

# *Improving the Company's Capital Model in the Context of Production Modernization as a Factor in the Sustainability of an Industrial Enterprise*

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**Abstract**—This article discusses the main problems of modernization of the production process in industrial enterprises in the modern conditions of the Russian economy. Many problems are due to the war of sanctions and counter-sanctions, the fall in the growth rate of the world economy, the specifics of the development of socio-economic relations in the Russian Federation. Based on the analysis of relevant factors affecting the operation of the enterprise, a model is presented that determines the interdependence of the modernization of production and the sustainable economic development of the company. Based on the analysis of domestic and foreign literature, the main provisions of the modernization process are formulated and the algorithm of the modernization implementation mechanism at an industrial enterprise is presented. This mechanism takes into account the main indicators of sustainable development of an industrial enterprise and indicators for evaluating the effectiveness of modernization. Proposals are presented for improving the company's capital model, which reflects the strategic aspects of investment activity necessary for the successful implementation of modernization reforms in an industrial company. The obtained results were tested by a number of Russian enterprises, which led to positive results of their activities, contributed to more sustainable development and strengthening of competitive positions.

**Keywords**—*economic stability; modernization; industry enterprises; crisis; innovation, competitiveness*

## I. INTRODUCTION

In modern, dynamically developing conditions of constant increase in the level of competition, as well as environmental factors that have an aggressive impact on the organization's activities, overcoming various kinds of crises and preventing a bankruptcy situation, as well as developing measures to achieve a stable development. In this connection,

the problem of forming and improving the capital of a company in the conditions of production modernization, representing a dynamic process consisting of investment, innovation, production flows attributable to the process of sustainable development, becomes urgent.

In economics, the concept of “modernization” reflects the processes of change and renewal in the technological and social development of society, both globally and at the country, industry, or individual enterprise level [6]. This process includes an increase in the properties of the production system and its individual components, involving the use of investment resources, the selection of economic efficiency criteria, based on the analysis of which forms a decision to improve the production process [9]. Thus, between the process of modernization of production and economic sustainability of the enterprise can be identified interconnection and mutual influence.

Today in Russia, the average age of machinery and equipment is about 11.2 years [18]. Basically, this situation is due to imports. For example, the share of imports in the machine tool industry is more than 90%, in heavy engineering - 60–80%, in the electronics industry, about 80–90%. This means that the ability to maintain the technological level of the Russian economy is more dependent on the import of services (maintenance and repair) and on the replacement supplies from abroad as the equipment becomes obsolete and related technologies [24]. The tightening of a number of countries of sanctions against Russia after the Crimea joined it in March 2014 and due to the ongoing political crisis in Ukraine led to the fact that the domestic industry faced enormous problems. These include the risk of being left without Western technologies, without cooperation with foreign investors, with restrictions on the purchase of imported equipment and

components. The Government of the Russian Federation decided to abandon imported equipment and introduce an import substitution regime. At present, a list of goods has been formed, which will be allowed to be purchased only from domestic, Belarusian and Kazakh manufacturers.

To overcome these problems, it is necessary to form a management system for modernization and design and technological activities of an industrial enterprise, as well as to create a management system for scientific and technological reproduction, innovative, educational, scientific processes that take place inside the enterprise and together with other market participants [23].

## II. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

The problems of formation and management of the capital structure, investment investments in the process of modernizing the production of industrial enterprises and related interactions have been investigated by many foreign and domestic scientists.

The issues of modernization of production and industrial enterprises in conditions of unsustainable development are devoted to the works of T.A. Khudyakova, A.V. Schmidt [15].

Structural factors of modernization of enterprises in Russia are considered in the study by N.A. Dubrovina [8].

Factors of external influence on modernization processes are considered in the works of R. Eschenbach, H. Schiller [2].

A. Aganbegyan's research [1] is devoted to the problems of managing investment policy in the conditions of crisis.

Analysis of well-known works on this research topic showed that recently a set of approaches to managing the modernization of production at an industrial enterprise has been formulated and its influence on economic sustainability and crisis-free development of production systems has been outlined [4]. However, it is worth noting that these issues are considered, as a rule, in the context of an approach based on the principles of designing a system of measures for the exit of an enterprise from a crisis state [5]. At the same time, the modernization of production should be aimed, first of all, precisely at preventing such crisis conditions [22]. Therefore, it is necessary to clearly understand the essence of the process of modernization of production and its impact on the economic sustainability of an industrial enterprise, which a number of domestic researchers pay close attention to [19].

As one of the models of the organization of the investment process of modernization of production in order to achieve the economic sustainability of the enterprise, P. Loon's technology was used [20].

## III. MATERIALS AND METHODS

### A. Description of the Technique

In modern conditions of economic development, the achievement of sustainable development of an industrial enterprise is determined by the positive dynamics of quantitative and qualitative transformations of elements and business processes at various stages of its life cycle. In our work, we took this into account, relying on the research of I.A. Baeva, V.I. Shiryayeva [3]. These transformations are characterized by the renewal of the production base, the release of a new product, the modernization and reconstruction of the technological base [9].

Analyzing opportunities for sustainable development, we took into account the research by Khudyakova T.A., who believes that the sustainability of the company is largely determined by the level of investment and innovation potential of the enterprise, which serves as a fundamental factor [14]. Any industrial enterprise is an open, dynamic system, since it is in constant interaction with the external environment, subject to significant fluctuations [11]. An industrial enterprise receives resources from the external environment in the form of raw materials and materials, fuel and energy, capital and information, labor resources, equipment and other assets that later become part of its internal environment. Part of the resources is processed, converted into products and services, which are then returned back to the external environment [16]. In the process of implementing modernization projects aimed at maintaining the financial stability of industrial enterprises, it is necessary to improve the company's capital formation model necessary for the implementation of the company's investment policy. As an algorithm for modeling this process, we used the proposals of V.I. Shiryayev [25].

We took into account that the size of invested capital and the possibilities of investment activity depend on the type of enterprise - whether it rents capital or is itself engaged in investments in the business of another organization. Provided for the need to analyze the magnitude of the costs per unit of capital leased to the firm for a certain period of time. Reflected in the modeling process the position that the size of invested capital is determined by the difference between the marginal product of capital and the size of costs per unit of capital [17]. It was also revealed on the basis of the theory and practice of modernization of Russian enterprises that investment investments necessary for the introduction of modern technologies depend on the marginal product of the organization's capital, the amount of costs per unit of capital, the size of the outgoing capital. The result of our research was the improvement of the formation model of the investment capital of an industrial enterprise.

Thus, the management of the company must comply with a certain mechanism for the implementation of modernization. The main element of the developed mechanism is to identify areas of modernization in order to achieve sustainable economic development. The proposed mechanism represents the implementation of the modernization of production through a sequence of certain stages. At each stage, an assessment and analysis of certain indicators of the economic activity of an industrial enterprise is carried out.

The developed mechanism consists in the possibility of achieving the specified rates of sustainable economic development on the basis of an integrated approach to the modernization of an industrial enterprise through the introduction of innovative technologies.

**B. Algorithm of the Mechanism for the Implementation of Industrial Modernization**

Considering sustainable economic development as a complex, complex and structured phenomenon and a process involving a large number of factors, an algorithm is proposed for assessing the level of sustainability of development based on the use of modernization methods. The proposed algorithm may include a sequence of the following main steps:

1) Analytical – prognostic stage. It involves the definition and analysis of the main technological aspects of the enterprise. At this stage, a technological audit, analysis of the technical preparation of production. Evaluation of energy efficiency, environmental friendliness, flexibility, automation of production, as well as indicators of the development of new types of products. The analysis of the main factors of the environment of an industrial enterprise.

2) Estimated – prognostic stage. It includes the formation of indicators of sustainable development of an industrial enterprise. The company's management should assess the effectiveness of its core business, analyze the structure of the company's income and assets, the structure of borrowed funds, net profit, and determine the return on assets. Based on this assessment, the required amount of investment is calculated and the possibility of obtaining it. Also at this stage, the possibilities of acquiring and introducing technological innovations, technical, resource-saving technologies are being studied.

3) Formative stage. At this stage of the mechanism, it is proposed to identify areas of modernization in order to achieve sustainable development of the enterprise. It is necessary to accurately design the direction of innovative transformations, staff retraining.

4) Control and corrective stage. Implies a comparison of planned results with standard indicators.

**C. Graphic Model of the Implementation of Modernization**

The model of the mechanism for implementing the modernization of an industrial enterprise is a system of basic criteria affecting the economic sustainability of an enterprise.

We note the main provisions of the modernization. The external environment of an industrial enterprise is characterized by a large number of rapidly changing parameters, which requires a fairly quick response, which objectively proves the difficulty of achieving sustainable economic development [21]. The model of the mutual influence of modernization and sustainable economic development is presented in Figure 1.

The presented model shows that the functioning of an industrial enterprise depends on the influence of factors of the external and internal environment.

Also, analyzing the activity of an enterprise, it is necessary to take into account the influence of the main indicators of sustainable development and indicators of the efficiency of production modernization [12].

Sustainable economic development can be viewed as a process characterized by an increase in economic efficiency, technological efficiency, and product quality.

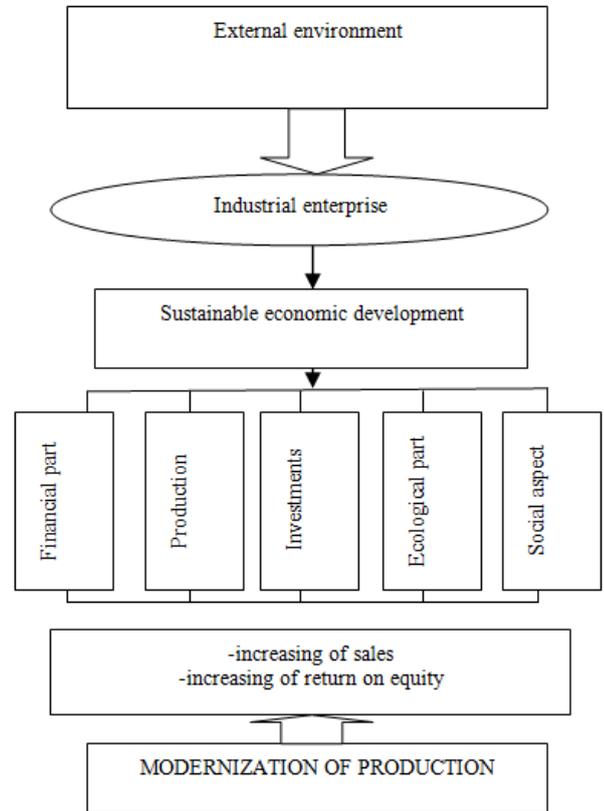


Fig. 1. Graphic model of the mutual influence of sustainable economic development and modernization of production

The growth of indicators of economic efficiency and technical excellence can be achieved by drawing up a strategic plan for comprehensive modernization. The continuity of the modernization process must be ensured by the relevant elements of the organizational structure of management of an industrial enterprise [26].

Imagine a model of the implementation of modernization in an industrial enterprise (Figure 2).

The presented mechanism allows the management of the enterprise to take into account all the aggressive and most disturbing impacts during the process of comprehensive modernization of production, as well as the impact of these impacts on the sustainable development of an industrial enterprise [10].

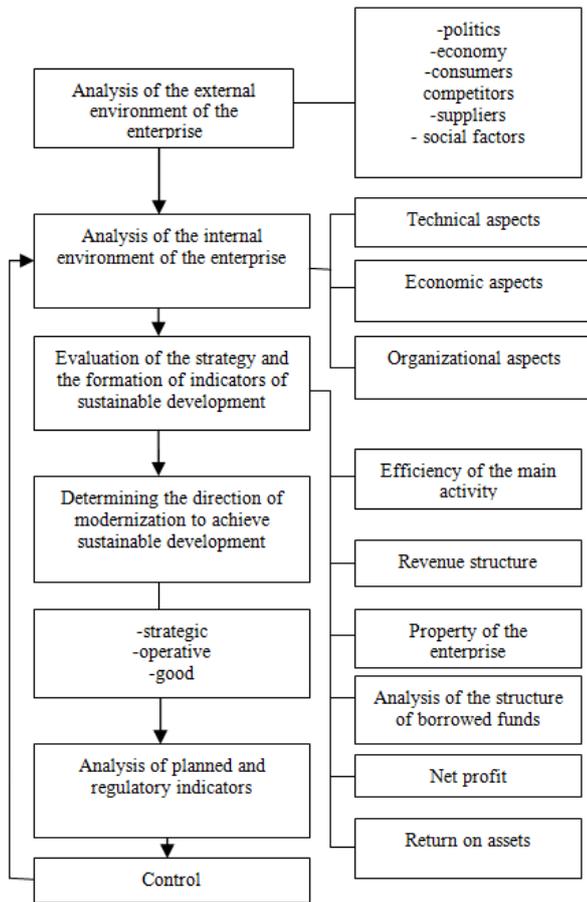


Fig. 2. Graphic model of the mechanism of the modernization of industrial enterprises

#### D. Economic and Mathematical Model

One of the main factors for the effective functioning of any enterprise in the competition is its timely and adequate response to changes in the external environment, creating a situation of decision-making under risk. In this regard, the assessment of opportunities for increasing investment in the modernization of production and their management is a key task of strategic management, and, consequently, intra-company planning.

Modernization of the enterprise and the transition to modern technology requires long-term investment. The standard neoclassical investment model reflects how the level of investments and capital stocks are interrelated with the marginal product of capital and the interest rate [18]. When forming an adequate capital model of an enterprise, owners usually focus on two types of companies. The first are manufacturing enterprises that produce products using rented capital. The second are companies that lease capital to industrial enterprises. In Russia at the end of the last century, very close relations developed in the implementation of relevant business processes between these types of enterprises; therefore, when modeling the formation of capital by a firm, the behavior of both market subjects should be taken into account.

In the first case, the company, deciding how much capital is needed for modernization transformations, applies the rule of equality of economic resources, according to which it is advantageous to use additional resources, while the marginal product of a given resource in monetary terms is equal to the marginal cost of this resource. When an enterprise calculates the amount of capital, it compares the costs and benefits of each unit of capital. Many Russian companies operate using an outdated technological base, which increases variable costs. The average fixed costs are also very high due to the heavy capital equipment costs. Therefore, the optimal use of enterprise resources is associated with technological innovations. The real size of the price for the rental of capital should be equal to the marginal product of capital ( $MRK = R / P$ ). Consequently, the enterprise will increase investments in modernization if the marginal product of the organization's capital begins to exceed the real price for the rental of capital.

Let us see how companies that donate capital on the basis of partnerships to lease to producers of products. Such an organization compares the possible income and costs of ownership of capital leased. In the conditions of doing business in Russia, there are the following risks of increasing data costs. First, there are interest costs when the company can lose interest on capital due to leasing it to the manufacturer, rather than placing the amount in the bank. Secondly, there are costs for depreciation deductions, since the capital rented out loses its value in the process of depreciation. Finally, thirdly, there is a risk that the price of capital may change downwards. Although in Russia it is often the opposite.

Based on the foregoing, it is possible to consider the amount of delays for a unit of capital leased over a certain period of time using (1)

$$i \times P_k \pm \Delta P_k + n \times P_k = P_k (i \pm \Delta P_k / P_k + n), \quad (1)$$

where  $i$  is the nominal interest rate,  $P_k$  is the price of acquiring a unit of capital,  $\Delta P_k$  is the amount of income and loss,  $n$  is the rate of depreciation,  $n \times P_k$  is the monetary amount of depreciation.

In order for an enterprise to provide the necessary firms to a manufacturer for implementing an investment modernization strategy, the following inequality must be fulfilled (2)

$$MRK > P_k (i \pm \Delta P_k / P_k + n), \quad (2)$$

where  $MRK$  is the marginal product of capital.

So, the adequacy of the investments used by the manufacturing enterprise depends largely on what decision the company providing the capital to rent will make. Actions are possible, both to increase and reduce the stock of capital, which is determined by the situation on the market. The calculation of the rate of profit per unit of invested capital is presented in (3)

$$N_r = R / P - (P_k / P) \times (i_r + n) \quad (3)$$

where  $N_r$  is the rate of return per unit of invested capital,  $R / P$  is the return per unit of capital,  $i_r$  is the real interest rate,  $n$  is the rate of depreciation, and  $(P_k / P) \times (i_r + n)$  is the cost.

In the conditions of sustainable development, the real price of renting capital turns out to be equal to the marginal product of capital, the rate of return on invested capital can be expressed as follows (4)

$$N_r = MRK - (P_k / P) \times (i_r + n). \quad (4)$$

Income from investments is possible when the ultimate product of capital is higher than the amount of expenses per unit of capital (5)

$$MRK > (P_k / P) \times (i_r + n) \quad (5)$$

The increase in own capital stock is determined by the profitability of its ownership and leasing of a manufacturing company. The size of the invested capital is determined by the difference between the marginal product of capital and the size of the costs per unit of capital (6)

$$I_n = MRK - (P_k / P) \times (i_r + n), \quad (6)$$

where  $I_n$  is the size of the net investment.

Note that any company that leases capital and leases it, tries to increase its invested capital if MRK has more costs per unit of capital. Then the capital stock ( $\Delta K$ ) is calculated using (7)

$$\Delta K = I_n \times [MRK - (P_k / P) \times (i_r + n)]. \quad (7)$$

Practice shows that the size of  $I_n$  is quite strongly influenced by the appropriate stimulation of the company's investment activity.

In general, the total amount of expenditures on investments in the fixed capital of an enterprise is equal to the sum of net investments and investments for the reimbursement of used capital (8)

$$I_g = I_n \times [MRK - (P_k / P) \times (i_r + n)] + n \times K, \quad (8)$$

where  $I_g$  is the total investment in fixed assets of an enterprise,  $n \times K$  is the amount of investments for reimbursement of outgoing capital.

The investment required for the modernization of the enterprise depends on the marginal product of the organization's capital, the value of costs per unit of capital, and the size of the capital that has been discharged. The increase in interest rates leads to an increase in costs per unit of capital, reduces the total amount of investment.

The opportunity for the sustainable development of the enterprise in the framework of technological re-equipment comes when equality comes:  $MRK - n = i_r$ . That is, the difference between the value of the marginal product of capital and the rate of depreciation becomes equal to the real interest rate.

It is also necessary to consider the risks in the implementation of the process of modernization of production. Considering possible risks is one of the core directions in reforming the enterprise, since non-optimal solutions lead to new costs and loss of possible income [13]. An approach to the assessment of strategic risk is proposed, based on the use of such an integral indicator as the risk coefficient. Risks can be assessed by comparing expected profit and expected loss

when comparing various options for modernization strategies (9)

$$K_i = Z_i / R_i, \quad (9)$$

where  $K_i$  is the risk coefficient of the  $i$ -th variant of the modernization strategy;  $Z_i$  - expected profit of the  $i$ -th variant of the strategy;  $R_i$  is the expected loss of the  $i$ -th variant of the strategy. The risk factor  $K_i$  shows what kind of income falls on one ruble loss.

#### IV. CONCLUSIONS

Thus, within the framework of the presented concept of sustainable economic development, the vital activity of an industrial enterprise ceases to be uncontrollable, a spontaneous process, and becomes self-organizing. The management mechanism is comprehensive, aimed at new strategic goals, contributes to ensuring its security at all stages of the life cycle.

Modernization of industrial enterprises should be based on the introduction of advanced technologies, the development of the innovation process in the organization.

The interrelation of the modernization of the production process and sustainable economic development presented in the work can also be considered at the level of indicators characterizing these processes. The indicators for evaluating the effectiveness of modernization include: a net rate of return; turnover of total assets; equity; employee productivity; cost of fixed assets; the level of capital productivity, machine performance, cost of goods sold.

It is also extremely important to improve the model of formation of the company's investment capital, which is necessary for the implementation of the process of modernization of the industrial activity of an industrial enterprise.

The paper presents a model of dependence of sustainable economic development of an industrial enterprise and production modernization. A mechanism is proposed for improving the investment model of the modernization processes of an industrial enterprise. Using this mechanism, the management of the company can make a more precise management decision on the choice of the direction of modernization and the amount of investment needed to achieve the sustainable development of an industrial enterprise.

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