

## SYSTEMIC MODERNIZATION OF RUSSIAN ENTERPRISES: THEORETICAL RATIONALE, MOTIVES, PRINCIPLES

*The article discusses the basic principles, methodological, economic, and mathematical tools for addressing the problem of modernizing Russian enterprises. The paper shows that the solution of this problem affects a wide range of relevant issues of modern economic science, including the effective structuring of the socio-economic aspect of society, concepts and definitions of the term “enterprise,” theory of the firm, theory of productive functions and associated models, methods for organizational and evolutionary management of economic development at the micro level. The author proposes the concept of the enterprise as a system of institutional and organizational, social and labor, property and technological, business and model sectors interacting both with each other and with the authorities, population, economic and business entities at the regional and federal levels. This concept allows not only to formulate a correct definition of the term “enterprise,” but also specify the ways for implementing the modernization projects at enterprises. The article develops the concept of systemic modernization as a method for transformation of economic entities that holds an intermediate position between the administrative modernization and organic evolution. It classifies risks and benefits associated with both methods of transformations. The author shows that the basis for describing the operation of the enterprise going through the stage of modernization could be the resource- and competence-based theory of the firm, which focuses on interaction between resources of the enterprise and its capabilities (ambitions, aspirations, competences). The mismatch between the amount of resources and level of capabilities of the enterprise is a powerful incentive for its transformations. The author developed a small-size model describing the operation of enterprise in the process of modernization, including resource- and competence-based productive function, as well as other functions of costs and dynamics of resources and capabilities of the firm. The article presents key elements for the strategy of the mass modernization of enterprises at the regional and federal levels.*

**Keywords:** enterprise, modernization, system modernization, theory of the firm, resource-competence theory, production function, model of the enterprise under modernization

### Introduction

The enterprise is under-represented today in the Russian economic and social discourse as the basic structural unit in the organization of modern economy that creates the value added. In the selection of options for the Strategy 2030, and in the preparation of the Strategy 2020, the discussions focus primarily on the macroeconomic goals, tools, and proportions. Meanwhile, it is well known that direct interplay between the basic factors of production, such as labor, capital, natural resources, entrepreneurial abilities, occurs exactly at the enterprise level. It is also the place where a natural conflict between the interests of participants of production and economic activities is overcome, ontological, epistemological, ideological, and praxeological aspects of human activity are brought together, tangible and intangible assets are combined, social and economic goals and criteria are interwoven, development trajectories of consumers, suppliers, competitors, and partners intersect. Given the nodal role of the enterprise, we should dramatically increase attention to the processes within the firms and to their space and time relationship with the environment.

In our opinion, it is the micro-level of the economy that ultimately determines the meso- and macro levels, even though it is experiencing, in turn, the impact of these levels. The insufficient efficiency of the Russian economy is, to a great extent, caused by the backwardness of national enterprises. Therefore, the solution to the problem of getting out of the economic crisis must be sought, above all, on the path of modernization and post-modernization development of national enterprises.

Current technical and technological, institutional and organizational, financial and economic condition of Russian enterprises is far from desirable. According to the survey of industrial enterprises conducted by CEMI of RAS and Russian Economic Barometer in 2015 (in fact, the collected data refer to pre-crisis year of 2014), 55 % of the enterprises assessed their financial and economic condition negatively (“difficult” – 13 %, “unstable” – 42 %). Only 2 % of the surveyed enterprises reported that

their business was "on the rise". According to Rosstat, at the end of 2015, the wear of fixed assets was 48.8 %. About one-third of enterprises are loss-making.

The harmonization of relationships between the enterprises and their external environment is difficult given the high degree of uncertainty in the economy. The heads of the enterprises do not understand the policy of the authorities, while the need for long-term economic strategy at the federal and regional levels is recognized, respectively, by 90 % and 84 % of the surveyed firms.

As for the conditions of internal operations of industrial enterprises, the most appropriate term to describe them, according to the survey, is "stagnation." More than half of firms neither implement nor plan to implement the restructuring. Some of the enterprises (41 %) do not have a comprehensive strategy.

In light of this, it is particularly interesting to examine the issue of the relationship between the external environment of the enterprise and its internal content. In practical terms, this relationship is reflected in the orientation of decisions adopted at the enterprise, i.e. whether these decisions are oriented towards the interests of owners, consumers, general director, employees, enterprise as a whole. The answers of respondents indicate that the interests of owners and general director are in the first place (40 and 43 % of respondents give them the primacy); the interests of employees are left "in the background" (they are a priority for 11 % of the surveyed firms).

In general, the analysis indicates the need of serious changes in the relations both between the enterprises and authorities, and between the participants of productive activities. In both cases, it is necessary to implement the organizational and economic modernization of internal and external environments of the firms. In other words, the focus should be on the systemic modernization of the majority of Russian enterprises.

"Modernization" literally means making modern. For enterprises, this implies bringing their technological, organizational, and managerial levels in line with the characteristics of today's most advanced firms. The vast majority of Russian enterprises are in need of modernization. However, it faces a number of fundamental problems, both theoretical and methodological.

The first problem is of fundamental nature. When we talk about the modernization of a particular enterprise, we recommend to implement a so-called "non-destructive modernization," i.e. transformation that preserves the enterprise as an integrated economic entity. Preserving the identity of such entity requires certain care and respect for Hippocrates' rule of "doing no harm" applied to the socio-economic sphere. To meet this requirement, it is necessary to identify the components of an enterprise that determine its identity and the possibility of identifying that enterprise as a specific element of the "general population" of enterprises. This runs into the theoretical problem of defining the concept of "enterprise" that would set it apart from other economic entities and allow to analyze the signs of its possible destruction. This definition is made and studied in Section 1 of this article.

The second problem relates to the clarification of the concept of modernization. Modernization is viewed as a controlled transformation of the enterprise aimed at improving individual characteristics of its structure and functions. An alternative to the modernization is the evolution of the enterprise as its organic development oriented on adaptation to changing the environment. Systemic modernization comes in the form of a compromise between the managed modernization and regulated evolution and, therefore, minimizes the risks of modernization and evolution processes. This issue is considered in Section 2.

It would be of interest to consider the reflection of modernization in the context of the theory of the firm. Neoclassical theories of the firm view labor and capital as the main factors in the activities of the company, while sales volume is considered as the result of production and desire of maximum profit is seen as the main motive. This design leaves virtually no place to the motives for modernization of production, which diverts resources from the core business activities. There is a need to provide another theoretical description of the firm's activities, that would reveal motivation, factors and results of the modernization. The resource – and competence-based theory of the enterprise in the process of modernization that meets these requirements is presented in Section 3. We also present a small-size parametric model describing the operation of the enterprise in the process of modernization, which allows (in the case of actual data) to define the optimal proportions for the allocation of profits of the enterprise in the period of modernization.

Based on the analysis in Sections 1–3, Section 4 defines the fundamental elements of modernization strategy to be implemented in the modernization projects of individual companies and in the modernization of the institution of enterprise in general.

### **1. The Concept and Definition of Enterprise**

Despite the intuitive understanding of the term “enterprise,” it has no generally accepted scientific definition. It turns out that such definition cannot be formulated outside the theoretical concept of the economy in general. The definition of “enterprise” is critically dependent on the accepted structuring of the economy, which in turn is determined by the views on the structure, driving forces and factors of economic behavior. In other words, the theory of the enterprise depends on the theory of the national economy or, more precisely, the “national socio-economic theory.”

To define the concept of the enterprise, we need to specify a general characteristic property of entities relating to the enterprises, as well as to propose the criteria for differentiating/identifying the entities included in the given set. It should be noted that it is quite difficult to fully meet the second requirement, since the enterprise is a socio-economic system that is naturally evolving in time and space. This means that to identify a particular enterprise as a unit we must specify its invariants that do not depend or weakly depend on changes in the spatial position of the enterprise and its state in time. It should be noted that neither name, nor registered address, nor specialization of the enterprise are such invariants.

Therefore, the definition of the enterprise should include two parts: 1) general attributes that differentiate the class of enterprises from the array of socio-economic systems; 2) particular identification attributes that allow to determine whether two entities from the set of entities meeting the general requirements are different enterprises or not.

No definition known in the orthodox economic literature meets these requirements (see, for example [1]).

The overall structure of the definition of enterprise is as follows. As the general attributes indicating that a particular socio-economic system refers to enterprises, we can use functional characteristics of the enterprise, such as its performance of production, sales, distribution, and restoration functions. With this approach, the enterprise is defined as an organization with non-fixed period of operation, which has the rights of a legal entity or similar rights, and is engaged, on a permanent basis, in the activities to make products, sell them outside the organization in the form of goods, services, or works, and which independently distributes the income from the sales and ensures the reproduction of physical, labor, financial, and other resources used by such organization. As a rule, the enterprise is deemed to be an organization that does not include another organization with the listed attributes. This means that enterprise is the minimal structural unit of the economy that is independently engaged in the production, economic, and reproduction activities. It should be noted that, in contrast to standard definitions, the issue of the goals of the enterprise is not included in this functional definition, because these goals may vary depending on the stages of the life cycle of an enterprise.

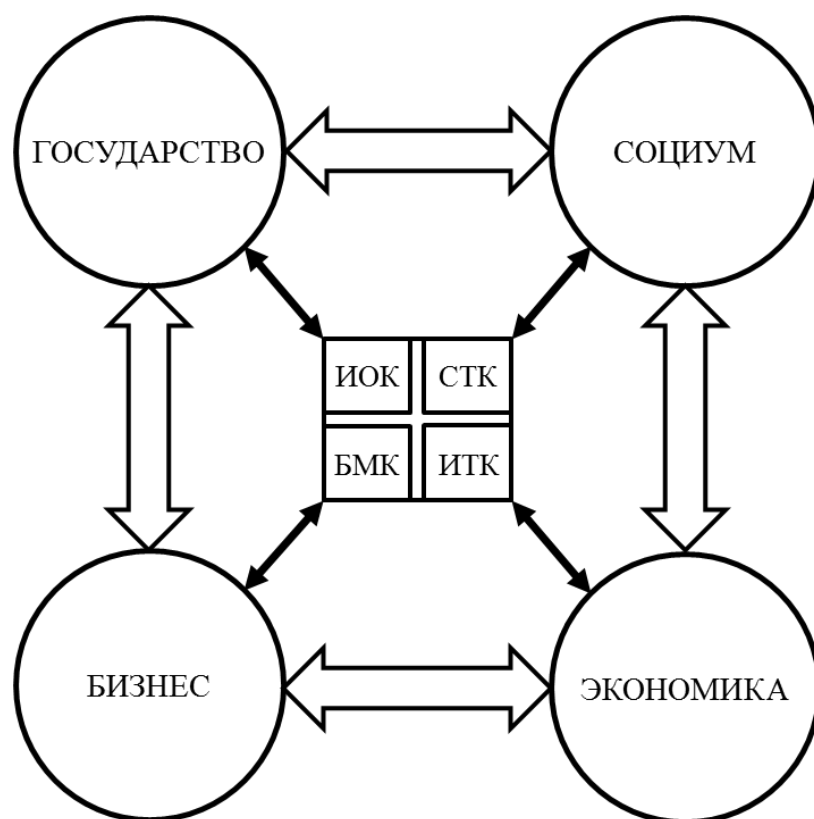
As the identifying attributes that allow to evaluate the continuity in the characteristics of the enterprise, we propose to use the structural characteristics of the enterprise as a socio-economic system, namely, whether the enterprise has the necessary subsystems (complexes). This should include the use of such subsystems (complexes) of the enterprise, a radical change of which would lead to the loss of identity and, in fact, to the liquidation of that enterprise (which does not preclude the emergence of a new enterprise).

Such immanent structural identity components include four complexes:

1) Institutional and Organizational Complex (IOC), a system of formal and informal norms, rules, regulations, and traditions that are rooted within the framework of the enterprise and define the characteristics of the operations of the enterprise, its separate subsystems and the relationship between the participants in its activities;

2) Social and Labor Complex (SLC) that includes the personnel of the enterprise engaged in coordinated target-oriented activities to ensure the operations of the enterprise;

3) Property and Technology Complex (PTC), a set of assets owned and used by the enterprise in its economic activities;



**Fig.** The enterprise in the four-link structure of society

4) Business and Model Complex (BMC), a set of business models applied by that enterprise to external processes of product sales, issue and distribution of securities, relationships with business partners, etc.

Therefore, we propose to consider as invariants of the enterprise the characteristics of four complexes that are related to this enterprise and determine substantial features of the enterprise as a socio-economic system. It should be noted that in [2] we proposed to consider one more separate complex, such as the information complex that reflects the notions of economic actors and other stakeholders (consumers, suppliers, investors, potential employees, etc.) with regard to that enterprise as an economic entity (the brand in a wide sense of the word); however, it appears that within the enterprise it would be more logical to consider the information complex as a derivative complex, since it is impossible to separate it from other complexes, and the method of providing the relevant information is related to business complex.

The basic complexes, including of IOC, SLC, PTC, BMC, form the core of the enterprise and interact with the components of the basic structure of society. Such components representing the driving forces of the society include [2, 3] the state as a political organization supporting the institutional structure of the society, society as the country population structured by social organizations, economy (in the narrow sense) as the sphere of implementing the processes of production, distribution, exchange and consumption, and business as the sphere of accumulating financial means and implementing investment business projects for profit. The most substantial interactions of these systems with each other and with the relevant complexes of each enterprise are shown in the figure below.

To preserve the enterprise as an economic entity, the modernization should, on the one hand, not lead to a radical change in IOC, SLC, PTC, and BMC, and on the other hand (in the case of changes in these complexes), it should preserve their mutual proportionality. This limits the scope of modernization and ensures the stability of enterprise population both on the global and local scale.

## 2. Modernization vs. Evolution

In a general sense, modernization should be understood as the process of transforming a given entity by implementing the innovations that bring the modernized entity closer to the most efficient existing examples of such entities [2]. Therefore, modernization requires to look for similar entities, analyze their efficiency and select the most efficient one as an example. It should be noted that such

search inevitably involves significant costs that are essentially similar to transaction costs. After the completion of this process, there are the necessary transformational costs associated with managing the transformation of the entity (in this case, the enterprise) in order to bring it closer to the example. Moreover, while getting closer to the example in one aspect, it is possible to move away from it in other aspects.

We can assume that the modernization measures that rely on transfers and borrowing of organizational and economic technologies may produce mixed and not quite definite effects, and could be associated with risks and chances. In fact, the situation is similar to the one that arises in the transplantation of institutions [4].

The risks of modernization are associated primarily with the probability that the newly cultivated qualities may be rejected and not retained in the subsequent movement of the entity or lost in the event of serious problems of external nature, not to mention the shocks. The chances of modernization arise from hoping for a quick and purposeful change, which is enabled by the use of administrative resources for timely correction of and protection from the impact of adverse external factors.

A polar alternative to modernization is evolution, a process of natural organic development of the entity directed towards the improvement of its functional qualities (unlike the involution, which is an organic development in the opposite direction, and revolution, which is a non-organic, leap-ahead change).

The evolution implies continuity of development and is largely free of the risks associated with modernization. At the heart of the evolution processes, there are such concepts as cultivation, heredity, natural selection.

At the same time, the evolutionary development is also associated with risks and chances inherent for this type of movement.

The risks of evolution are related to the probability of deviating from the goal set for the change, departure from the established targets, general uncertainty of the direction and speed of change. The chances of evolution are associated with the organic development, probability of correcting unfavorable episodes in the next generations of the entity, possibilities of scaling the entity in space and time.

A compromise between modernization and evolution is systemic modernization, a target-oriented managerial impact on the entity that takes into account its systemic structure and preserves the basic systems associated with the operation of the entity. The risks and benefits of modernization and evolutionary paths to transformation are summarized in the table below.

Table 1

**The risks and benefits of modernization and evolution**

Development option	Key characteristics of the option	
	Risks	Benefits
Modernization	High analytical costs High transformation costs Risk of losing the integrity of enterprise Probability of rejecting the acquired qualities in the event of adverse external impact	Possibility to control and manage transformation Possibility to use administrative resources Possibility to quickly achieve results Ensuring the possibility of including the enterprise in the community of enterprises that are highly developed in terms of organization and technology
Evolution	Possibility of deviating from the goal of transformation Possibility of losing control over results Long period of transformation Possibility to harmonize the development of entity and dynamics of its socio-economic and administrative environment	Possibility to scale the entity in space and time Seamless change, preserving the integrity of entity Low cost of transformation management Uncontrolled length of the transformation process

Systemic modernization can be considered as an intermediary link between evolution and modernization, between organics and politics. The prerequisites of successful systemic modernization are based on using the properties of systems related to their stability in time and space which, in turn, is caused by the evolutionary characteristics of systemic entities.

Systemic modernization is an organic modernization. The sustainable results can be achieved only by the organic transformation that involves all aspects and levels of the economy. The systemic

modernization can also be described as “system-protective” (or “non-destructive”). The systemic modernization implies careful and progressive implementation of well-prepared innovations along with preserving the functioning of basic socio-economic systems related to the operation of that entity.

### **3. Enterprise as the Entity of Modernization: Applying the Resource- and Competence-Based Theory of the Enterprise**

The general theory of the firm has been traditionally developing in two main areas. One of them is trying to find the answer to the question of why the firms exist and new firms constantly emerge, despite the alternative market institutions that can ensure the creation of new economic benefits [5]. In other words, it deals with explaining the existence of the firm as an institution. The second area aims to explore issues related to the behavior of firms, decision-making, factors for success and failure of firms [6–10] (see overview in [11]). This is more about specific firms and their groups rather than the institution of the firm compared to alternative institutions used for organizing the production. The first area is called “Why,” while the second is referred to as “How.” It is the latter area that represents an interest in the context of addressing the problems of modernization of Russian enterprises.

The performance of the enterprise depends on external and internal factors. The internal factors include resources available to and engaged by the enterprise, and the capabilities of the enterprise that determine its capacity to adapt to the conditions of using the resources. The factors related to resources can, therefore, be changed within a relatively short period, for example, by engaging physical resources, including raw materials, components, knowledge of new employees. The factors associated with the capabilities of the enterprise, in general, are difficult to change. This includes, for example, mental characteristics of the firm's staff, institutions rooted in the enterprise, established traditions, etc. In fact, such (slowly evolving) factors describe the capacity of the enterprise. For a particular firm in a specific situation and given its aspirations and ambitions, the capabilities of the enterprise can also be described as its competences.

Two approaches to the concept of “resources” are known to exist within the framework of the theory of the firm. For example, V.L. Tambovtsev refers to E. Penrose [12] by defining resources “in their broadest sense as everything that ensures the operation of the firm” [13]. In this case, almost everything can be described as the resources, including material wealth, spiritual values, and institutional conditions for the operation of the firm. According to another approach described, in particular, in [14] the resources of enterprise are meant to include only the benefits, the deprivation of which from the enterprise clearly does not lead to the liquidation of the enterprise or its degeneration. Therefore, a resource may be a subject of inter-company turnover.

The aggregate of possibilities is interpreted by D. Teece, G. Pisano, and A. Shuen as capabilities of the firm [15] (we also include in the capabilities the claims of the firm to hold a particular place in the market, business and administrative environment, as well as competences, i.e. the ability of the firm to make appropriate decisions in the prevailing conditions). It should be noted that this approach was further developed in [16, 17]. According to E. Penrose, “the firm can extract the rent not because it has the best resources, but rather because it has a distinctive capability that enables the better use of these resources” [12, p. 54].

Unlike the resources that can be engaged by the firm, its capabilities can only be developed, awakened, or revealed. In other words, the capabilities cannot be bought (although they can be acquired), and they are not subject of inter-company trade. Capabilities cannot be separated from the firm, but they can be strengthened or weakened, developed or suppressed. Thus, both the amount of resources and level of capabilities are variable characteristics of the state of the firm, although the efforts to change them are qualitatively different, as the improvement of capabilities requires considerable time, while the increase in the stock of resources can in principle be effected fairly quickly. Unlike the investments in the gain of resources, the investments in the gain of capabilities (competences) of the enterprise are usually implemented with a significant distributed lag.

Therefore, it is advisable to divide the internal factors of activities of the enterprise by resources and capabilities. However, this division is not absolute. Often, the capabilities are manifested only in response to the needs for them, which in turn arise following the appearance of new resources at the firm. As a result, the resources may serve as a kind of generators (or catalysts) of growth in competences and, alternatively, the identification of capabilities can trigger the acquisition of resources or change in the conditions of activities of the enterprise (for example, change of the firm's position in the legal

space, such as re-registration in another region, or change in the firm's coordinates, such as change of specialization and transition to another industry). In general, the relationship between resources and competences (capabilities) of the enterprise is similar to the relation between supply and demand, where demand creates supply, and supply creates demand.

The immediate motive for modernization is discrepancy between the amount of resources and the level of capabilities of the enterprise. Increasing the level of capabilities requires higher production volumes, which in turn causes an increase in the level of capabilities. The modernization itself is implemented by changing these indicators, which allows to get closer to their equilibrium values.

For enterprises that are on the threshold of modernization, the trajectory of further development is determined exactly by the combination of resources and capabilities. Therefore, the most appropriate theory to describe the functioning of an enterprise in the process of modernization is resource- and competence-based theory of the firm [18].

Unlike the general theory of the enterprise, the theory of the enterprise in the process of modernization applies to the enterprises that undergo the modernization stage as a special phase of their life cycle. The enterprise in the process of modernization (M-enterprise) differs from the enterprises that are at the stationary stages of their life cycle (S-enterprises) by the following characteristics:

1. M-enterprise does not seek to maximize its profits. Since the transition of the enterprise to modernization is usually caused, on the one hand, by perceived imbalance between the level of enterprise capabilities and, on the other hand, by the quantity and quality of resources. The minimization of such imbalance becomes the target function for the period of modernization.

2. The factors of the productive function of the M-enterprise are the total amount of resources and level of capabilities (competences) of the enterprise (unlike labor and capital, which is typical for S-enterprises).

3. After compulsory payments to the tax and other authorities, the profits of M-enterprise are distributed between investments in the gain of resources and development of capabilities.

4. The gain of resources in the current year depends on the amount of investments in this area in that year, as well as on the achieved level of capabilities. The higher is the level of capabilities, the more effectively these funds are spent. The dependency has the form of S-curve, the saturation level (asymptote) of which is determined by the levels of capabilities.

5. The gain in the level of capabilities depends on the amount of investments in this area with a distributed lag, as well as on the achieved level of resources. The higher is the level of resources, the more effectively these funds are used. The dependency has the form of S-curve, the saturation level (asymptote) of which is determined by the levels of resources.

The structural diagram of the model represents a description of the reproductive cycle of the enterprise in the transition from year  $t$  to year  $t + 1$  ( $t = t_0, t_{0+1}, \dots, T$ ). This includes using the following:

1) Productive function of the enterprise  $Y_t = F(R_t, C_t)$  reflecting the relationship between the annual income of the enterprise  $t(Y_t)$ , amount of resources ( $R_t$ ) and the level of capabilities ( $C_t$ ).

2) "Consumer" function of costs  $Z_t = I(R_t, C_t)$  expressing the dependency of the total costs of the enterprise to engage and maintain the productive factors on the total amount of resources  $R_t$  and the level of capabilities  $C_t$ .

3) "Consumer" function of the gain of resources  $R_{t+1} = G(u_t, C_t)$  reflecting the dependency of the annual amount of resources  $t + 1$  on the amount of investments  $u_t$  into the gain of resources of the enterprise and the level of capabilities  $C_t$ .

4) "Consumer" function of the gain of capabilities  $C_{t+1} = H(v_t, R_t)$  reflecting the dependency of the level of capabilities  $C_{t+1}$  on the amount of investments  $v_t$  into the gain of capabilities and existing level of resources  $R_t$ . The control variable is the structure of the profit allocation of the enterprise  $Y_t - Z_t$  after taxes and other compulsory payments  $N_t$  to investments  $u_t$  into the gain of resources  $R_t$  and investments  $v_t$  into the gain of capabilities  $C_t$ .

The following three-mode function is considered as the productive function:

$$Y_t = (a_1 R_t^b + a_2 C_t^b)^c \cdot (b_1 R_t^b + b_2 C_t^b)^d,$$

it reflects three variants of effectiveness with regard to the return of factors depending on the ratio of  $R_t$  to  $C_t$ , including minimum, average, and maximum ( $a_1, a_2, b_1, b_2, b, c, d$  – parameters). The estimation of this function based on the empirical data allows to determine the boundaries of the ratio between  $R_t$

and  $C_t$  separating the area of “equal” impact of  $R_t$  and  $C_t$  on the volume of production  $Y_t$  from the areas of relative deficit or surplus  $R_t$  and  $C_t$  [19, P. 95–96].

As the consumer function of costs, we use the following linear function:

$$Z_t = s_1 R_t + s_2 C_t + s_0,$$

where  $s_0, s_1, s_2$  are the parameters.

As the consumer function of the gain of resources  $r_{t+1} = G(u_t, C_t)$ , we use the following function:

$$R_{t+1} = R_t + u_t S(C_t),$$

where  $S(C_t)$  is the logistic function,  $S(C_t) = (k \cdot e^{mC_t}) / (1 + k \cdot (e^{mC_t} - 1))$ ,  $k < 1$  is the parameter; the value of the gain of the resource ranges from the value  $ku_t$  (with the low level of capabilities  $C_t$ ) to  $u_t$  (with infinitely increasing level of capabilities  $C_t$ ).

As the consumer function of the gain of capabilities  $C_{t+1} = H(v_t, R_t)$ , we use the following function:

$$C_{t+1} = \alpha_0 C_t + \alpha_1 C_{t-1} + \dots + \alpha_\tau C_{t-\tau} + v_t S(R_t),$$

where  $S(R_t) = (l \cdot e^{pR_t}) / (1 + l \cdot (e^{pR_t} - 1))$ ,  $l < 1$  is the parameter; the value of the gain of the resource ranges from the value  $lv_t$  (with the low level of resources  $R_t$ ) to  $v_t$  (with infinitely increasing level of capabilities  $R_t$ ).

As a result, we obtain the following parametric model:

$$Y_t = (a_1 R_t^b + a_2 C_t^b)^c \cdot (b_1 R_t^b + b_2 C_t^b)^d, \quad (1)$$

$$Z_t = s_1 R_t + s_2 C_t + s_0, \quad (2)$$

$$Y_t - Z_t - N_t = u_t + v_t, \quad (3)$$

$$R_{t+1} = R_t + u_t \frac{k \cdot e^{mC_t}}{1 + k \cdot (e^{mC_t} - 1)}, \quad (4)$$

$$C_{t+1} = \alpha_0 C_t + \alpha_1 C_{t-1} + \dots + \alpha_\tau C_{t-\tau} + v_t \frac{l \cdot e^{pR_t}}{1 + l \cdot (e^{pR_t} - 1)}, \quad (5)$$

$$u_{t \geq 0}, v_{t \geq 0}, R_T - qC_T \rightarrow \min, \quad (6)$$

where  $a_1, a_2, b_1, b_2, b, c, d, k, l, m, p, s_0, s_1, s_2, \alpha_0, \alpha_1, \dots, \alpha_\tau, T$  are the parameters based on statistical data;  $t_0, t_{0+1}, \dots, T$  is the period of modernization of the enterprise.

This parametric model allows to determine the basic parameters of the operation of enterprise in the period of modernization. The variables are the indicators describing the profit allocation  $u_t, v_t$ ; as a criterion for optimization, we propose to use the terminal indicator describing the deviation of the amount of resources from the level of capabilities of the enterprise, including the reduction factor  $q$ .

Measuring the amount of heterogeneous resources including the resources of institutional and organizational complex, socio and labor complex, property and technology complex and business and model complex of the enterprise represents a separate problem, which currently is far from having a univocal solution. An even greater challenge presents measuring the level of capabilities (competences) of the enterprise. This can be addressed by using the properly modified methods for assessing the potential of working teams [20].

#### 4. Key Elements of the Strategy for Systemic Modernization of the Enterprise

Different approaches to the basic concept of the enterprise lead to different variants of strategic principles of modernization.

1. According to the concept defining the enterprise as a system of four structural and functional complexes (institutional and organizational complex, social and labor complex, property and technology complex, business and model complex), modernization should be implemented within each of these complexes, while maintaining the strategic parameters of their proportions in the structure of operation and management of the enterprises.

2. The powerful incentives for progressive modernization of the enterprise are provided through formulating and setting ambitious goals, which require the enterprise to attract new highly efficient physical and labor resources. This means that the modernization of each of the four basic complexes of the enterprise (IOC, SLC, PTC, BMC) should be based on pre-designed investment and innovation project, and the combination of these projects should be coordinated on the basis of the general strategic plan of the operation of enterprise. Therefore, the modernization of enterprises is inextricably linked to the widespread introduction of strategic planning at the micro level.

3. The strategic project of modernization should correspond to the macroeconomic strategy of operation and development of the national economy aimed at harmonizing the relations between the state, society, economy, and businesses. Maintaining the efficient operation of cross-level communication channels between the subsystems of society (see Fig.), of the one part, and the described inter-company complexes, of the other part, is a prerequisite for sustainable development of society and creative nature of the modernization in each individual enterprise.

4. This work should be conducted both at the federal and regional levels. The coordination of activities between the regional authorities and regional businesses in the interests of regional economy and improving the quality of life for the population of the region should be based on implementing the projects for the modernization of enterprises operating in the region. This will ensure the unity and continuity of the strategies of social and economic development at the macro, meso (regional context), and micro levels.

5. At the enterprises, it is necessary to create the systems for monitoring and analyzing the resource and competence conformity. The optimal selection, start and the completion of modernization projects must be consistent with the forecasts for the dynamics of the resource-based and competence-based proportions prepared within this type of monitoring.

6. The small-size dynamic model describing the operation of the enterprise can be used as a tool for analyzing the data of resource and competence monitoring (1)–(6). The model can be used as the basis to formulate the recommendations for optimizing the proportions of profit allocation to invest funds in the gain of resources and improve the competence of the enterprise.

7. The design of modernization as a process of “creative destruction” must be in line with the principle of “non-destruction” of the technical and economical, social, and labor capacity of the enterprise. The principle of “destructive creation” is unacceptable, if the destruction brings to the brink of the risk the long- or medium-term prospects of the enterprise. In Russia, where most socio-economic initiatives are brought to the point of absurdity, the systemic modernization as a compromise between the administrative restructuring and evolutionary development has practically no alternative in the structure of the socio-economic strategy for the sustainable and balanced development of the country.

8. The structure of the Strategy for the Socio-Economic Development of Russia until 2030 should include a section reflecting the areas and expected results of systemic modernization of Russian enterprises. Such modernization should be viewed as a driver for improving the efficiency and competitiveness of economy in the regions and Russia as a whole.

### **Conclusion**

The problem of implementing the modernization processes in Russian enterprises more actively has a paramount importance for the recovery of the Russian economy. Addressing it requires to coordinate the efforts of the federal government, regional authorities, sectoral and inter-sectoral businesses, managers, owners and employees of the enterprises. The theoretical aspects of the modernization of enterprises are directly linked to such areas of economics as the theory of the firm, theory of industrial organization, spatial economics, economic dynamics, evolutionary theory, change management, theory of maximizing behavior. The “mirror” of modernization reflects the concurrence of almost all points of view on the strategy for the development of the Russian economy. This article presents only the key components of the problem field considered in theoretical, conceptual and strategic aspects. Based on the fundamental values of systemic approach, achievements of the systemic economic theory, methods of productive functions and related models, we tried to develop in this article an integrated concept for the modernization of business entities. We believe that the implementation of such concept not only will improve the competitiveness of enterprises, but also will contribute to consolidating the economic theory, policy, and practice.

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