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THE ALGORITHM OF RISKS IDENTIFICATION IN THE OPERATING MODEL

АЛГОРИТМ ІДЕНТИФІКАЦІЇ РИЗИКІВ У МОДЕЛІ ОПЕРАЦІЙНОЇ СИСТЕМИ ОРГАНІЗАЦІЇ

The main purpose of creating an operational model is to ensure the synchronization of the organization's strategy and operational functions. The algorithm of the operating system can be represented as a hierarchical sequence of optimization processes aimed at achieving the final goal – value chain map. The operating system of an individual organization has its own process and parametric features that distinguish it from others. The risk factors will reflect these differences and the methods of their prediction and compensation should also be adapted to the specifics of the operating systems. It is impossible to optimize the operating model, to ensure the economic stability of the organization, ignoring objective and subjective sources of risks. Exclusion of risk parameters of operational processes directly affects the overall efficiency of the operational system, reduces uncertainty and unwanted fluctuations in the quality indicators of the operational model. The article examines the hierarchical algorithm of risk identification in the operational model of the organization.

Key words: *alternative, system, operational model, risk identification, state, hierarchical algorithm.*

Основна мета створення операційної моделі – забезпечити синхронізацію стратегії та операційних функцій організації. Алгоритм операційної системи можна представити як ієрархічну послідовність оптимізаційних процесів, направлених на досягнення кінцевої мети - задоволення потреб споживачів на заданому рівні якості (value chain map). Якісна операційна модель дозволяє організації покращити свою конкурентну перевагу, оптимізувати операції та задовольнити зацікавлені сторони. Операційна система окремої організації має власні процесні та параметричні особливості, що відрізняють її від інших. Фактори ризику будуть відображенням цих відмінностей і методи їх передбачення та компенсації також мають бути адаптовані до особливостей операційних систем. Тому, розробка алгоритмів та інструментів оцінки ризиків на етапі створення операційних моделей є першочерговим завданням сучасних ризик-менеджерів. Оптимізувати операційну модель, забезпечити економічну стійкість організації неможливо, ігноруючи об'єктивні та суб'єктивні джерела ризиків. Управління ризиком стає важливою складовою операційної системи організації будь-якої сфери діяльності. Виключення ризикових параметрів операційних процесів безпосередньо впливає на загальну ефективність операційної системи, зменшує невизначеність та небажані коливання якісних показників операційної моделі. У статті досліджується ієрархічний алгоритм ідентифікації ризиків в операційній моделі організації. Складові системи: стратегія, структура, процеси, технології, персонал, розглядаються як окремі стани процесу управління. Кожний стан описується множиною альтернатив, що повність визначає можливі коливання параметрів окремого стану. Пропонується ідентифікувати ризики як втрату ефективності операційної системи за рахунок не оптимального управління. Управління розглядаються як процес реалізації альтернатив на множину станів системи – об'єктів управління, мета якого – компенсація впливів ризикових факторів. Класифікація станів за рівнем ризику дозволить уникнути *критичного рівня ризику. Пропонується виключати з моделі стани з критичним рівнем ризику ще на етапі формування вхідних параметрів операційної моделі.*

Ключові слова: *альтернатива, система, операційна модель, ідентифікація ризиків, стан, ієрархічний алгоритм.*

Formulation of the problem. The main goal of creating an operational model is to ensure the synchronization of an organization's strategy and operational functions. The operational model encompasses the key parts and components of the enterprise's operational system: capabilities, resources, technologies, management, and relationships. It defines the criteria for the effectiveness of the operational system's functioning and serves as an algorithm of actions to meet consumer needs at a specified level of quality – the value chain map. A high-quality operational model enables an organization to improve its competitive advantage, optimize operations, and satisfy stakeholders. It is impossible to optimize the operational model and ensure the economic stability of the organization without addressing both objective and subjective sources of risks. Risk management becomes an important component of the operational system. The anticipation and mitigation of risk parameters in operational processes directly impact the overall efficiency of the operational system, reducing uncertainty and undesirable fluctuations in qualitative indicators, which are integral accompanying factors in economic activities. The necessity to develop new tools for assessing operational risks arises from the increase in unforeseen losses that cannot be explained solely as financial or strategic risks. Researching and enhancing methods for assessing operational risks in the operational model are promising and intellectually challenging tasks.

Analysis of recent research and publications. The theoretical foundations and methodology of strategic risk management are described in the scientific article [1] by authors Zanora V.O. and Zachosova N.V. The implementation of developments from the domestic risk management school in the quality management system of enterprises is presented in the works of Posokhov I.M. [2; 3]. The relevant aspects of risk management in entrepreneurial structures are described in the work by Miroshnychenko G. [4]. The algorithm for process management in the development of enterprises with consideration of risks is the subject of the article by Yu.V. Lytyuh and S.V. Poznyak [5]. The risk factors and methods for predicting them in personnel management are the subject of research by Yefimanova I.Yu., Pankova V.D., Tkachuk L.M. [6]. Systems for managing project risks and methods for their minimization are described in the chapter of the collective monograph by the author T. Doroshenko [7]. Despite the interest of many scholars in the field of risk management, a clear, universal algorithm for verifying risks in operational models cannot exist in principle. The operational system of a particular organization has its own procedural and parametric features that distinguish it from others. Risk factors will reflect these differences, and the methods for predicting and compensating for them must also be adapted to the peculiarities of operational systems. Therefore, the development of algorithms and tools for assessing risks at the stage of creating operational models is a primary task for modern risk managers.

Formulation of the purpose of the article. The goal of the article is to describe an algorithm for identifying risks in the operational model of an organization.

Presentation of the main material. The operational model encompasses the fundamental parts and components of an enterprise's operational system: capabilities, resources, technologies, management, and relationships. Creating an operational model involves forming a set of alternative management decisions, defining criteria for the effectiveness of the operational system's functioning, and developing a methodology for evaluating alternatives based on the chosen criteria. General requirements for the operational model can be formulated as follows:

– The model structure is hierarchical – each component of the model supports the goals of higher levels and aligns with the organization's strategic tasks.

– The model is adaptive to changes in market conditions and fluctuations in internal processes.

– The operational model is efficient based on the criteria of maximizing production and minimizing waste through resource and procedure optimization.

– It ensures coordination and promotes effective collaboration between teams and departments.

– Includes automation and technologies to enhance operational capabilities and stimulate innovation.

– Customer-oriented – effective in terms of value and meeting the needs of the target market segment, ultimately contributing to customer satisfaction and loyalty.

Each of the requirements for the structure of the operational model incorporates risk parameters, such as economic resources. Economic resources can take various forms, and accordingly, operational losses resulting from their inefficient use can also take different forms (material, labor, informational). The realization of certain operational risk events may not lead directly to monetary expenses but can result in losses in the efficiency of the operational system, which are challenging to quantify in monetary terms (losses in service quality, reputational losses). However, these categories should also be considered as losses from operational risks since they result from disruptions in the operational process algorithm. It's worth noting that an additional source of operational risks is the human factor, a factor whose impact is quite challenging to predict in the operational model.

Operational models formally describe the relationships between inputs to the operational system, operational processes, and quality indicators of the output product. These models provide a basis for determining the results of operational activities. An operational system consisting of *n* subsystems ($n = \{n_i\}, i = 1 \div N$) can be described as an ordered set of possible states S=$\{S_j\}$, ($j = 1 \div m$), each of which is characterized by a comprehensive indicator of the operational system's efficiency. Identifying risk as a comprehensive indicator of the loss of efficiency in the operational system or as volatility in economic indicators leading to a decrease in profits and an increase in costs. Therefore, risk management in the operational model can be defined as the implementation of alternatives $A = \{A_k\} k = \div n$ in the set of states of the operational system S=$\{S_j\}$. The goal of risk management is to maximize the reduction of the probability of a negative outcome and minimize potential losses associated with the implementation of an alternative and the transition from state S_i to state S_j. To simplify the algorithm, we will group subsets of states S=$\{S_j\}$ into four categories based on the level of risk:

– The set of deterministic states (non-risky states) $S_1 \in \{S_j\}$;

– The set of states with an acceptable level of risk $S_2 \in \{S_j\}$;

– The set of subsets with a critical level of risk $S_3 \in \{S_j\}$;

– The set of subsets with a catastrophic level of risk $S_4 \in \{S_j\}$.

The states of the system S_3 are the object of operational management, the goal of which is to compensate for the impacts of risky factors. In other words, management should transition the system from state S_3 to S_2, or S_1. We consider the states of the system subsets S_4 as those that would lead to the impracticality of the existence of the operational system of the organization. The efficiency losses of the operational system due to risk factors (such as management process errors, decreased quality of the output product, increased cost of tangible assets, penalties for violating environmental standards, etc.) can be represented as a vector R_j

$$R_j = \left(r_{j1}, r_{j2}, \cdots r_{ji}, r_{jn}\right), \quad (1)$$

r_{ji} – assessment of subsystem efficiency loss *n* in a given state S_j. To compensate for efficiency losses in states S_3, and S_2 of the operational system, one of the possible implementations $A_k \in A$, can be applied, where *A* is the complete set of alternatives for the system state S_j. Each alternative is associated with costs for its implementation (the price of the alternative). These costs C_{ji} $(=1\div m)$ can be considered as a monetary assessment of transitioning the system from state S_j to state S_i in the subsets S_3 and S_2. The set of possible states S_j, numerical state parameters (state probability p_j, loss magnitude C_j) are formed based on the previous analysis and serve as input parameters for the operational system. The concept of the operational model with identified risks can be formulated as the task of finding the extreme value of the comprehensive criterion for the efficiency losses of the management system. The transition from the state S_j of the critical risk level subset S_3 to the state S_i of the acceptable risk level subset S_2 can be defined by the complex criterion function $K=\{K_i\}$:

$$Z_j=\min_k \max_i \sum_K \left(C_{ji}+\sum_{S_2} p_i \cdot r_{ji} \cdot \left[a_k^j \times a_k^i \right] \right), \quad (2)$$

where: a_k^j, a_k^i are linguistic variables defining the selection of strategy A_k from the set of alternatives A

$$a_k^j=\begin{cases} 1, if\ A_k \in S_j \subset S_2 \\ 0,\ if\ A_k \notin S_j \subset S_2 \end{cases};$$

$$a_k^i=\begin{cases} 1,\ if\ \ A_k \in S_i \subset S_3 \\ 0,\ \ if\ \ A_k \notin S_i \subset S_3 \end{cases}. \quad (3)$$

One can make the model more precise by simulating the change in operational processes over time [9$ 10] and observing the volatility of intermediate products of the operational system, calculating the impact on the variation of operational system output parameters. However, this is not practical for processes with insignificant variations in performance indicators. In the concept of the operational model, our interest lies in the output efficiency indicator, and introducing additional variables would only complicate the algorithm. However, it is necessary to analyze states of the operational system with a critical level of risk or those that contribute the most to the risk assessment in more detail. More significantly, in our opinion, is the formalization of stochastic input parameters of the operational system – the vector of state probabilities $p=(p_j)$ and the elements of the transition cost matrix (C_{ji}).

Conclusions. The solution of management tasks within operational systems requires a clear mathematical algorithmization of the relationships between system parameters, operational processes, and indicators of the operational system's performance. The peculiarity of risk identification models for operational processes lies in the specificity of the modeling object:

1. The modeling object is an integral system of hierarchical configuration with top-down management.
2. System components such as strategy, structure, processes, technologies, personnel, are considered as separate states of the management process.
3. Each state has variable parameters that can be described as a set of alternatives.
4. The degree of determinism of alternatives for individual states depends on the completeness of information about the parameters of the components of the operational system.
5. States of the system with a critical level of risk require detailed analysis, changes in operational processes, or changes in the model configuration.
6. Risks can be identified as a loss of operational system efficiency due to suboptimal management.

Uncertainty in input parameters, risk factors, can be successfully interpreted using fuzzy logic tools. To build more detailed models, it is advisable to involve expert specialists. Excluding states with a critical level of risk will help avoid critical uncontrolled situations in operational systems of organizations in any field of economic activity.

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