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TECHNOLOGY OF ENTERPRISE POTENTIAL MANAGEMENT IN THE COORDINATE SYSTEM OF ORGANIZATIONAL DEVELOPMENT

Abstract

The article considers the technology of enterprise potential management in the coordinate system of organizational development. The built model of organizational support requires consideration of factors that are common to all its components. In particular, when making local decisions in the centres of responsibility associated with a particular component of the system. Organizational development of the enterprise is largely associated with the phase of the life cycle of the enterprise. Each of the components of the system of sets of organizational support for the rationalization of the potential of the enterprise is active throughout the life cycle of the enterprise. But the onset of the final phase of development is a sign of the absence or weakness of the mechanism built at the enterprise for the development of creative initiatives in the management of enterprise potential. It is substantiated that the parameters of the model of organizational support of rational realization of enterprise potential require quantitative parameterization, especially for making informed decisions related to capacity management by phases of the enterprise life cycle.

Keywords*: potential, organizational support, enterprise, management, rationality.*

1. Introduction

Achieving rationality in the realization of the potential of the enterprise (PE) requires organizational, information and communication, personnel, logistics and other types of support. Organizational support, as a rule, covers several vectors, namely: the formation of the organizational structure of management, the creation of rules and procedures in the organization, the distribution of functions and powers in the personnel system. Despite the fact that in the context of these vectors, a lot of researches have been done, it should be recognized that among them there are few that relate to the organizational support of the potential of the enterprise. In addition, scientists do not take into account the fact that in the context of intensification of integration processes, increasing the level of business informatization and intensification of competition, the concept of "organizational support" goes beyond traditional vectors. Given this, the problem is the fragmentary nature of the existing theoretical and methodological provisions for the formation of PE management technology in the coordinate system of organizational development (OD).

Studies that cover the problems of organizational development have a fairly wide range of subjects that they cover. Nevertheless, they can be divided into those that relate exclusively to the theoretical aspects of organizational development [1], [2], and those that have a deeply applied focus. Nowadays, most studies belong to the second group. Thus, the, authors, who study organizational development, consider it in the system of assessing the creditworthiness of enterprises [3], as a stage of technology of financial and analytical management [4], a component of legitimizing the use of unmanned aerial vehicles [5], management tools for innovative entrepreneurship [6], a tool for overcoming destructive phenomena in personnel management of companies based on empirical [7], [8], [9], [10] and expert [11] evaluation and data analysis [12], [13].

2. The aim and objectives of the study

The purpose of the study is to build the control technology of the PE in the coordinate system of the OD. To achieve this goal, you must perform the following tasks:

– to reveal the features of organizational support for the rational implementation of PE;

– to identify the stages of monitoring and regulation of management decisions on the implementation of PE;

– to propose a model of the PR system of the enterprise as a prerequisite for the rational management of PE.

3. Organizational support for the rational implementation of PE

Organizational support for the rational implementation of PE has several components, namely: organizational management structure of PE ($\bigcup S$); rules and procedures for managing PE ($\bigcup P$); system of distribution of functions and responsibilities among managers involved in the management of PE ($\bigcup F$); mechanism for the development of creative initiatives in the management of PE ($\bigcup M$).

Together, these components form a system of sets of organizational support for the rationality of the implementation of PE ($\bigcup Z$), which in a formalized way can be written as follows:

$$\left.\begin{array}{l} \bigcup Z = \bigcup S \cup \bigcup P \cup \bigcup F \cup \bigcup M; \\ s \in \bigcup S \Leftrightarrow \exists Z \in S, s \in Z; \\ p \in \bigcup P \Leftrightarrow \exists Z \in P, p \in Z; \\ f \in \bigcup F \Leftrightarrow \exists Z \in F, f \in Z; \\ m \in \bigcup M \Leftrightarrow \exists Z \in M, m \in Z, \end{array}\right\} \quad (1)$$

where s – is a subset of the elements of the set $\bigcup S$; p – is a subset of the elements of the set $\bigcup P$; f – is a subset of the elements of the set $\bigcup F$; m – is a subset of the elements of the set $\bigcup M$.

The subset s includes permanent structural units (s_1), working groups and commissions in the management system of PE (s_2), as well as working groups and commissions, which are created temporarily to implement certain management initiatives or solve identified problems (s_3), ie $(s_1; s_2; s_3) \subset$ s. It should be noted that one of the characteristics of the developed organizational structure of PE management is its hierarchy, which is manifested in the emergence of management levels – higher ($\bigcup S_v$), middle ($\bigcup S_s$) and lower ($\bigcup S_n$), as well as the relationship of subordination among managers of different levels of management.

In a formalized way, the description of the hierarchy of the organizational management structure of the PE is written as follows:

$$\left.\begin{array}{l} \bigcup S_v \supset \bigcup S_s \supset \bigcup S_n; \\ s_{1.1} ... s_{1.n} \subset \bigcup S_v; \\ s_{2.1} ... s_{2.n} \subset \bigcup S_s; \\ s_{3.1} ... s_{3.n} \subset \bigcup S_n, \end{array}\right\} \quad (2)$$

where $s_{1.1}...s_{1.n}$ are the structural elements of the organizational structure of the management of PE at the highest level of management; $s_{2.1}...s_{2.n}$ are the structural elements of the organizational structure of PE management at the middle level of management; $s_{3.1}...s_{3.n}$ are the structural elements of the organizational structure of PE management at the grassroots level of government.

The subset p also includes several elements – $(p_1; p_2; p_3) \subset p$, where p_1 is a system of provisions on structural units, which are entrusted with the functions of management of the PE; p_2 is a system of job descriptions in terms of structural units, which are entrusted with the management functions of the PE; p_3 are instructions related to the implementation of certain general corporate measures in the PE management system.

The subset f includes such components as a database on the distribution of functions between the structural units of the enterprise for the management of PE (f_1), as well as a database on the distribution of functions and powers among managers involved in the management of PE, ie $(f_1; f_2) \subset f$.

The constituent elements of the subset m are a structural unit, working group or commission, the function of which is to guide the development of creative ideas in the field of PE management (m_1) rules and procedures for managing the development of creative ideas in the management of PE (m_2), and a system of goals in the management system the process of development of creative ideas (m_3), which is realized through the distribution of functions and powers between managers of the unit m_1. So, $(m_1; m_2; m_3) \subset m$.

Based on the structure of the subset m we see that in the system of organizational support for the rational implementation of PE there is an intersection of its individual components, namely

$$\left.\begin{array}{l} \bigcup M \cap \bigcup P = \{m_1 \mid m_1 \in \bigcup M \wedge m_1 \in \bigcup P\}; \\ \bigcup M \cap \bigcup S = \{m_2 \mid m_2 \in \bigcup M \wedge m_2 \in \bigcup S\}; \\ \bigcup M \cap \bigcup F = \{m_3 \mid m_3 \in \bigcup M \wedge m_3 \in \bigcup F\}. \end{array}\right\} \quad (3)$$

Thus, $\because (\bigcup S \cup \bigcup P \cup \bigcup F) \cap \bigcup M \therefore Z \sim \bigcap Z.$

Fig. 1 shows a graphical model of organizational support for the rational implementation of PE.

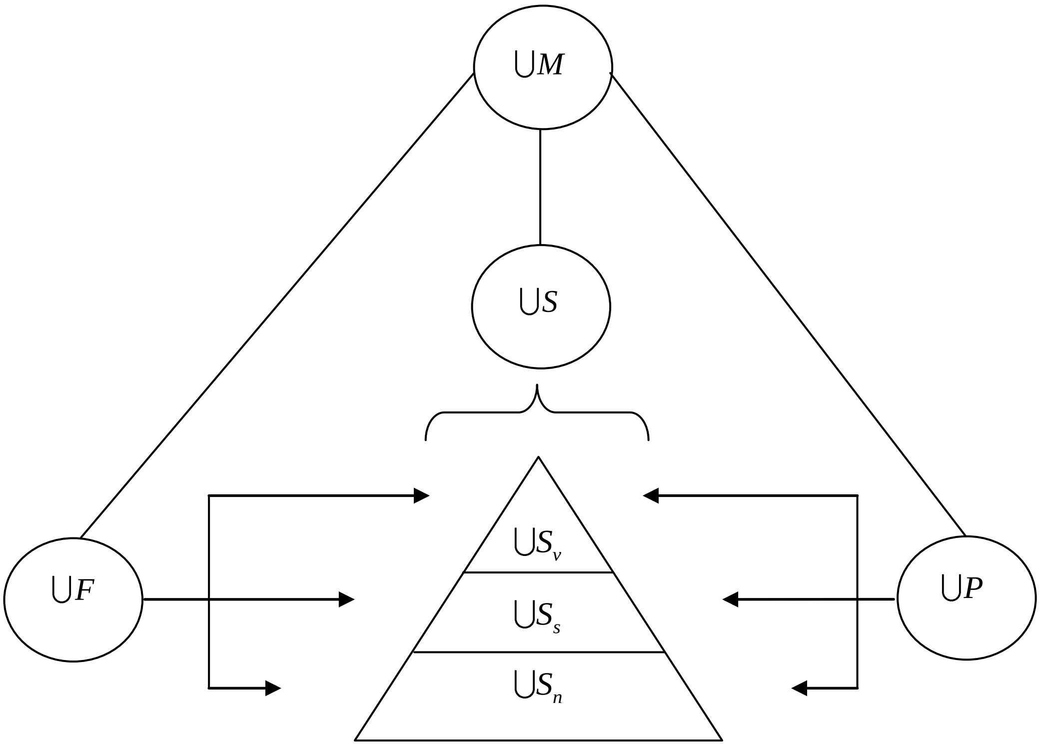

Fig. 1. Model of organizational support of rational implementation of PE

The constructed model indicates that the system of organizational support of rational implementation of PE is influenced by factors that are common to several components. It is important to take this into account when making local decisions at specific hierarchical levels of government, in particular in the centres of responsibility that relate to a particular component of the system. For example, let the deputy director of creative development set a certain unrealistic goal. This will inevitably affect the goals of the head of the creative development department and the tasks of the creators. Due to the unrealistic task, irrational actions can be taken to stimulate creative groups to work more productively, to involve creators on outsourcing terms, and so on. To avoid the negative effects of the intersection of sets in the system of organizational support for the rational implementation of PE it is necessary:

– permanent monitoring of internal and external environments in which the PE is formed;

– ensuring transparency in identifying and solving problems of achieving rationality in the management of PE;

– avoidance of subjectivism in the choice of optimal solutions to achieve rationality in the management of PE by practising collegial decision-making and the use of automated information technology for processing management information. Here, in particular, we are talking about modern decision support systems which are characterized by: providing assistance to the manager in the decision-making process and providing support in the full range of task contexts; support and strengthen the reasoning and evaluation of the leader;

increasing the efficiency of decision-making; implementation of integration of models and analytical methods with standard data access and sampling from them; easy to operate; construction on the principle of interactive problem solving; focus on flexibility and adaptability to adapt to changes in the environment or modify approaches to solving problems chosen by the user, etc. [14].

Organizational development of the enterprise is largely associated with the phase of the life cycle of the enterprise: the origin, creation, growth, maturity and decline [13]. Each of the components of the set of organizational support for the rational implementation of PE is active throughout the life cycle of the enterprise, but it should be recognized that the onset of the final phase of development is a sign of absence or weakness of the enterprise mechanism for developing creative initiatives in management ($\bigcup M$).

In the conditions of effective functioning of the mechanism of development of creative initiatives in management of PE of a phase of growth and maturity, under the influence of a market conjuncture and level of an aggravation of a competition, should periodically change each other. This means that the rationality of the implementation of PE should be reproduced or gain a positive increase. Consider this example, productivity as an indicator that characterizes the rationality of the implementation of PE:

$$\left.\begin{array}{l} \bigcup W_b = O_b \cup T; \bigcup W_z = O_z \cup T; \\ \bigcup W_b \cap \bigcup W_z = \{T \mid T \in \bigcup W_b \wedge T \in \bigcup W_z\}; \\ \bigcup W_z / \bigcup W_b \doteq \Delta, \Delta \geq 0, \end{array}\right\} \quad (4)$$

where O_b, O_z are production volumes in the base and reporting periods, pcs.; T is duration of periods, year; $\bigcup W_b$, $\bigcup W_z$ are sets of indicators that characterize labour productivity in the base and reporting periods; Δ is an increase in labour productivity in the reporting period compared to the base, pcs. / year.

Therefore, Δ is the resulting parameter, and T and V_i are the factors on which Δ depends. We present an economic-mathematical model that will reflect the relationships between these parameters, where the values of the function are defined in the range from 0 to ∞, and the resulting parameter should vary depending on the nature of the relationship between the studied parameters:

$$\Delta = f\left(T, V_i\right) \Rightarrow \Delta = \alpha T^{\beta} V_i^{\theta}, \quad (5)$$

where α, β, θ – power regression coefficients.

By converting the equation $\Delta = \alpha T^{\beta} V_i^{\theta}$ into a linear-logarithmic form using the least squares method and applying the operation of potentiation (deprivation of the mathematical expression of logarithms in order to simplify it), we can calculate the power regression coefficients:

$$\left.\begin{array}{l} \ln(Y) = a_0 + a_1 \ln\left(T\right) + a_2 \ln\left(V_i\right); \\ \ln(Y) = a_0 + \beta \ln\left(T\right) + \theta \ln\left(V_i\right) \Rightarrow \ln(Y) = \ln\left(\alpha\right) + \ln\left(T^{\beta}\right) + \ln\left(V_i^{\theta}\right) \Rightarrow \\ \Rightarrow \ln(Y) = \ln\left[\alpha T^{\beta} V_i^{\theta}\right] \Rightarrow Y = \alpha T^{\beta} V_i^{\theta}, \end{array}\right\} \quad (6)$$

where a_0, a_1, a_2 are linear regression coefficients.

Therefore, using the method of the least squares and a number of mathematical transformations, it is possible to obtain the power dependence required to study the dynamics of growth of values of indicators of rationality of PE implementation, as well as analysis of the impact on this dynamics of time and cost of creative and innovative development.

Let's analyze the above economic and mathematical model for the long-term dynamics of the studied factor and performance indicators. During the analysis we take into account possible data errors (since the values obtained as a result of applying model (5) can be both larger and smaller relatively to the actual values, the errors can be less than zero, which leads to inadequate weighing on the basis of linear coefficients. solution of this problem is possible by squaring the negative values), as well as their effect on Δ and its variance. As a result, we obtain the following equation:

$$\sigma_t = x_0 + x_1|y_{t-1}| + x_2|y_{t-2}| + ... + x_z|y_{t-z}| = x_0 + \sum_{i=1}^{z} x_i|y_{t-i}|, \quad (7)$$

where σ_t is a variance of the resulting parameter calculated for the time period t; x_0, x_1, ..., x_z are linear regression coefficients; $y_{t-1},..., y_{t-z}$ are series of errors with a shift in time from 1 to z periods; z is the largest number of periods for which a shift is possible.

4. Monitoring and regulation of management decisions on the implementation of PE

From the standpoint of the process-functional approach to ensure the rationality of management decisions on the implementation of PE require their permanent monitoring and regulation. Monitoring and regulation are integral steps in making organizational management decisions.

Monitoring and regulation functions are implemented during the implementation of organizational decisions. The purpose of these stages is to identify deviations of the values of actual indicators that characterize the implementation of organizational decisions from the expected values, as well as the elimination of these deviations.

In the technology of making organizational management decisions, the stage of monitoring its implementation involves specifying the objectives, selection of the object of monitoring, methods and sources of management information, as well as monitoring, i.e. the use of selected methods and technologies of monitoring. As a result, the managers of the enterprise, who are responsible for monitoring the implementation of the organizational management decision on the implementation of PE must come to a clear conclusion – the decision needs to be adjusted or not? In case of detection of deviations the process of regulation of realization of the organizational administrative decision begins.

The purpose of regulation is to eliminate deviations of actual indicators that characterize the implementation of PE from the expected (planned) values of these indicators. However, the reason for the detected deviations is not only the actions or inaction of the executors of decisions, but also a change in the objective circumstances in which the PE is implemented. These include changes in market conditions, the nature of changes in the price index, the reduction or increase in interest rates on loans, legislative innovations, the emergence or knowledge of tariff barriers, commodity quotas, and so on. That is, the subjective and objective factors in which the PE is formed and implemented require a review of the relevance of the inserted goals and the compliance of decisions with modern realities. These tasks are performed during the specification of regulatory objectives.

Once the goals and objects of regulation are defined, the selection and application of methods for regulating the implementation of PE takes place. The conducted researches allow to state that in the system of coordinates of OD methods of regulation should be considered in the context of components of system of organizational maintenance of rationality of realization of PE. With this in mind, regulation may include: the creation and liquidation of units, positions, functions and powers, as well as rules and procedures in the management system of the PE; redistribution of functions and powers, as well as positions in the management system of PE; clarification of goals, functions and powers, as well as methods and technologies for achieving goals in the management system of PE.

Applying the provisions of set theory, in particular the Zermelo-Frenkel axiom system (ZFC), we consider the logic of the technology of regulating the implementation of organizational management decisions on the implementation of PP. To do this, we construct matrices of correspondence of ZFC axioms to regulatory solutions (Table 1) and operations on sets that characterize specific organizational solutions (Table 2).

Table 1. Matrix of compliance of ZFC axioms with the regulatory decision in the system of organizational maintenance of rationality of software realization

Regulatory decisions		ZFC axioms				
		The axiom of steam	The axiom of the boulevard	The axiom of union	Selection axiom	Axiom of regularity
Creation	Subdivisions		•	•	•	•
	Positions		•	•	•	•
	Functions and powers		•	•	•	•
	Rules and procedures		•	•	•	•
Liquidation	Subdivisions			•		
	Positions			•		
	Functions and powers			•		
	Rules and procedures			•		
Redistribution	Functions and powers	•		•	•	•
	Positions	•		•	•	•
Specification	Goals	•		•	•	•
	Functions and powers	•		•	•	•
	Methods and technologies for achieving goals			•	•	•

The essence of the application of the above axioms of set theory and operations on sets is, despite the constant change of factors of internal and external environments in which the PE is formed and implemented, to build a logically unambiguous technology to achieve expected results of management decisions. Based on the above ZFC tools, we will build such a technology.

Table 2. Matrix of correspondence of ZFC axioms to operations on sets in system of organizational support of rationality of PE realization

Operations on sets			ZFC axioms				
			The axiom of steam	The axiom of the boulevard	The axiom of union	Selection axiom	Axiom of regularity
Binary	The difference of sets	An absolute complement of the set		•	•		
		Relative complement of the set	•			•	•
		Symmetric difference of sets	•			•	•
	Addition of the set		•	•		•	•
	Combining a set		•		•	•	•
	Intersection of sets				•	•	•
Unary	Addition of the set			•		•	•
	Boulevard formation			•		•	•

As you can see from Fig. 2 this technology includes monitoring and control algorithms, which are interconnected at the stage of detecting deviations, as well as establishing the fact of realization of the purpose of regulation.

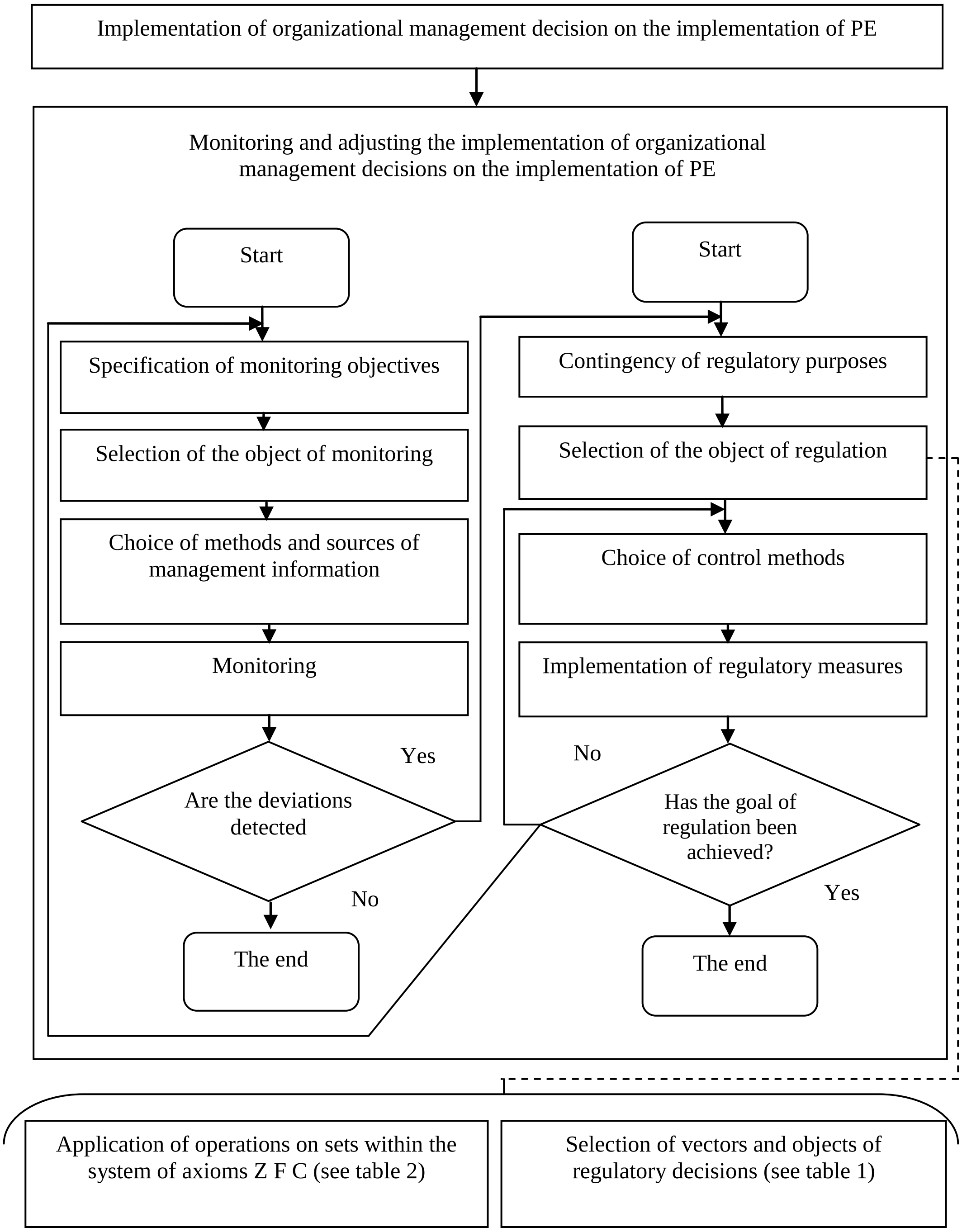

Fig. 2. Technology of achieving the expected results of the implementation of organizational management decisions for the implementation of PE

The logic of unambiguous scientifically sound choice of regulatory decisions is provided by the use of matrices 1 and 2, which allow to develop an adequate roadmap to eliminate deviations identified at the monitoring stage and achieve those values of indicators that characterize the effectiveness of PE that are relevant at the time of implementation.

Buslenko BV notes that today the AMBITE system (Advanced Manufacturing Business

Implementation Tool for Europe) is widely used in PE performance management, as well as such systems as: Management by Objectives (MBO), Key Performance Indicators (KPI), Balanced Scorecard (BSC), Six Sigma, EFQM, Excellence Model, GOAL technology, etc. The purpose of creating these and similar systems is to focus the attention of top management on the development of a system of goals and their delivery to subordinates, the definition of specific methods and techniques for achieving certain goals; creating the most transparent and clear picture of the enterprise through the use of both financial and non-financial indicators and performance indicators, their differentiation by levels of the hierarchy of the enterprise, bringing to specific performers, use in the system of staff motivation [15].

5. Modeling of the OD system of the enterprise as a prerequisite for the rational management of PE

The conducted researches allow to state that modeling of OD of the enterprise should be characterized:

– appropriate input indicators that reflect the factors that affect the rationality of its potential management;

– optimal transformation technology;

– a set of expected output indicators.

Mathematically, this dependence can be represented as functions:

$$\Psi(m) = \mathrm{F}[\Xi(m), \Omega(m)] \qquad (8)$$

where $\Psi(m)$ is the function of the output indicator of the technology of modeling the OD of the enterprise; $\Xi(m)$ indicators of realization of technology of modeling of PR of the enterprise; $\Omega(m)$ – the input indicators of enterprise modeling technology.

By logic, the initial indicators of the technology of modeling the OD of the enterprise should reflect the initial conditions of formation and implementation of software. The generalized result of determining the conformity of the technology to partial functional indicators is the formation of the input vector indicator of the modeling technology of the OD enterprise (E):

$$p_{m1}\ ,\ p_{m2}\ ,\ p_{m3}\ ,\ p_{m4} \subset P\ , \qquad (9)$$

where p_{m1} is an indicator of regulation of realization of modeling technology of OD of the enterprise; p_{m2} is an indicator of transparency of stages of development of technology of OD of the enterprise; p_{m3} is an indicator of specification of stages of technology of OD of the enterprise; p_{m4} is the ability of technology to ensure the development of a practically suitable and potentially effective model of PE for the formation and implementation of PE.

The component indicator of the enterprise PE modeling technology ($\sum$) characterizes the quantitative ratio of elements and stages of this technology. In formalized form, write it as follows:

$$\textstyle\sum_{m1}\ ,\ \sum_{m2}\ ,\ \sum_{m3}\ ,\ \sum_{m4}\ ,\ \sum_{m5} \subset \sum\ , \qquad (10)$$

where $\sum_{m1}$ is a compliance of stages of technology with the needs of modeling and their information content; $\sum_{m2}$ is a compliance with the scientific and practical argumentation of the stages of technology without excessive detail with the excess of time and money spent on their implementation; $\sum_{m3}$ is an expediency of employees' participation of management levels in modeling of technology of OD of the enterprise; $\sum_{m4}$ – objectivity of selection of coordinators and executors to modeling of OD of the enterprise according to their understanding of existing problems and experience in organizational development of the enterprise; $\sum_{m5}$ – expediency of application of the set of modeling methods of OD of the enterprise defined in procedure.

The reserve indicator reflects the optimality and validity of the technology of modeling the OD of the enterprise from the standpoint of resource provision of its implementation. The backup indicator of the technology of modeling the OD of the enterprise (T) is as follows:

$$t_{m1}, t_{m2}, t_{m3} \subset T \qquad (11)$$

where t_{m1} is an indicator that expresses compliance with the principle of cost optimization for a given quality of the required resources; t_{m2} is an indicator, which provides time rationing of the stages of implementation of the technology of modeling the OD of the enterprise; t_{m3} is an indicator that shows the availability of the necessary intellectual resources needed to model the OD of the enterprise.

The management indicator characterizes the level of controllability of modeling technology by organizational development of the enterprise and the possibility of corrective action in identifying shortcomings. Let us present the management indicator of technology of OD modeling of the enterprise (Υ) so:

$$\Upsilon_{m1}, \Upsilon_{m2}, \Upsilon_{m3}, \Upsilon_{m4}, \Upsilon_{m5} \subset \Upsilon \qquad (12)$$

where Υ_{m1} demonstrates its non-random nature, as well as the relevance of the development in relation to the current situation; Υ_{m2} is an indicator that characterizes the distribution of responsibilities and powers for its implementation; Υ_{m3} is an indicator that characterizes the stimulating effects on performers and coordinators for effective modeling of the enterprise's OD; Υ_{m4} is an indicator that characterizes the estimated impact on the course of its stages and the identification of possible shortcomings in the modeling of the OD of the enterprise; Υ_{m5} is an indicator that provides the ability to eliminate quickly deviations in the technology of modeling the OD of the enterprise.

Based on the binary principle, we have reason to believe that the total value of the type of integrated indicator will be equal to the sum of binary values of partial indicators with the maximum possible value equal to the power of the integrated indicator. That is, the calculation of indicator values, taking into account the standardization of maximum values, will look like this:

$$\left.\begin{array}{l} \because [P \sim P_{\max}] \wedge P = p_1 + ... + p_4 \therefore \delta_p \sim P / P_{\max}; \\ \because [\Sigma \sim \Sigma_{\max}] \wedge \Sigma = \Sigma_1 + ... + \Sigma_4 \therefore \delta_\Sigma \sim \Sigma / \Sigma_{\max}; \\ \because [T \sim T_{\max}] \wedge T = t_1 + ... + t_4 \therefore \delta_T \sim T / T_{\max}; \\ \because [\Upsilon \sim \Upsilon_{\max}] \wedge \Upsilon = \Upsilon_1 + ... + \Upsilon_4 \therefore \delta_\Upsilon \sim \Upsilon / \Upsilon_{\max}, \end{array}\right\} \qquad (13)$$

Where P, $\sum$, T, Υ are the value of the total vector, component, backup and management indicators of the technology of modeling the OD of the enterprise, respectively; $p_1 \ldots p_4$, $\sum_1 \ldots \sum_5$, $t_1 \ldots t_3$, $\Upsilon_1 \ldots \Upsilon_5$ are binary values of partial vector, component, reserve and management indicators of the technology of modeling of OD of the enterprise accordingly; $\mathrm{P}_{\max}$, $\sum_{\max}$, $\mathrm{T}_{\max}$, $\Upsilon_{\max}$ are the maximum possible values of the general vector, component, reserve and management indicators of technology of modeling of OD of the enterprise accordingly; P, $\sum$, T, Υ are power of the general vector, component, reserve and administrative indicators of technology of modeling of OD of the enterprise accordingly;

δ_p, δ_Σ, δ_T, δ_Υ, standardized values of the general vector, component, reserve and management indicators of modeling technology of OD of the enterprise accordingly.

Standardized values can range from 0 to 1. Based on the obtained values, we can calculate the integrated input indicator of the technology optimality of modeling the OD of the enterprise (γ):

$$\gamma = \sqrt{\eta_p \delta_p^2 + \eta_\Sigma \delta_\Sigma^2 + \eta_T \delta_T^2 + \eta_\Upsilon \delta_\Upsilon^2}, \quad (14)$$

where η_p, η_Σ, η_T, η_Υ are the coefficients of weight of the general vector, component, reserve and administrative indicators of technology of modeling of OD is of the well-known Fishburne's criterion [16]:

$$\eta_i = 2\left(\kappa_\alpha - \varpi_i + 1\right) / \left(\kappa_\alpha + 1\right) \times \kappa_\alpha, \quad (15)$$

where η_i is the weight of the i-th general input indicator of the technology of modeling the OD of the enterprise; - the number of common input indicators of the technology of modeling the OD of the enterprise, κ_α =4; $\tilde{\omega}_1$ is a serial number of the *i*-th general indicator of technology of modeling of OD of the enterprise.

Important in determining the integrated input indicator of the optimality of the technology of modeling the OD of the enterprise is the interpretation of its obtained value, i.e. the establishment of boundaries that characterize the state of the indicator. This task can be performed based on the Sturgess' rule [17]:

$$h_X = X_{max} - X_{min} / 1 + 3{,}322 lg n_X, \quad (16)$$

where h_x is the length of the interval of the value of the integrated input indicator of the optimality of the modeling technology the OD of the enterprise; nx is a number of population units; X_{max}, X_{min}, are the maximum and minimum possible value of the integrated input indicator of the optimality of the modeling technology of the OD of the enterprise, X_{max}=1, X_{min}=0.

Therefore, the value of the interval h_x = 0.3 is obtained. Based on this, we come to the conclusion about the level of input optimality of the enterprise OD modeling technology:

– low level of optimality (from 0 to 0.33);

– average level of optimality (from 0.33 to 0.66);

– high level of optimality (from 0.66 to 1).

Internal indicators, which describe the implementation of the modeling technology of the OD of the enterprise, should determine the consistency and activity of processes within its stages. The key general indicators within the internal processes of the modeling technology of the enterprise of the OD are proposed to apply the following:

1. Congruence indicator – demonstrates the consistency of all components of technology, their unity and consistency, which is the key to the success of its implementation. Let us present the general indicator of congruence of modeling technology of the OD of the enterprise (N_m):

$$n_{m_1}, n_{m_2}, n_{m_3}, n_{m_4} \subset N_m, \quad (17)$$

where n_{m1} presupposes their logical connection and the absence of those stages, the results of which are not used or have a destructive effect on the modeling of the OD of the enterprise; n_{m2} characterizes their maximum objectivity and the appropriate level of validity; n_{m3} expresses the consistency of scientific methods in the formation of strategy and their complementarity, as well as the transparency of the functions performed by the participants involved in this formation; n_{m4} is an indicator of transparency and non-abuse of available resources by stakeholders.

2. The indicator of the intensity of information exchange within the technology expresses the power of use of information resources, which makes the model of PR of the enterprise more reasonable, complete and practically applicable. This indicator of the technology of modeling the PR of the enterprise (I_p) is expressed by the following dependence:

$$o_{m_1}, o_{m_2}, o_{m_3}, o_{m_4}, o_{m_5} \subset \mathrm{O}_m, \tag{18}$$

where o_{m1} demonstrates the completeness of interaction between the participants in the performance of their functional responsibilities within a certain vector of development of technology for modeling the OD of the enterprise, which makes their decisions more effective; o_{m2} expresses the interaction between the participants of different functional areas of development of technology for modeling the OD of the enterprise, through which the integration and completeness of solutions are achieved; o_{m3} is a key indicator of cooperation between the executors and managers of the process of developing technology for modeling OD of the enterprise, as well as between participants representing different levels of OD, which allows more effective consideration of various aspects of modeling technology for enterprise OD and achieve positive results at all levels; o_{m4} demonstrates taking into account previous experience in the development of such technology and the peculiarities of the functioning of the OD system to the current period to apply proven tools to impact positively this sector and avoid past mistakes; activity of introduction and creation of new information resources in the procedure; o_{m5} allows not to lose the relevance and prospects of the developed technology for modeling the OD of the enterprise in relation to dynamic changes in the environment of its development.

Indicator of time optimality of technology reflects its compliance with the specified initial duration, feasibility and relevance in relation to the priorities of PE implementation in the coordinate system of the OD. The general internal indicator of technology of modeling of OD of the enterprise will look so:

$$\Pi_{m_1}, \Pi_{m_2}, \Pi_{m_3}, \Pi_{m_4} \subset \Pi_m, \tag{19}$$

where Π_{m1} is an indicator that reflects the optimal ratio of time spent at different stages, the absence of significant time gaps between transitions from one stage to another in the development of modeling of the OD of the enterprise; Π_{m2} is an indicator that demonstrates the coherence and timeliness of all stages of the technology of modeling the OD of the enterprise; Π_{m3} is an indicator that indicates that the time indicators of the technology allow to solve the current problems of modeling the OD of the enterprise and are timely in relation to the established prospects; Π_{m4} is an indicator that reflects the interdependence and relationship in time of the processes of development of technology for modeling the OD of the enterprise with strategic transformations of other types of enterprise development.

We propose to calculate the value of the integrated internal indicator of the enterprise modeling technology similarly to the calculation of the input indicator. That is, like expressions (13), we determine the numerical value of the general internal indicators on the basis of binary evaluation of their components and obtain N, O, Π.

In the future, these values are standardized according to the principle (13) and the values $\delta_N, \delta_O, \delta_\Pi$ are obtained, the weighting factors of each of the common indicators are determined by the Fishburn's criterion and the integrated internal indicator of OD enterprise modeling technology (γ) is calculated:

$$\gamma = \sqrt{\eta_N \delta_N^2 + \eta_O \delta_O^2 + \eta_\Pi \delta_\Pi^2}, \tag{20}$$

where η_N, η_O, η_Π are the coefficients of weight of the general indicator of congruence, intensity of information exchange and time optimality of modeling technology of OD of the enterprise accordingly. We obtain a value that can range from 0 to 1, and scale on the basis of Sturgess's formula (26). As a result, we obtain a step of the interval, which will be $h_z = 0.3$ Accordingly, we conclude that the obtained limits of the value of the indicator γ, i.e. the internal optimality of the technology of modeling the OD of the enterprise:

– low level of optimality (from 0 to 0.33);
– average level of optimality (from 0.33 to 0.66);
– high level of optimality (from 0.66 to 1).

The last group of indicators consists of the initial indicators of the technology of modeling the OD of the enterprise, which describe the timeliness of the technology completion, the quality and suitability of its application for modeling the OD. Based on the analytical processing of the author's positions, we believe that the most objective will be the following initial general indicators:

1. Indicator of optimality of technology completion (Θ) characterizes the completeness of work performed within it and the consistency of the final management decisions to approve the developed strategy.

$$\Theta_{m_1}, \Theta_{m_2}, \Theta_{m_3}, \Theta_{m_4} \subset \Theta, \tag{21}$$

where Θ_{m1} is an indicator that expresses the quality of technology completion management from the standpoint of consistency of the results obtained in the previous stages; Θ_{m2} is an indicator that characterizes the completeness and validity of the final stage, which strengthens the argumentation of the developed technology; Θ_{m3} is an indicator that demonstrates the completeness of the technology, its validity and clarity to ensure the implementation of further stages of modeling; Θ_{m4} is an indicator that confirms the implementation of all managerial influences on the procedure, including control and regulation, which makes the existing technology justified by the possibility of influencing its development and confirms its non-stochastic nature.

2. Technology performance indicator (Θ_{m1}) expresses the characteristics of the created model of the OD of the enterprise in relation to its suitability for use. Here is the general expression of the technology performance indicator:

$$i_{m_1}, i_{m_2}, i_{m_3}, i_{m_4} \subset \mathrm{I}_m, \tag{22}$$

where i_{m1} confirms its validity and objective nature; i_{m2} is an indicator that reflects its compliance with the existing problems of the OD of the enterprise and adaptation to the specifics of its operation; i_{m3} is an indicator that provides the ability of the selected simulation technology to achieve the objectives set at the initial stages of OD; i_{m4} is an indicator that characterizes the possibility of its modification and improvement for use in future periods after achieving the set goals for solving current problems.

Regarding the calculation of the integrated output indicator of the enterprise OD modeling technology, it is determined similarly to the input and internal indicators, i.e. we apply the binary method of values of common output indicators (24), standardize them relative to the maximum possible value (24) and determine the value of integrated output of the indicator of technology of modeling of OD of the enterprise:

$$\gamma = \sqrt{\eta_{\Theta_m}\delta^2_{\Theta_m} + \eta_{I_m}\delta^2_{I_m}}\,, \qquad (23)$$

where $\eta_{\Theta_m}, \eta_{I_m}$ are coefficients of weight of the general indicator of optimality of completion and efficiency of technology of OD modeling of the enterprise accordingly. The weight of indicators is calculated based on the Fishburne's rule (15).

The intervals of the values of the output indicator are calculated similarly on the basis of the Sturgess' rule (16). Given that the number of intervals will be 2, the value of each interval h_y=0,5. Accordingly, we conclude about the value of the output indicator:

– suboptimal results of the technology of modeling the OD of the enterprise (from 0 to 0.5);

– optimal results of the technology of modeling the OD of the enterprise (from 0.5 to 1).

Therefore, the stages of modeling the OD of the enterprise are:

– building a tree of OD goals;

– strategic analysis of the internal and external environment of the enterprise;

– modeling of OD trends;

– development and analysis of strategic alternatives to OD;

– selection of the optimal modeling technology;

– determination of conditions for adjustment of modeling technology;

– detailing of the selected modeling technology.

As we can see, the first stage is to build a tree of OD goals for PE management. The purpose of building a goal tree is to reconcile them in space and time, to avoid conflicting goals at different hierarchical levels of government. When the goals are defined, there is an analysis of the internal and external environments of the formation and implementation of PE in the coordinate system of the OD. This task is possible on the basis of a wide range of methods, including methods of SWOT-analysis, SPACE-analysis, PIMS-analysis; extrapolation and cluster analysis methods, scenario method, heuristic methods (brainstorming, expert evaluation, morphological analysis, Delphi method, etc.), correlation-regression analysis, etc. In order to obtain the most complete and objective results, we consider it appropriate in the formation of modeling technology of the enterprise to comprehensively combine several methods, different in nature (general and specific, heuristic and statistical), correlation and regression analysis; statistical analysis; extrapolation method; method of office research, etc.

After the analysis of internal and external environments of formation and realization of OD in the system of coordinates of OD there is a transition to modeling of OD tendencies of the enterprise. At this stage, it is advisable to use a variety of economic and mathematical models with appropriate criteria. Development and analysis of strategic alternatives provide various possible options for the formation and implementation of PE in the coordinate system of the OD, the establishment of criteria by which to evaluate the various developed options for modeling technology. The most common general criteria for the effectiveness of any technology is the achievement of goals, inconsistency with the models of development of other management projects, compliance with the established restrictions. At this stage, it is important to use certain methods of analysis, such as the method of scenarios, expert evaluation, matrix models of analysis and so on.

The choice of the optimal technology for modeling OD is based on the evaluation of strategic alternatives and should, first of all, be ensured by the objectivity and coherence of management decisions. The level of expertise of the experts and actors responsible for making these decisions is also important.

It is important from the standpoint of preparedness for possible future negative impacts of the external and internal environment of the enterprise, which can lead to various bifurcations and require clarification and adjustment of existing actions for its development is to determine the conditions for adjusting the strategy of OD modeling technology. Detailing the technology of OD modeling on the calendar plan of measures ensures the establishment of the sequence and duration of work within the strategy and allows to determine the limits of authority and responsibility for its implementation.

Analysis of the indicators shown in Fig. 1,2 technologies of modeling of OD of the enterprise provide:

– binary evaluation of partial indicators of enterprise modeling technology;

– calculation of values of the general indicators of technology of OD modeling of the enterprise;

– standardization of values of the general indicators of technology of OD modeling of the enterprise;

– calculation of values of integrated indicators of procedure of technology of OD modeling of the enterprise.

6. Conclusions

1. The obtained model (7) allows the subjects of PE control to establish how the error values affect the deviation Δ from the average value. Based on this, we can draw the following conclusions:

– the influence of errors on the variance indicates that the higher the level of uncertainty for the studied stochastic quantity, the greater the oscillations, the stronger the influence of reflexivity;

– in the absence or low influence of errors on the variance, the reflexivity does not affect the dynamics Δ;

– the values of the regression coefficients for model (7) give an idea of the period with which the growth of uncertainty is reflected in the variance of a random variable, which allows to show how “stretched” in time is the influence of managers involved in PE management.

2. The use of the proposed technology as a variant of the specification in the AMBITE system, as well as in combination with factor analysis, which allows MBO, KPI, BSC, etc. will increase the level of objective processing and use of management information during monitoring and regulation of organizational management decisions in the PE management system. This will also eliminate the restrictions on the use of qualitative analysis, and thus bring the level of compliance of the selected criteria for regulatory decisions to the actual conditions prevailing in the environment of the enterprise.

3. Component parameterization of the technology of modeling of PE of the enterprise will allow to provide its optimality and positive efficiency thanks to the reasoned set of indicators for its analysis. It is important that the application of the developed recommendations by experts responsible at the highest level for the development of OD modeling technology is possible in the formation of this type of technology at different stages of PE management and at different current states.

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