MODELING PROCESS OF CREATION OF NEW JOBS IN DEFENSE-INDUSTRIAL COMPLEX[1]

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In the article the instrumental base solution of the problem of creating new jobs in the defense industry, focused on the maximum possible amount of output in terms of financial and other constraints is suggested. Presented in its models and algorithms suitable for solving the two major problems currently facing front of the complex: its innovative modernization and increasing the production of military products.

Keywords: defense-industrial complex, modeling, process creation, jobs, model, optimization.

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МОДЕЛИРОВАНИЕ ПРОЦЕССА СОЗДАНИЯ НОВЫХ РАБОЧИХ МЕСТ В ОБОРОННО-ПРОМЫШЛЕННОМ КОМПЛЕКСЕ

В статье предложена инструментальная база решения задачи создания новых рабочих мест на предприятиях оборонно-промышленного комплекса, ориентированная на максимально возможный объём выпуска продукции в условиях финансовых и других ограничений. Представленные в ней модели и алгоритмы приемлемы при решении двух основных проблем, стоящих в настоящее время перед комплексом: его инновационной модернизации и наращивания производства продукции военного назначения.

Ключевые слова: оборонно-промышленный комплекс, моделирование, процесс, создание, рабочие места, модель, оптимизация.

1. Introduction

At the beginning of the 90th years of the last century as a result of the liberalization of the Russian economy of control over the national economy. was a partial loss. As a result of the defense-industrial complex (DIC), oriented in the least due to their specific market needs, without adequate government support was destroyed and a significant reduction in [1]. Much of the negative developments that have taken place at that time in the defense industry, were due to the elimination of the old and the lack of new effective system of defence-industrial complex in the market conditions and the lack of certainty of its development objectives [2].

At the end of XX – beginning of XXI century, the main threat to the strategic development of the defense industry were risks associated with their organizational and economic changes (mergers, acquisitions, companies, etc.), the introduction of market mechanisms (merging, absorption of enterprises, etc), the introduction of market mechanisms (change of ownership of enterprises, carrying out the conversion of military production, a significant decrease the role of the state in regulating their activities, etc.), as well as a sharp decrease in the state order. After the adoption of new policies and programs that changed the objectives of the defense industry in the long run to first place in the next decade face risks related to the need for rapid innovation, modernization of these sectors (by 2015, it is planned to start modernization of more than 500 enterprises). It is planned that the defense industry will annually increase the volume of production, which by 2020 should be increased to 5 times [3].

Simultaneous solution of these problems are inherent in complex transformational big risks that became apparent as early as 2013 (the crisis of staffing of defense industry, lack of the required technologies, facilities, etc.). Even with the substantial (more than 4 times compared with the previous decade) increase in funding strategic development of defense industry, planned for the next 10 years, many defense companies are not ready for full implementation of all planned innovative activities, as scientific and production potential of the defense industry in 1992-2012 years decreased by 6,3 times, the number of its employees fell by more than 4 times. As a result, more than 50% of the defense industry enterprises are currently experiencing a shortage of staff and lack of jobs [4].

Changing the purposes of defense-industrial complex in the years 2014-2020, due to their large-scale and complex modernization, required the development and implementation of a new mechanism of state regulation of the activity of the complex. This makes it necessary to improve the management of this process, an important focus of which is modeling the process of creating new jobs in the defense industry [5].

2. Economic-mathematical modeling of the process of creating new jobs in the defense industry

The process of creating the required number of new jobs in the defense industries is intended to provide the maximum level of output at a given time [6]. It is primarily in the areas experiencing the greatest shortage of jobs (the so-called «narrow» branches of DIC [7].

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The process of creating new jobs C_y^R in the k «narrow» branches at any given time t_c in a formalized form is as follows:

$$\frac{dC_y^R(t_c)}{dt_c} = S^R Q^y(t_c), \qquad (1)$$

where SR – average number of jobs created per unit of time; $Q^y(t_c)$ – total number of employees in the «narrow» sectors of the defense-industrial complex.

Since at the same time (according to the terms of input-output) are using the «old» jobs for the rest of the n-k «not narrow» branches of defense industry, given the time of entry of these jobs in the manufacturing process can write the following expression:

$$\frac{dC^R(t_c)}{dt_c} = \overline{C^R{}_c}\frac{dC_y^R(t_c)}{dt_c}, \qquad (2)$$

where $\overline{C^R{}_c}$ – coefficient that shows the ratio of the number of jobs involved in all sectors of defense industry to the number of jobs created in its «weak» sectors, i.e.:

$$\overline{C^R{}_c} = \frac{\sum_{i=1}^{n} C_i^R}{\sum_{i=1}^{k} C_i^R} \qquad (3)$$

Then with consideration of (1) and (3) equity (2) becomes:

$$\frac{dC^R(t_c)}{dt_c} = \frac{S^R Q^y(t_c)\sum_{i=1}^{n} C_i^R}{\sum_{i=1}^{n} C_i^R}, \qquad (4)$$

If we consider qualification once again being prepared workforce of the working-age population, the expression (4) can be represented as follows:

$$\frac{dC^R(t_c)}{dt_c} = \frac{K_c^R S^R Q^y(t_c)\sum_{i=1}^{n} C_i^R}{\sum_{i=1}^{n} C_i^R}, \qquad (5)$$

where K_c^R – factor taking into account the skills of workers, whose average value is determined from the statistical data, K_c^R = 0,75 – 0,8.

Let us assume that to create one job k_i in the defense industry at a time will need $1/S_{k_i}^R$ workers, and to create $C_{k_i}^R$ jobs at a time it is neccesary $C_{k_i}^R$ / $S_{k_i}^R$ workers. To create a unit of time of one job will require on average $\sum_{i=1}^{k}\frac{C_{k_i}^R}{S_{k_i}^R} / \sum_{i=1}^{k} C_{k_i}^R$ workers.

Then one employee at a time creates the following jobs:

$$S^R = \sum_{i=1}^{k} C_{k_i}^R / \sum_{i=1}^{k}\frac{C_{k_i}^R}{S_{k_i}^R} \qquad (6)$$

Suppose that the running time of an employee in all n sectors of DIC is equal to one time, and the time at each of the branches can be determined in accordance with the values of the coefficients of the matrix of direct costs in the j-th integrated structure of each i-th defense industry $\|y_{ij}\|_t$. The matrix $\|y_{ij}\|_t$ is productive when the inverse matrix $\|E - y_{ij}\|^{-1} = \|b_{ij}\|$ is non-negative. Based on the above, it is possible to define a mechanism to create new jobs in the «narrow» branches with the products of n branches of DIC. It should be taken into account, the system in industry operates at a certain level, i.e. the vectors M, Z, Y, V (M – value involved production capacity, Z – the volume of gross output, Y – output of the final product, V – volume involved fixed assets) and others in defense industry are limited by internal and external conditions of their development.

Denote with S_{ik}^{RO} the number of jobs k-th of the «narrow» branch DIC which are provided by products i-th branch, generated by one person at a time. On this basis, the ratio of $1/S_{ik}^{RO}$ specifies the number of employees working in the i-th sector and provide one job in the k-th «narrow» branch with products by i-th branch at a time.

To create one job in the k-th «narrow» branch of defense industry by products of all n branches for the unit of time such as one year, you will need $\sum_{i=1}^{k}\frac{1}{S_{ik}^{RO}}$ workers. One worker will be able to create for a single year $S_{ki}^R = \frac{1}{\sum_{i=1}^{k} 1/S_{ik}^{RO}}$ of new jobs in the k-th "narrow" branch of DIC. Given that the duration of the employee's working hours during the extended reproduction of an innovative product of defense industry can grow, we assume that the average length of the working period in the year h_{ci} for an employee i-th branch of defense industry in this period can be expressed as follows:

$$h_{ci} = K_{pi} h_{\text{м}i}, \ (i = \overline{1,n}), \qquad (7)$$

where $h_{\text{м}i}$ – the average length of the working period in the year the employee in the i-th defense industry; K_{pi} – coefficient reflecting the increase in working hours in the i-th branch of DIC (if necessary) during the extended reproduction of innovative products.

Then:

$$S_{ik}^{RO} = \frac{h_{ci}}{T_{ik}}, \ \left(i = \overline{1,n}\right) \qquad (8)$$

The number of hours spent by an employee of the i-th industry in creating the i-th output to a single location in the k-th «narrow» branch of defense industry (T_{ik}), can be determined from the expression:

$$T_{ik} = \frac{y_{ik} P_k^M}{U_{pi}}, \ \left(i = \overline{1,n}\right), \qquad (9)$$

where y_{ik} – the coefficient matrix of direct costs; P_k^M – the average cost of jobs created in the k-th «narrow» branch of defense industry; U_{pi} – the average production of one worker i-th branch of the defense-industrial complex in a single year.

Consequently, the expression for the coefficient S_{ki}^R whith consideration of (6) – (9) takes the form:

$$S_{ki}^R = 1/\sum_{i=1}^{n}\frac{y_{ik} P_k^M}{h_{ii} U_{pi} K_{pi}}, \ \left(i = \overline{1,n}\right) \qquad (10)$$

It should be noted that if the jobs are created at the same time in k «narrow» branches of defense industries, the expression (10) with (14) can be represented as follows:

$$S^R = \sum_{i=1}^{k} C_{ki}^R \Big/ \sum_{i=1}^{k}\sum_{i=1}^{n}\frac{y_{ik} P_k^M C_{ki}^R}{h_{ii} U_{pi} K_{pi}} \qquad (11)$$

Changes in the structure of technological communications system of branches of defense industries are defined at each step of the process of creating new jobs, as discussed above methodological approach that takes into account the changes in the matrix $\|y_{ij}\|_t$ depending on the amount of growth of production capacity in the "narrow" field of the defense-industrial complex, that is:

$$\Delta y_{ik}^c = \frac{(M_i(t_{c1}) - M_i(t_k))/M_i(t_{ci})}{(\max\frac{b_{ik}}{M_i(t_{c1})})M_i(t_{c1}) + \frac{\Delta M_i(t_{c1})}{M_i(t_{c1})} b_{ik}} \qquad (12)$$

where $M_i(t_{c1})$ – the value of the production capacity of the i-th industry of DIC at time t_{c1} – completion of the first step of the process; $M_i(t_k)$ – the value of the production capacity of the i-th branch at time (t_k) – end of the process of creating new production capacities.

In this case, the maximum possible volume of production of the end of military products for defense industry at time t_{c1} is determined depending on the adopted strategy of expanded reproduction of innovative H_1, H_m or H_n:

$$\max_{H_1} Y_{\text{в}i}^{\text{в}}(t_{c1}) = \frac{(M_y^c(t_{c1}) - (\sum_{j=1}^{n} b_{yj}^c Y_{\text{в}j}^{*p} + \sum_{j=1}^{n} b_{yj}^c Y_{\text{г}j}^c))K_y}{\sum_{j=1}^{n} b_{yj}^c K_j}, \quad (13)$$

$$\left(i = \overline{1,n}\right)$$

where $Y_{\text{в}j}^{*p}$ – taken into account when solving this problem part of the final product for military purposes; $Y_{\text{в}j}^{*p}$ – taken into account when solving the problem part of the final product for civilian use.

Based on the foregoing, we transform the expression (11). To do this, we introduce a form $\Delta C_y^R / \Delta M_y$, that characterizes the increment of the number of new jobs created to the increment of the amount of power the «narrow» branch of defense industry. To determine the value of this ratio we use the relation (12). Then:

$$C_y^{R3}(t_{c1}) = \frac{1}{a_{gi}}(\alpha_i^c(M_y^c(t_{c1}) - \beta_y^c) + \beta_i^c)^{\frac{1-a_{gi}}{a_{gi}}} \alpha_i^c \quad (14)$$

where a_g – the coefficient of elasticity of cost of labor in a given time period, α_i^c, β_i^c and β_y^c – the parameters that take into account the conditions of completeness, technological communication and the minimum required volume of production of the end products for civil and military use by defensr-industrial industry at time t_c.

In view of (14) the expression (11) takes the form:

$$C^{RY} = \frac{\sum_{i=1}^{k} \frac{\alpha_i^c}{a_{gi}} (\alpha^c(M_y^c(t_{c1}) - \beta_y^c) + \beta_i^c)^{\frac{1-a_{gi}}{a_{gi}}}}{\sum_{i=1}^{k}\sum_{i=1}^{n} \frac{y_{ik} P_k^M \frac{\alpha_i^c}{a_{gi}} (\alpha_i^c(M_y^c(t_{c1}) - \beta_y^c) + \beta_i^c)^{\frac{1-a_{gi}}{a_{gi}}}}{Q_{pi} h_{\text{м}i} K_{pi}}} \quad (15)$$

To determine the values of the coefficient $\overline{C}_c^R$ we use the expression (14) in view of (13). Then:

$$\overline{C}_c^R = \frac{\sum_{i=1}^{n} (\alpha_i^c(M_y^c(t_{c1}) - \beta_y^c) + \beta_i^c)^{\frac{1}{a_{gi}}}}{\sum_{i=1}^{k} (\alpha_i^c(M_y^c(t_{c1}) - \beta_y^c) + \beta_i^c)^{\frac{1}{a_{gi}}}} \quad (16)$$

Thus, the values S^R and $\overline{C}_c^R$ over the i-th step are constant because of the immutability of «bottlenecks» in the sectors of defense industry production capacity in this step of the process.

Given that the solution of equation (5), the value $Q^Y(t_c)$, that is equivalent to the assumption according to the number of jobs, the total number of affected jobs $C^{R3}(t_{c1})$ by ranches of DIC can be determined using the following equation:

$$C^{R3}(t_{c1}) = C_{\text{н}}^{R3}(t_{c1}) + C_y^{R3}(t_{c1}) \quad (17)$$

where $C_i^{R3}(t_{c1})$ – the total number of affected jobs are not «weak» areas of defense industry; $C_y^{R3}(t_{c1})$ – the total number of jobs involved in the «narrow» defense industries.

From the expression (17) we get:

$$C_y^{R3}(t_{c1}) = C^{R3}(t_{c1}) - C_{\text{н}}^{R3}(t_{c1}) \quad (18)$$

In turn, $C^{R3}(t_{c1})$ can be determined as follows:

$$C^{R3}(t_{c1}) = C^{R3}(t_k) + \Delta C_y^R(t_{c1}), \quad (19)$$

where $\Delta C_y^R(t_{c1})$ – the total number of jobs created by the end of the first step of the process, that is, increase the number of jobs in the «narrow» branches of defense industries; $C^{R3}(t_k)$ – total number of jobs involved at the end of the process of creating new jobs.

Then the expression (18) with (19) becomes:

$$C_y^R(t_{c1}) = C^{R3}(t_k) + \Delta C_y^R(t_{c1}) - C_{\text{н}}^{R3}(t_{c1}) \quad (20)$$

Based on the above and taking into account that the length of the process depends mainly on the rate of labor force training [8], we accept:

$$C_y^R(t_{c1}) = \Delta Q_3^N(t_{c1}), \quad (21)$$

where $\Delta Q_3^N(t_{c1})$ – the amount of labor to be produced at time t_{c1}.

In turn, $\Delta Q_3^N(t_{c1})$ can be determined on the assumption of exponential dependence preparation manpower the expression of the following form:

$$\Delta Q_3^N(t_{c1}) = Q_T^N(t_k)(1 - e^{-\upsilon t_{c1}}), \quad (22)$$

where $Q_T^N(t_k)$ – the number of working-age population of the state in the end of the reorientation process in DIC for extended reproduction of innovative products; υ – intensity of training per employee, defined as $\upsilon = 1/T_c$ where T_c – average worker's training time, which is determined on the basis of statistics.

Starting from (21) and (22), expression (20) takes the following form:

$$C_y^R(t_{c1}) = C^{R3}(t_k) + Q_T^N(t_k)(1 - e^{-\upsilon t_{c1}}) - C_{\text{н}}^{R3}(t_{c1}) \quad (23)$$

Substituting this expression into (5) and use (3). Then:

$$\frac{dC_y^R(t_{c1})}{dt_{c1}} = K_C S^R \overline{C}_c^R (C^{R3}(t_k) + Q_T^N(t_k))(1 - e^{-\upsilon t_{c1}}) - C_{\text{н}}^3(t_{c1}) \quad (24)$$

Transform the differential equation (24) to mean:

$$\frac{dC_y^R(t_{c1})}{dt_{c1}} = K_c^R S^R \overline{C}_c^R C_{\text{н}}^{R3}(t_{c1}) + K_c^R S^R \overline{C}_c^R (C^{R3}(t_k) + Q_T^N(t_k)) - K_c^R S^R \overline{C}_c^R Q_T^N(t_k) e^{-\upsilon t_{c1}} \quad (25)$$

We introduce the following dependencies:

$$\begin{cases} K_c^R S^R \overline{C}_c^R = C_1 \\ K_c^R S^R \overline{C}_c^R (C_{\text{н}}^{R3}(t_k) + Q_T^N(t_k)) = C_2 \\ K_c^R S^R \overline{C}_c^R Q_T^N(t_k) = C_3 \end{cases} \quad (26)$$

Then expression (25) can be written as:

$$\frac{dC_y^R(t_{c1})}{dt_{c1}} = C_1 C_{\text{н}}^{R3}(t_{c1}) + C_3 e^{-\upsilon t_{c1}} - C_2 = 0 \quad (27)$$

Thus, we obtain a linear differential equation of the first order with constant coefficients C_1, C_2 and C_3, which has a general solution in the following form:

$$C_y^R(t_{c1}) = e^{-C_1 t_{c1}} \left(\frac{C_2}{C_1} e^{(C_1 t_{c1})} - \frac{C_3}{C_1 - \upsilon} e^{(C_1 - \upsilon)t_{c1}} + C_0 \right) \quad (28)$$

In this case, an arbitrary constant C_0 is discovered from the condition $C_y^R = (t_{c1}) = 0$ for $t_{c1} = t_k$, that is, for the first step of the process. It is determined on the basis of t_{c1} substituting into equation (28) since the end of the reorientation process in the defense industry expanded reproduction of innovative products. The number of jobs involved at time t_k, is known. For the next steps is taken into account as a condition $C_y^R = (t_{c1}) = 0$ for $t_{ci} = t_{c(i-1)}$. Thus, the amount of C_0 is considered constant and process step changes during the transition from one step to another step of the process.

The analysis showed that for the process at each step is characterized by a time lag between the end of the process of creating a certain number of jobs for «narrow» branches of defense industry and the start of production at the new jobs created.

In this connection, use a distributed function of time lags in the form:

$$V_i(t) = V_i(t_0) + \Delta V_i(t_1)l + \Delta V_i(t_2)l + \ldots + \Delta V_i(t_k)l + \ldots, \quad (i = \overline{1,n}), \quad (29)$$

where l – time lag.

The above function is defined assuming that the influence of growth of assets $\Delta V_i(t_i)$ on the level of the current value of $V_i(t)$ decreases exponentially with time. For the process of creating new jobs, this function will be as follows:

$$V_i(t_c) = V_i(t_k) + \Delta V_i(t_{c1})l + \Delta V_i(t_{c2})l + \ldots + \Delta V_i(t_{ck})l + \ldots, \quad (i = \overline{1,n}), \quad (30)$$

where $V_i(t_c)$ – the value of fixed assets of the i-th branch of defense industry at the time of the end of the reorientation process in the defense industry for expanded reproduction of innovative products; $\Delta V_i(t_{ci})l$ – fixed capital i-th branch of defense industry at a given time, taking into account the time lag l.

Using the transformation of L. Koyk, which in this case is: $V_i(t_c) = V_i(t_k) - (1 - l) + \Delta V_i(t_{c1}) + l(V_i(t_c))_{\tau_c}$, and introducing the average growth rate of fixed assets ρ, the magnitude of which can be determined according to the statistics, we get:

$$V_i(t_c) = V_i(t_k) + \Delta V_i(t_{c1}) + l\Delta V_i(t_{c2}) + l^2(\Delta V_i(t_{c2})/(1+\rho)) + \ldots + l^n(\Delta V_i(t_{c2})/(1+\rho)^{n-1}) + \ldots =$$
$$= \Phi_i(t_k) + \Delta V_i(t_{c1}) + l\Delta V_i(t_{c2}) \times (1 + \frac{l}{1+\rho} + (\frac{l}{1+\rho})^2 + \ldots + (\frac{l}{1+\rho})^{n-1} + \ldots) =$$
$$= V_i(t_k) + \Delta V_i(t_{c1}) + (\frac{l}{1 - \frac{1}{1+\rho}})\Delta V_i(t_{c2}) = V_i(t_k) + (1+\rho) \times (1 + \frac{l}{(1+\rho) - r})\Delta V_i(t_{c2}) =$$
$$= V_i(t_k) + (\frac{(1+\rho)^2}{(1+\rho) - l})\Delta V_i(t_{c2}), \quad (i = \overline{1,n}) \quad (31)$$

If you know the investment in fixed assets of the defense-industrial complex (KV), then equation (30) can be represented as follows:

$$V_i(t_{c1}) = V_i(t_k) + z_iKV_t + z_ilKV_{t-1} + \ldots + z_ilKV_{t-n} + \ldots, \quad (i = \overline{1,n}), \quad (32)$$

where z_i – relative proportion of investments that are used to create fixed assets of the i-th branch of defense industry. Therefore, the expression (31) with (32) becomes:

$$V_i(t_{c1}) = V_i(t_k) + z_i(\frac{(1+\rho)^2}{(1+\rho) - l})KV_{t-1}, \quad (i = \overline{1,n}), \quad (33)$$

Number of affected jobs in branches of DIC on the issue of defense finished product at the moment t_{c1} is defined as follows:

$$\overline{C_i^R}(t_{c1}) = (\overline{\alpha}_i^{c1}(M_y^{c1}(t_{c1}) - \beta_y^{c1}) + \overline{\beta}_i^{c1})^{\frac{1}{a_{gi}}}, \quad (i = \overline{1,n}), \quad (34)$$

where:

$$\overline{\alpha}_i^{c1} = \frac{\alpha_i^c}{K_{pi}K_{ci}^R K_{3i}(V_i(t_{c1}))^{a_{gi}} y_{0i}}, \quad (i = \overline{1,n}); \quad (35)$$

$$\overline{\beta}_i^{c1} = \frac{\beta_i^c}{K_{pi}K_{ci}^R K_{3i}(V_i(t_{c1}))^{a_{gi}} y_{0i}}, \quad (i = \overline{1,n}), \quad (36)$$

where K_3 – the coefficient of capacity utilization by branches of DIC.

Thus, the number of jobs involved in the production of the final product by branches of defense industry will be less than the number of existing and newly created jobs by the end of each step of the process. In this regard, intersectoral balance will be carried out at a level determined by the number of jobs involved in the «narrow» branch of the industry («narrow» branches of industries), but not at the level of jobs created in these sectors of the defense-industrial complex.

In view of the above, the start production of the end of military products at each step of the process «shifted» to a value Δt_{ci} that is $\Delta t_{ci} = t_{ci} - t_{ci}^з$, where t_{ci}, $t_{ci}^з$ – time of creating and involving jobs in the i-th step of the process with and without a time lag.

The next step of the process would have to include two (or possibly more) of «bottlenecks» in production capacity branches of defense industry, which will lead to the simultaneous creation and harnessing the jobs in these «weak» sectors, starting from the moment of time $t = t_{c2}$, etc. This procedure allows you to define a discrete spectrum of time to create new jobs, the integration of human resources and capacity to build the ultimate level of production of military products for one of the previously adopted strategies: H_1, H_m or H_n.

Therefore, the total time of the creation of new jobs is determined by the formula:

$$t_c = t_{c1} + t_{c2} + \ldots + t_{ci} + \ldots + t_{cn} \quad (37)$$

In (37), each component of the time is an iterative method with a known value $C_y^R(t_c)$, which in turn is linked to the quantities of production capacity, labor, gross and end military products.

Thus, the process of creating new jobs for the enhancement of capacities of defense industry may last as long as certain requirements are met them in the generated output.

3. Conclusion

In the simulation of the creation of new jobs in the defense industry used the established analytical relations between the main characteristics of this process are presented in the form of raw data, intermediate and final results of the solution of these problems that allow for the appropriate logic and mathematical operations [9]. In the optimization mechanism laid down by maximizing the creation and engagement of new jobs and production capacity in the defense-industrial complex. Model realization of the mechanism implemented on the basis of structured design methodology based on the concept of optimization algorithm in a hierarchical structure of its blocks. The practical implementation of the results of simulation of the process of creating new jobs in the defense industry, presented in this paper, aims to improve the scientific validity of the policies and programs of development in the long run.

References

1. The development of the theory and practice of business management of high-tech complex. // Ed. Avdonin B.N., Batkovsky A.M., Bozhko V.P. – M.: MESI, 2013. - 365 p.
2. Principles of State Policy of the Russian Federation in the field of defense-industrial complex in the period up to 2020 and beyond. Approved by the Decree of the President of the Russian Federation dated 19 March 2010
3. The state armament program for 2011-2020 (GPV-2020). Approved by the Decree of the President of the Russian Federation of December 31 2010.
4. Avdonin B.N., Khrustalyov E.J. The methodology of organizational and economic development of the knowledge-intensive industries. – M.: Nauka, 2010. - 367 p.
5. Burenok V.M., Lyapunov V.M., Mudrov V.I. Theory and practice of planning and management of development of weapons. / Pod redakciej A.M. Moskovskogo. – M.: Vooruzhenie. Politika. Konversiya, 2004. – 419 s.
6. Batkovsky M.A., Bendikov M.A., Zakutnev S.E. etc. The development strategy of high-tech enterprises. / Pod red. Batkovskogo M.A. – M.: Pechatnyj dvor «Na Alekseevskoj», 2004. – 456 s.
7. Burenok V.M., Lavrinov G.A., Khrustalyov E.J. The mechanisms of production management of military products. – M.: Nauka, 2006. - 304. p.
8. Batkovsky A.M., Batkovsky M.A., Bulava I.V. etc. The theory and methodology of the development strategy of the enterprise. - Moscow: The International Academy of valuation and consulting, 2009. - 278 p.
9. Avdonin B.N., Batkovsky A.M., Batkovsky M.A. Analysis tools research and production of high-tech enterprises of the defense-industrial complex. // Bulletin of Federal State Unitary Enterprise «Central Research Institute «Center», 2011, Issue number 3. – pp. 21-33

Литература

1. Развитие теории и практики управления предприятиями высокотехнологичного комплекса. // Под ред. Авдонин Б.Н., Батьковского А.М., Божко В.П. – М.: МЭСИ, 2013. – 365 с.
2. Основы государственной политики Российской Федерации в области развития оборонно-промышленного комплекса на период до 2020 года и дальнейшую перспективу. Утверждены Указом Президентом РФ от 19 марта 2010 г.
3. Государственная программа вооружения на 2011–2020 годы (ГПВ-2020). Утверждена Указом Президента РФ от 31 декабря 2010 г.
4. Авдонин Б.Н., Хрусталёв Е.Ю. Методология организационно-экономического развития наукоемких производств. – М.: Наука, 2010. – 367 с.
5. Буренок В.М., Ляпунов В.М., Мудров В.И. Теория и практика планирования и управления развитием вооружения. / Под редакцией А.М. Московского. – М.: Вооружение. Политика. Конверсия, 2004. – 419 с.
6. Батьковский М.А., Бендиков М.А., Закутнев С.Е. и др. Стратегия развития высокотехнологичных предприятий. / Под ред. Батьковского М.А. – М.: Печатный двор «На Алексеевской», 2004. – 456 с.
7. Буренок В.М., Лавринов Г.А., Хрусталёв Е.Ю. Механизмы управления производством продукции военного назначения. – М.: Наука, 2006. – 304 с.
8. Батьковский А.М., Батьковский М.А., Булава И.В. и др. Теория и методология разработки стратегии развития предприятия. – М.: Международная академия оценки и консалтинга, 2009. – 278 с.
9. Авдонин Б.Н., Батьковский А.М., Батьковский М.А. Инструментарий анализа научно-производственной деятельности высокотехнологичных предприятий оборонно-промышленного комплекса. // Вестник ФГУП «ЦНИИ Центр», 2011, Выпуск № 3. – С. 21-33