РОЗДІЛ IV
Управління та адміністрування

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MODELING OF BUSINESS PROCESSES ON THE BASIS OF BUILDING AN OPTIMAL SYSTEM OF COMPLEXING ADAPTIVE-ORGANIZATIONAL MECHANISM MANAGEMENT OF ENTERPRISES

The article is devoted to topical issues of research of peculiarities of business process modeling on the basis of construction of optimal system of complexing of adaptive-organizational mechanism of management. The study developed a scientific approach to business process modeling based on the use of complex adaptive-organizational management mechanism through simulation modeling of business processes based on matrix construction, which gives a more accurate assessment of the system and more fully describes the cause-and-effect relationship –«status-adaptation-management-status» on the enterprise. The researched description of the given functional dependences with use of a method of simulation modeling of business processes gives the chance to construct dynamics of forecast states of system of activity of the enterprise that will avoid erroneous decisions and will allow to construct subspace of management business-processes of the enterprise.

Key words: management, enterprise, modeling, business processes, management mechanism, system of complexing adaptive-organizational management mechanism.

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МОДЕЛЮВАННЯ БІЗНЕС-ПРОЦЕСІВ НА ЗАСАДАХ ПОБУДОВИ ОПТИМАЛЬНОЇ СИСТЕМИ КОМПЛЕКСУВАННЯ АДАПТИВНО-ОРГАНІЗАЦІЙНОГО МЕХАНІЗМУ УПРАВЛІННЯ ПІДПРИЄМСТВА

Стаття присвячена актуальним питанням дослідження особливостей моделювання бізнес-процесів на засадах побудови оптимальної системи комплексування адаптивно-організаційного механізму управління. У дослідженні запропоновано науковий підхід на основі побудови оптимальної системи комплексування адаптивно-організаційного механізму управління підприємством та запропоновано структуру її дослідження. Дану систему комплексування можна описати у формі порівняльної матриці, ряди якої є набором виконуваних дій, спрямованих на зміну економічних показників системи, що відображають стан об'єктів адаптивно-організаційного механізму управління. Сутність її полягає в тому, що управлінські дії призводять до зміни параметрів об'єктів системи, у результаті чого об'єкти і система переходять з одного стану в інший через систему комплексування. Проаналізовано, що використання системи комплексування адаптивно-організаційного механізму управління дає більш точну оцінку стану системи та більш повно описує причинно-наслідковий зв'язок «стан-адаптація-управління-стан». Наведені характеристики системи про структурно-

функціональний взаємозв'язок об'єктів дозволяють зрозуміти можливий стан виділених об'єктів управління та системи в цілому записати у формі матриці станів. На підставі значень даних точок матриць, застосовуючи для вимірювання фінансової діяльності методи багатовимірного аналізу, можна отримати універсальну міру (вимірювач) і величину відмінності економічного стану господарюючих об'єктів, а також встановити збіг або близькість їх до деяких заданим характеристик ефективності його бізнес-процесів через моделювання та використання побудованої системи комплексування адаптивно-організаційного механізму управління підприємством. На основі правил й структури моделі побудована повна функціональна модель бізнес-процесів, що дозволяє пов'язати структуру та реальні об'єкти, виробничу систему й системи комплексування адаптивно-організаційного механізму управління. Таким чином, отриманий у дослідженні опис наведених функціональних залежностей дозволяє методом імітаційного моделювання побудувати динаміку прогнозних станів системи показників діяльності підприємства та визначити ймовірнісні прогнозні значення показників фінансово-економічного стану, що дозволить уникнути помилкових рішень та дасть можливість побудувати підпростір управління системою комплексування адаптивно-організаційного механізму управління, що відповідає вимогам раціональності та ефективності організації бізнес-процесів підприємства.

Ключові слова: управління, підприємство, моделювання, бізнес-процеси, управлінський механізм, система комплексування адаптивно-організаційного механізму управління.

Formulation of the problem. Management of any object is a set of techniques and methods of influencing it to achieve goals. Financial resources can be considered both as an object and a subject of management, it is obvious that they play an active role in managing a particular socio-economic system of any enterprise, while simulating business processes based on effective adaptive and organizational management mechanism ensures its long-term socio-economic sustainability and development. Moreover, if in carrying out financial and economic activities the company has the main purpose - the collection, registration and processing of data contained in financial and economic transactions, financial management includes means and methods of regulating profit and loss, determining the state of facilities on the basis of building optimal complexing systems.

The analysis of researches and publications. Analysis of the development of management theory and practice shows that the problems of using the optimal system of complex adaptive-organizational management mechanism occupied a significant place in the works of domestic and foreign scientists, but studies of their impact on business processes have not been researched sufficiently.

Studies have been devoted to the development of management issues: I. Ansoff, M. Butko, V. Didenko, T. Dyachenko, M. Yokhna, O. Kuzmina, L. Skibitska, F. Khmil [1-3, 5].

The activity of enterprises on the formation of adaptive-organizational management mechanism based on the impact on business processes of the enterprise were partially studied in the works of I. Blank, G. Kindratskaya, O. Malikov, G. Monastyrsky, A. Podderyogina, V. Sheludko [4, 7-8, 10].

Analyzing the features of modern approaches to the formation of the optimal system of complexing adaptive-organizational management mechanism based on modelling business processes of the enterprise, it should be noted that in they have insufficiently developed this system, which reflects the relevance of our chosen research topic.

The purpose of the work. The main purpose of the article is to form an optimal system of complexing the adaptive-organizational mechanism of management on the basis of scientifically sound theory of modelling business processes of the enterprise.

Presentation of the main research material. The system of complexing the adaptive-organizational management mechanism (hereinafter – SKAOMU) in most cases is based on the effective management of the financial system as a benchmark, which is considered in relation to the adopted management policy of a particular enterprise. In this case, SKAOMU analyzes the activities of various parts of the financial system, provides sound proposals to address identified shortcoming and provides recommendations for improving the efficiency of financial management.

In this case, SKAOMU analyzes the activities of various parts of the financial system, provides sound proposals to address identified shortcomings, provides recommendations for improving the efficiency of financial management.

First of all, it is worth considering the general aspects of SKAOMU, including the whole set of management objects. In our opinion, the SKAOMU model has the following structure: 1) the SKAOMU

object, 2) the criteria for the effectiveness of the state or functioning of the SKAOMU object, 3) the SKAOMU methodology. It is schematic, due to the fact that information overload can lead to difficulties in practical use. In this case, it is useful to compare the current state of affairs with the criteria of efficiency and our proposed model.

From the standpoint of management, the analysis of activities is an integral part of the management of the organization and performs the functions of standard (checking the status) of management structures and the object of management. This procedure should ensure the adjustment of management structures, the provision of various production facilities, economic and financial services with relevant regulations (rules) that establish certain management algorithms and their compliance with regulations [2, p. 334].

From these positions, the content of the construction of SKAOMU can be implemented through:

1. Analysis of organizational and regulatory documents governing the provision of commercial loans to customers (buyers).

2. Determining the level of actual implementation of the proposed regulations, namely:

• the presence of appropriate sanctions (visas) on the documents;

• availability of materials indicating the analysis of the financial condition (solvency) and business integrity of customers;

• compliance of the amounts and terms of loans with the established risk groups of customers or creditworthiness standards.

3. Assessment of the qualification structure and level of knowledge of economic and managerial staff, the actions of decision-makers and the relevance of these decisions to emerging situations.

In our opinion, the objects of SKAOMU can be the procedures of making managerial decisions of a financial nature and the distribution of powers of management staff using the system of information support for decision-making, and the criteria of effectiveness are:

- decision-making procedures and division of powers;
- division of powers of managers and decision-making procedures on financial issues that meet the basic principles of internal control, meet the organizational structure of the enterprise, goals and strategies of its development, providing a flexible response to rapidly changing external conditions;
- the decision-making system can be considered effective (conditionally) if it has led to at least the following results:

- sustainable income flow in the long run;
- increase in return on assets, equity and total capital;
- growth of market value and profitability of shares;
- high social results in the part relating to employees of the enterprise and members of their families;
- achieving optimal (regulatory) values of specific sectoral socio-economic indicators.

This system can be described as a comparative matrix, the series of which is a set of actions aimed at changing the economic performance of the system, reflecting the state of the adaptive-organizational management mechanism. That is why the new economic state of the system under this management (regulation) is solely the result of this regulation [7, p. 186]. Its essence is that management actions change the parameters of system objects, as a result of which objects and the system move from one state to another. On the other hand, the use of the system of complexing adaptive-organizational management mechanism gives a more accurate assessment of the state of the system and more fully describes the cause-and-effect relationship «status-adaptation-management-status». Therefore, the characteristics of the system on the structural and functional relationship of objects allow to understand the possible state of selected control objects and the system as a whole to write in the form of a matrix of status, a generalized view (composition and indicators) are presented in table 1.

Table 1

Matrix status of objects of the enterprise management system*

№ п/ п	Content of works (P_i)	Targets Indecators, Pch	Economic indicators in achieving goals					
			PE_1	PE_2	PE_3	PE_4	PE_5	PE_6
1	Expansion of production (P_1)	$Pch_{(1)}$	PE_{11}	PE_{12}	PE_{13}	PE_{14}	PE_{15}	PE_{16}
2	Commissioning of new equipment (P_2)	$Pch_{(2)}$	PE_{21}	PE_{22}	PE_{23}	PE_{24}	PE_{25}	PE_{26}
M	Application of research works (P_m)	$Pch_{(m)}$	PE_{m1}	PE_{m2}	PE_{m3}	PE_{m4}	PE_{m5}	PE_{m6}

**Source*: modified and compiled by the author based on the analysis of [1, 3]

Table 1 adopts the following notations: Pch(1) – target indicator (estimated management indicator) that can be achieved during the implementation of works (Pi);

PE1 – the name of the selected economic indicator of activity, which reflects the performance of the i-th work; PE (ij) = (PE (11), ..., PE (16) PE (21), ..., PE (26),…, PE (m6)} – the value of the j-th economic indicator that reflects.

For example, for the selected simulation fragment of the situation shown in Table 1, shown by a limited set of Pch (i) = {Pch (1), Pch (2), ..., Pch (6)} as a target, the value of labor productivity resulting from the expansion of production (P1) can be selected (see Table 2).

Table 2

Economic indicators that reflect the status of the objects of the management system*

Indicators	Name of indicators
PE_1	The amount of investment, external loans
PE_2	Change in assets
PE_3	Changing the cost of raw materials, energy and other factors of production
PE_4	Change in the cost and price of products (services) produced
PE_5	Change in the amount of wages
PE_6	Time intervals of achievement of the set productivity and payback of investments (investments)

**Source*: modified and compiled by the author based on the analysis of [1, 4]

The given example of formation of values of target and economic indicators shows that application of matrix descriptions of a condition of objects and system allows to solve three interrelated problems:

- formation of an assessment of the socio-economic condition of the system, which reflects the result of specific work;
- definition of criterion space, which allows to establish multi-place relationships between sets of estimates;
- construction of the initial information base, which implements the development and adoption of appropriate management decisions through the construction of a system of complexing adaptive and organizational mechanism of enterprise management.

Analysis of the introduced rules and the proposed structure (objects, relationships) of the management system show that in general the totality of all forms of interaction can be described in the form of three related models, namely: real objects of the economic system, including factors of production, equipment and actions with the model of business process description; objects of primary management through the complexation of adaptive-organizational mechanism of management; objects and systems of reflections through the formation of socio-economic stability of the enterprise. The real objects of such a system give rise to real objects of management and adaptation to changes in the internal and external environment of the enterprise.

In turn, the real objects of management, in addition to the named real objects of production and economic activity, include cost indicators (cost of fixed assets, costs, profits), reflecting the business processes of production (services) [3-5].

Table 3

System model of real subject area and its paired mappings*

Formulas	Variables	Interpretation
$S^{м}_{ф} = < R^{ф}_{(i)}, A^{ф}_{(i)}, T > i \epsilon I$	$S^{м}_{ф}$ $R^{ф}_{(i)}$ $A^{ф}_{(i)}$	A system of relationships that describes the real objects and processes of the subject area Real objects of the subject area n-place relations (operations) in the space of real objects of the subject area… at i = 1, n.

continuation of Table 3

Formulas	Variables	Interpretation
$S^{np}{}_i = < R^{np}i, A^{nh}{}_{i\,(j)}, T >$	$S^{np}{}_i$ $A^{nh}{}_{i\,(j)}$ $R^{np}i$	A system of relations that describes the information objects of the real system that form the primary management system. Information objects (Io), which are presented in the form of mapping objects of real systems in the information space (Io – objects of the subject area of management) m-local relations (operations) of information objects (Io-objects) of information spaces by J = 1, m.
$S^{бy}{}_i = < R^{бy}{}_{i(i)}, A^{бy}{}_{s(i)}, T >$, (j є 1)	$S^{бy}{}_i$ $A^{бy}{}_{s(j)}$ $R^{бy}{}_{i(j)}$	A system of relations that describes the information objects of the real system (information processes of the subject area, which form a management system based on business process modeling. Information objects, which are presented in the form of displaying information objects of the primary area in the information space m-local relations (operations) of information objects of the information space at j = 1,… m.
$S^{yy}{}_i = < R^{yy}{}_{i(j)}, A^{yy}{}_{i(j)}, T >$, *(j є J)*	$S^{yy}{}_i$ $A^{yy}{}_{i(j)}$ $R^{yy}{}_{i(j)}$	The system of relations, which describes the information objects and processes of the subject area, which form the management system through the system of complexing the adaptive-organizational management mechanism. Information objects, which are presented in the form of mappings of Io - objects of the primary subject area and Io objects of management in the information space m-local relations (operations) of information objects (Io - objects) of the information space of the management space at j = 1,….m.
$S^{yy}{}_{ipo} = < R^{yy}{}_{ipo(j)}, A^{yy}{}_{ipo(j)}$, T >, *(j є J)*	$S^{yy}{}_{ipo}$ $A^{yy}{}_{ipo(j)}$ $R^{yy}{}_{ipo(j)}$	The system of relations, which describes the calculated information objects of the management system, which together with form a system of government through the formation of socio-economic stability of the enterprise. Settlement information objects (Io - objects), which are presented in the form of display Io - objects of the primary subject area and Io objects of management of information space of settlement Io - objects of management m-local relations (operations) of settlement information objects (Io - objects) of the information space of management at j = 1,…. m.

**Source*: modified and compiled by the author based on the analysis of [1, 3-4, 8-10]

Using the mathematical apparatus of systems theory allows a formal description of the relationships named objects of the subject area, the system of complexing adaptive-organizational control mechanism to write in the form of system mappings of the form (see Fig. 1):

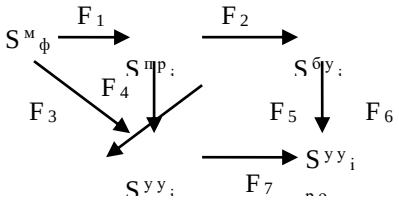

Fig. 1. *Modeling the relationship of subject information areas**
**Source*: modified and compiled by the author based on the analysis of [8-10]

In fig.1 we shows the set of functional relationships of a set of objects that constitute the essence of the different areas of management that form the system of communication of control objects, described in table 4.

Table 4

Contents of functional connection mappings of SKAOMU objects*

Communication	Description of connections
$F_1 : S^{м}_{ф} \rightarrow S^{пр}_{i}$	Formation of primary information objects of the subject area, based on many objects and actions of the real management system.
$F_3 : S^{м}_{ф} \rightarrow S^{уу}_{i}$	Formation of primary information objects of the subject area of management on the basis of many objects and actions of the real system, the composition and structure of which are determined by the requirements of means and methods of managing the activities of a particular object.
$F_2 : S^{пр}_{i} \rightarrow S^{бу}_{i}$	Formation of adaptation management information objects on the basis of information objects of the primary area.
$F_4 : S^{пр}_{i} \rightarrow S^{уу}_{i}$	Formation of information objects of management on the basis of information objects of the primary area.
$F_5 : S^{бу}_{i} \rightarrow S^{бу}_{про}$	Formation of management information objects based on management information objects through business process modeling.
$F_6 : S^{бу}_{i} \rightarrow S^{уу}_{про}$	Formation of settlement information objects of management on the basis of information objects of management through the system complexing of the adaptive-organizational mechanism of management.
$F_5 : S^{уу}_{i} \rightarrow S^{уу}_{про}$	Formation of settlement information objects of management through formation of social-economic suitability of the enterprise

**Source*: modified and compiled by the author based on the analysis of [3-4, 8-10]

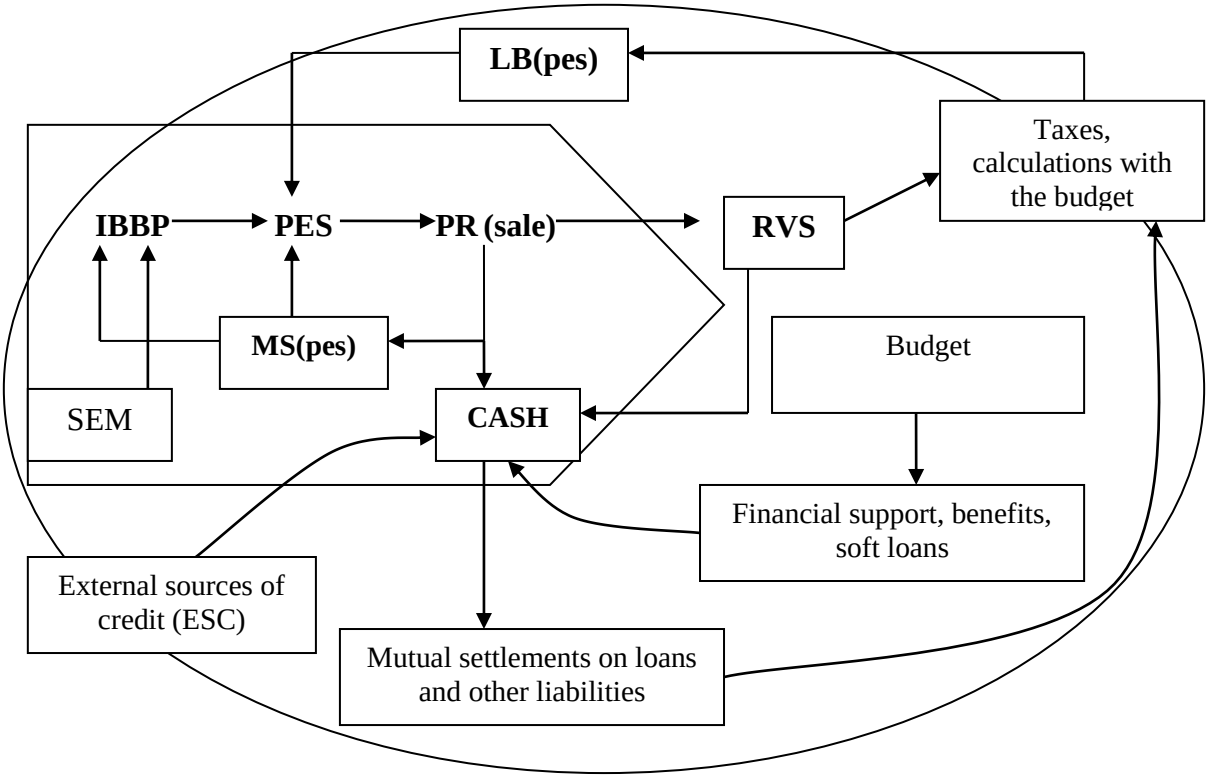

Fig. 2. *Modeling the structure of business processes on the basis of SKAOMU**
**Source*: modified and compiled by the author based on the analysis of [3-4, 6, 8-10]

In this model (see Fig. 2) the following objects are offered: IBBP – input base of business processes of the system, including factors of production (raw materials, labor, etc.), money, capital investments; PES – production and economic system, including organizational and production, technological, financial and economic structures that ensure the production and sale of products (services); PR(sale) – products (services) of the production-economic system and its implementation in kind; MS(pes) – management system (means, methods, objects) of the production and economic system; LB(pes) – legislative, regulatory framework, regulatory activity of the production-economic system; RVS – revenue from sales of products (services) in value terms; CASH – cash after taxes and other payments to the budget, which remain the property of the production and economic system; SEM – suppliers of equipment, raw materials, energy resources, including research, know-how. The relationship between production, economic and internal management is described in table 5.

Table 5

Objects and interrelation of business processes and systems of integration of adaptive-organizational management mechanism*

Object and relationship	Interpretation
IBBP→SEM→PR(sale)	Production process, production and economic, financial activities, obtaining products (services) - technology, equipment, personnel, raw materials.
PR(sale)→RVS	Sales of goods – money
PR(sale)→MS(pes)	Information flows about the state of business processes
MS(pes)→ SEM	Management of processes for the production of products and services, including technology, production and economic activities
CMS(pes) →IBBP	Management of factors of production
MS(pes)→RVS	Sales revenue management
MS(pes)→CASH *CASH – IBBP,CASH, –SEM*	Management of own funds, their distribution to production and payments on debts to suppliers

**Source*: modified and compiled by the author based on the analysis of [2, 6, 8-10]

Based on the rules and structure of the model, a complete functional model of business processes can be built, which allows to connect the structure and real objects, production-economic system and systems of adaptive-organizational management mechanism.

It is worth noting that the relationship of objects described by means of functional reflections link the business processes of the enterprise and various areas of management adaptation.

In general, examples of fragments of the formation of management objects and related objects of management accounting, depending on the tasks of modeling business processes of the enterprise (in relation to the model) can be described by a set of «tasks - management - adaptation - result» in table 6.

Table 6: OM - objects of management; EI - estimated indicators, including indicators of non-economic nature, AOM - objects of adaptive-organizational management.

The analysis of the given objects of management allows to draw the following basic conclusions. The assessment of the state of modeling of business processes of the system can be represented by a set of objects grouped by functional feature. The resulting management objects may not coincide with the objects of adaptive and organizational management. Objects of the adaptive-organizational mechanism of management (OAOMM), which are calculated indicators, can be obtained by calculations from the primary objects of OM, OM and AOM, and from objects obtained through the use of other calculated indicators , obtained by grouping type «OM – OM and AOM».

All management objects obtained through the use of business process modeling objects have legal force, at the same time these objects obtained on the basis of the use of relations and functional dependencies of the type «OM – EI – OM, AOM», have legal force exclusively for the management staff of a particular management system, where EI (OM) is a calculated indicator obtained from operations on OM.

The accepted statements apply to the case of construction and use of functional dependencies that form a business process model based on the construction of an optimal system of complexing adaptive-organizational mechanism of enterprise management. On the other hand, the choice of calculated indicators of functional model relations makes it possible to build a space of resulting dependencies that reflect the economic state of the production system, to assess current and forecast values on the basis of which to form a system of management decisions.

Table 6

Complexation of the system of adaptive-organizational management mechanism on the basis of business process modeling*

Name of tasks	Objects of management	Objects adaptive-organizational management
Provision of labor resources	OM	OM, AOM
Logistics	OM	OM, AOM
Sales	OM	OM, AOM
Production preparation	OM	OM, AOM
Organization and implementation of production and services	OM	EI
Organization and implementation of accounting and reporting	OM	OM, AOM
Technical preparation of production and capital construction	OM	OM, AOM
Financial and economic preparation of production	OM	OM, AOM
Marketing and sales forecasting (analysis of counterparties, competitors, markets)	OM	EI
Execution of auxiliary works (provide the production cycle)	OM	OM, AOM
Formation and implementation of operational management accounting	OM	EI
Planning and control	OM	OM, AOM
Conducting external financial transactions	OM	OM, AOM
Organization and conduct of investment activities	OM	OM, AOM

**Source*: modified and compiled by the author based on the analysis of [2, 5-7, 9-10]

Conclusions from the research. From the formal point of view, the values of the coefficients can be considered as points of multidimensional criterion space. Based on the values of these points, using methods of multidimensional analysis to measure financial performance, you can get a universal measure (meter) and the magnitude of differences in economic condition of economic objects, as well as to match or proximity to some specified characteristics of its business processes.

On the other hand, the interval measurement of SKAOMU and the determination of the estimated financial indicators of the economic unit, which are carried out in the process of its operation, makes it possible to build a volume-time graph (trajectory in time) of financial condition. Based on functional dependencies such as «financial condition – SKAOMU – management».

Thus, the obtained description of the above functional dependences allows the method of simulation to build the dynamics of the predicted states of the system. Determining the probabilistic forecast values of indicators of financial and economic condition will avoid erroneous decisions and provide an opportunity to build a subspace of management SKAOMU that meets the requirements of rationality and efficiency.

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