieve not only the goals of the enterprise, but also the personal goals of employees.

### **3.3 Target-programmed method of working with personnel**

Personnel management of a state institution should act as an active, consciously organized social action characterized, first of all, by a clearly expressed purposefulness, which is formed on the basis of the implementation of certain goals and priorities. The goal appears in the form of a planned image, achieving the desired result. Hence the importance of mastering the so-called target-oriented method of working with personnel. It becomes decisive in the management of the personnel of the institution in conditions when the country does not yet have a centralized system (as a single state structure) of personnel management of federal, regional and local authorities.

At the same time, it can be assumed that the personnel policy of a state organization and its important component - human capital management, including attraction, selection and retention of personnel - pursues the following main goals: the formation of high professionalism and culture of management and technological processes, the achievement of staffing all areas of labor activity with qualified, active and highly moral workers; the most effective use of the intellectual and personnel potential of employees, its preservation and development; creation of favorable conditions and guarantees for each employee to show their abilities, to realize positive interests and personal plans, stimulating his professional growth and career advancement in every possible way, increasing labor efficiency. It is obvious that such a personnel policy is hardly possible without the use of appropriate procedures, the introduction of new personnel technologies, and responsibility for their formal and bureaucratic application. Effective personnel technologies existed before, but they were used for different purposes, filled with different content. Today's management science understands them as a set of methods, techniques, organizational procedures aimed at optimizing work with personnel. The choice of technologies and the corresponding specific mechanisms for their implementation at a certain stage is the organization of personnel work in an institution, the essence of its long-term personnel strategy (policy) [1].

### **3.4 Structural and functional approach**

In the analysis and assessment of the state of staffing of a state institution, a structural and functional approach is required. Structural and functional analysis is one of the most important research approaches to the study of staffing for innovative processes. This approach is most widely used in the theory of organizations, when the problem is formulated with the functional division of labor in the enterprise, as well as the problem of the interconnectedness of the functions of individual system units. This presupposes a clear definition of the functions and competences of the subjects of work with personnel, the delineation of powers and responsibilities of the management and their personnel services, the determination by each subject of the personnel policy of its priorities, tasks for working with personnel for the long term. All this is reflected in targeted and comprehensive personnel programs, action plans, etc.

It is also important to use (taking into account the specifics of the formation of its structures and functions) their own technologies for working with personnel in the institution. In the course of personnel management, it is necessary to adjust stable and reliable mechanisms and technologies for working with personnel. It is necessary to predict, program and plan work with personnel; determine the needs for personnel and propose measures to meet them.

The formation of an employee assessment system, taking into account not only the abilities and professional competence of a person, but also the quality of work, will contribute to an increase in the efficiency of his official activities, the formation of a new social status of the employee.

### **3.5 Selection of personnel technologies**

Selection of personnel technologies is largely a matter of personnel practice. This process cannot be dogmatized, since the choice of technologies largely depends on specific conditions, resources and capabilities, on the tasks and stages of achieving the main goals [11].

Personnel technology is a means of managing the quantitative and qualitative characteristics of the personnel composition, which ensures the achievement of the main goals of the company and its effective functioning.

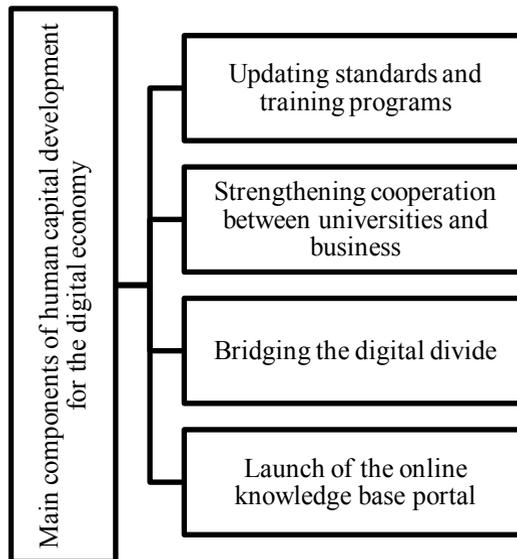
The content of personnel technologies is a set of consistently performed actions, techniques, operations that contribute to obtaining information about a person's capabilities (skills, abilities, capabilities, professional knowledge), and also allow forming the conditions for their implementation required for an enterprise.

Personnel technologies perform certain managerial functions: they provide a differentiated impact on the system of social relations of quantitative and qualitative characteristics of personnel, a more subtle and more rational inclusion of the employee's professional capabilities into the system of prescribed roles of the enterprise, and on their basis, a mechanism for the demand for a person's professional abilities in the enterprise is developed, for example, when introducing digital technologies.

Thus, personnel technologies are organically included in the management structure of the enterprise, have their own specifics and the object of their influence.

## 4 Discussion

The main components of human capital development for the digital economy include updating standards and training programs, strengthening cooperation between universities and businesses, reducing the digital divide, and launching the online knowledge base portal (Figure 2).



**Fig. 2.** Main components of human capital development for the digital economy.

### 4.1 Updating standards and training programs

The development of digital technologies imposes new requirements on the system of training personnel of defense enterprises, while training is required not only for programmers and engineers, but also for specialists with fundamentally new skills and competencies.

Western experts are trying to predict personnel rates for digital technologies. For example, British experts have calculated that by 2020, their country needs to double the number of trained engineers and specialists in the field of digital technology.

Russian officials have repeatedly announced a shortage of personnel in the IT sector. In Russia, there are only 350 thousand highly qualified IT specialists, while to fulfill the tasks of import substitution, at least a million is needed within 5-7 years [4].

The main task of the state in these conditions is to reorient the educational system to train specialists who meet market demands. It is necessary to introduce into the practice of teaching new educational standards and programs on key topics of digital technologies.

The Russian state program for the training of specialists is focused on training 60 thousand specialists in the field of information technology in 2020, and 100 thousand specialists by 2025 [12].

Changes in the labor market affected a change in the demand for creative people with systems thinking. Since human communication does not lend itself to automation, the digital transformation will require more specialists who can work in a team. At the same time, the return on communication skills increases. Since the volume of information is increasing in the context of digitalization, the need for specialists who can work with texts and data is also increasing.

If earlier everyone was engaged in developing professional skills, now it is necessary to add Digital Skills and Soft Skills. We are already lagging behind in the knowledge economy, there is not enough people with so-called 21st century skills and a new type of thinking.

The main systemic problem of providing the military-industrial complex with personnel is that the current state of the system of multi-level continuous education (secondary specialized, higher and additional vocational education) and the implemented set of state measures to retain personnel in the military-industrial complex do not fully meet the needs of the innovative development of high-tech branches of the defense industry and are insufficient to attract and retain highly qualified personnel [13].

One of the tools of an active policy of ensuring professional employment in the military-industrial complex should be an extensive and flexible system of retraining of personnel, ensuring their mobility and competitiveness in the labor market, obtaining the necessary knowledge and skills for the implementation of scientific, technical, organizational, entrepreneurial activities, taking into account the specifics of the intellectual product, market conditions for scientific and military-technical products. And a special place here must be given to the system of the Federal Service for Labor and Employment, in all regional governing bodies of which it is advisable to create special structures or subdivisions designed to regulate the professional markets of highly skilled labor force, primarily scientific and engineering personnel capable of satisfying the growing needs of the global market for special purposes.

## **4.2 Strengthening cooperation between universities and business**

Nowadays, state authorities actively support cooperation between universities and business. Thanks to it, about 9.5 thousand new jobs should appear in 2013-2017, including more than 3.5 thousand for university graduates. The work of universities with leading industrial companies requires new equipment, new technologies, new people, new management. Industrial science in Russia has almost ceased to exist. Therefore, leading universities must generate new ideas and train personnel in accordance with the demands of the industry - and today's young specialists will raise Russian enterprises to a new technological level in 10-15 years.

One of the practical possibilities for implementing the strategy of innovative development of Russia and increasing the volume of production of high-tech products are small innovative enterprises (hereinafter referred to as SIE) operating on the basis of budgetary scientific and educational organizations. According to the estimates of the National Science Foundation (NSF) of the United States of America (USA), it is the SIE that are recognized as the most effective form of innovation [14].

The largest number of SIEs in Russia was created in the system of the Ministry of Science and Higher Education of the Russian Federation, 327 universities and a scientific institution (73.8% of all founders) created 2,214 SIEs (82.4% of the total number of created ones). The founders added the right to use more than 3,109 RIA to the authorized capitals of the enterprises [15].

However, the activation of innovative activity in Russia is hampered by a number of problems of the formation and management of small innovative enterprises formed on the basis of scientific and educational organizations. The main problems include poor management of innovation processes and commercialization of new technologies, difficulties in finding financial resources, difficulties in identifying and protecting intellectual property, unprofessional justification of projects being implemented, which leads to low commercial efficiency of scientific developments.

The development of the SIE complex is currently slowing down. In search of income, previously established enterprises are switching to simple activities that do not provide innovative growth and the required efficiency. Without government support and investments, the successful implementation of new projects of small innovative enterprises on the basis of budgetary scientific and educational institutions is almost impossible.

### **4.3 Bridging the strategic digital divide**

The digital divide is a concept that has become widespread due to the increased importance of new digital technologies, the emergence of the information society and the transition to the digital economy. The strategic digital divide is the gap between the ideal and the actual state of the level of competencies by the elements of digitalization. In management practice, accounting for this element corresponds to the level of its significance for the economic efficiency and strategic development of the enterprise.

Strategic gaps were identified in the field of cybersecurity, new factors of competitiveness, problems of degradation of natural intelligence. There are also strategic gaps and the risk of exacerbating them in harnessing the power of digital infrastructure - electronic marketplaces, digital platforms, national leaders and leading end-to-end research centers.

A significant part of strategic gaps also affected such an important element in the digital economy as scientific, technological and socio-economic forecasting. ERP systems are not sufficiently implemented at the enterprises of the defense industry, and the necessary work with big data is not being carried out.

Strategic gaps have also been identified in a number of new production technologies, in particular, additive manufacturing technologies, as well as digital twin technologies [15].

### **4.4 Creation of knowledge management systems**

To stay ahead of the competition, it is necessary to develop the employees. Continuous development is achieved through the correct management of information and knowledge.

The knowledge management software market is extremely complex. This is caused by the fact that this area is relatively young, and the very definition of the concept of knowledge management is interpreted by different authors in different ways.

The attribution of software to knowledge management systems (KMS) is explained by the fact that in KMS, all types of information are called knowledge, including unstructured content (letters, sketches, photos), data (in databases and data warehouses), and knowledge (as patterns of the subject area allowing specialists to solve their problems).

Many firms offer knowledge bases that are very easy to set up and use, both as an internal knowledge base, as a source of IT information, an information resource for agents, or a collection of typical customer questions and answers. The knowledge base is available at any time, so clients and agents can themselves get the information they need at the right time.

KMS provide a single search tool for all data sources, fast and accurate search for user queries, search in information repositories inside and outside the company, personalization of search results based on search history, interests and employee position, as well as prompt receipt of new information by employees on topics and areas of their interest with the help of thematic mailings.

The effect of the implementation of the KMS is to reduce the loss of working time for information search, reduce the cost of re-creating documents by employees, and reduce the number of decisions based on inaccurate or incomplete information.

## 5 Conclusions

Human capital is a combination of the following factors: qualities that a person brings to his work: intelligence, energy, positivity, reliability, dedication; a person's ability to learn: giftedness, imagination, creative personality, ingenuity ("how to do things"); motivation of a person to share information and knowledge; team spirit and goal orientation. Despite the fact that knowledge has always been one of the most important conditions for the development of production, the uniqueness of the modern stage lies precisely in the accumulation of knowledge in such an amount, in which it has passed into a new quality, becoming the main factor of production.

With the introduction of the digital economy and digital technologies, the system of relations between enterprise managers and shareholders (owners) is changing significantly. They are based on increasing the efficiency of the company through the introduction of digital technologies in production processes and in the enterprise management system, as well as increasing the investment attractiveness and value of the business. This is achieved through changing business models and enterprise management, reducing the cost of entering new business areas in the digital era, and the combination of the benefits of digital technologies that provide growth in the added value of the enterprise.

In the context of the introduction of digital technologies, the requirements for digital literacy of members of the highest level of corporate governance - the board of directors, which determines the business development strategy and monitors its effectiveness, become important. Digital competencies of members of the board of directors will increase the efficiency of digital technologies implementation in industrial enterprises.

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