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ALGORITHMIZATION OF STRATEGIC DIAGNOSTICS IN THE SYSTEM OF CONTROLLING THE RESULTS OF FINANCIAL ACTIVITY OF THE ENTERPRISE

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ABSTRACT

The system of results of effective performance of strategic diagnostics in the system of controlling financial indicators is formed and the place and role of diagnostics in the organizational structure of the enterprise are determined. It is established that an important result of the introduction of the structure of strategic diagnostics is the additional synergy of departments, which is a factor in increasing the competitiveness of the enterprise. The nomenclature of organizational measures to ensure effective controlling has been formed and the directions of strategic diagnostics have been established. It is established that diagnostics must be conducted continuously by all characteristics that affect the financial performance of the enterprise in order to obtain an effective management strategy. It is established that not only the values of the mentioned characteristics but also their trends are subject to controlling and analysis. The forecast of activity of the enterprise is formed on the basis of this analysis. The structure of application of strategic diagnostics in the system of controlling financial results is developed. This allowed formalizing the place and role of diagnostics in the formation of effective management strategies. A mathematical model and formalized approaches for proposing managerial actions based on strategic diagnostic data have been developed. For the first time, the competitiveness indicator of the enterprise was used as the main objective function of the formalized approach with the use of strategic diagnostics. The practicality of the proposed theoretical approaches and mathematical model is proved by the example of the analysis of the results of the Eristov Mining and Processing Plant. The potential of production, the degree of its achievement and restraining factors to obtain optimal values of the plant's performance indicators are evaluated.

Keywords: strategic controlling, strategic management, controlling tools, solutions in controlling, strategic method of controlling, controlling system, strategic scorecard, finance

JEL Classification: R14, D18, P2, B40, G39, M40

INTRODUCTION

In Ukraine, the strategic importance of the formation of diagnostics as a systemic tool for controlling the financial performance of the enterprise is often neglected, narrowing controlling and diagnostics to the task of providing management with the information it needs. The implementation of diagnostics does not consider it necessary to form an appropriate organizational structure and provide it with the necessary resources to use the results of strategic diagnostics by lower and even middle management, which would allow managers to take a broader look at the range of issues and make more effective and consistent decisions.

Nowadays, organizing effective interaction with the external environment, forecasting risks and proposing methods to neutralize them, analyzing the causes of strategic problems and solutions, determining the directions of development is not even a condition for ensuring the appropriate level of competitiveness, but a guarantee of survival of the enterprise in the conditions of the crisis of the national economy and significant changes in the economy of neighboring countries, which are focused on implementing all aspects

of Industry 4.0. Strategic diagnostics in the system of controlling the financial results of the enterprise is one of the tools that allows for solving all these issues.

Strategic diagnostics is an integral part of the management system aimed at achieving the long-term goals of the enterprise, a tool aimed at increasing the effectiveness of far-reaching management decisions. This is especially important in the uncertainty of today's market, significant unforeseen effects of operational decisions of institutional structures as it provides opportunities to increase the strategic potential of the enterprise and to guarantee it some financial stability and protect against financial and industrial risks.

LITERATURE REVIEW

A significant number of researchers have studied various aspects of this issue. Thus, Tarasiuk [1] studied the impact of a comprehensive study of the possibilities of further development of the enterprise on its effective operation. Pielmeier [2] points out that the adaptability of companies and their desire to ensure competitiveness requires them to use information technology "Industry 4.0". Höllthaler [3] studied the features of strategic diagnostic approaches for small and medium-sized businesses. Christoph [4] considers strategic diagnostics in the use of production planning and controlling information systems (PPS) and cyber-physical production systems (CPPS). Dokiienko [5] believes that "value-based management (VBM) and a balanced scorecard (BSC) are justified to provide strategic management with enhanced forecasting capabilities". Nitsenko and Kravchuk [6] studied the use of accounting and analytical data to form a development strategy and ensure competitiveness. Kosteniuk [7] used the graphical method "Polygon of potential" for strategic diagnostics, which he considers promising. Buhai [8] studied the use of the dynamics standard approach to diagnose the financial condition of companies. Nitsenko and Rudenko [9] researched the use of strategic diagnostics to predict strategic development in conditions of uncertainty. Kononenko [10] studied the mechanism of strategic diagnostics and its place in the formation of the financial security of the enterprise. Reta [11] studied the effectiveness of the use of controlling systems and strategic diagnostic tools in Ukrainian enterprises. Orobinsky [12] researched the areas of improving the tools of strategic controlling and the use of risk-oriented technologies to ensure the financial stability of enterprises. Kiseľáková [13] used a strategically balanced scorecard (BSC) to form a creditworthy performance model (CWM) Kaplina [14] identified the role of controlling as a unifying basis of organization and management of the enterprise. Golovko [15] studied theoretical approaches to the definition of "financial controlling" and used Altman's model for practical analysis of the group of enterprises. Tkachenko [16] studied the problems of financial controlling taking into account the principles of systematics.

Bedrinets [17] studied aspects of the use of strategic controlling for crisis management. Shulha [18] studied the problems of using a comprehensive system of corporate level - BSC for strategic enterprise management.

AIMS AND OBJECTIVES

Despite the significant amount of scientific work on this issue, some aspects of it require further research, in particular, the study of the structure of the system implementation of strategic diagnostics; analysis and stratification of the results of diagnostic implementation; organizational measures for the effective application of strategic diagnostics; content of diagnostic tools, etc. Due to the fact that the mathematical methods of analysis proposed in the scientific literature are either too complex for practical application or their results are not relevant enough, mathematical approaches to solving this problem need to be developed.

The purpose of the article is to develop a structure for the application of strategic diagnostics in the system of controlling the financial results of the enterprise, create a mathematical model and formalized approaches to the formation of management actions based on strategic diagnostic data.

METHODS

A set of general and special methods of scientific knowledge was used to conduct the research, the results of which are provided in the presented article. The method of abstraction was used to substantiate the relevance of the topic, formulate the purpose and tasks of the study. The structural-genetic method was used for forming a system of results to be obtained by effective implementation of strategic diagnostics in the system of controlling financial indicators and determining its place in the organizational structure of the enterprise, forming a range of organizational measures to ensure effective strategic diagnostics and strategic diagnostics. The method of economic modeling, mathematical formalization was used to create a model for determining the competitiveness of the enterprise using strategic diagnostics. Methods of analysis

and synthesis, induction and deduction, ascending from the abstract to the concrete were used to analyze the results of the Eristov Mining and Processing Plant.

RESULTS

The formation of the policy of controlling the financial results of the enterprise should be preceded by the choice of strategy of the enterprise and the definition of directions for the implementation of this strategy. It is necessary to form an appropriate organizational structure (see Fig. 1) for the effective implementation of these tasks. In this structure, strategic diagnostics, as a tool in the controlling system should take its rightful place and ensure the implementation of its tasks, which will ensure success in the formation of effective management decisions. The results of the use of strategic diagnostics in the context of controlling the financial results of the enterprise in accordance with the stratification of implementation should be: substantiation of strategic objectives of the enterprise and the development of strategy options; defining the goal and drawing up a strategic plan to achieve it; organization of the internal structure of the implementation of strategic diagnostics in the system of controlling the financial indicators of the enterprise; empowering management entities with appropriate functions integrated into the organizational structure, powers and responsibilities; providing feedback between these entities; proper motivation of management entities to conscientious implementation of strategic diagnostics in the controlling system; organization of operative reaction to intermediate results of strategic diagnostics and corresponding operative change of tools of achievement of the purpose, financial strategies, etc.

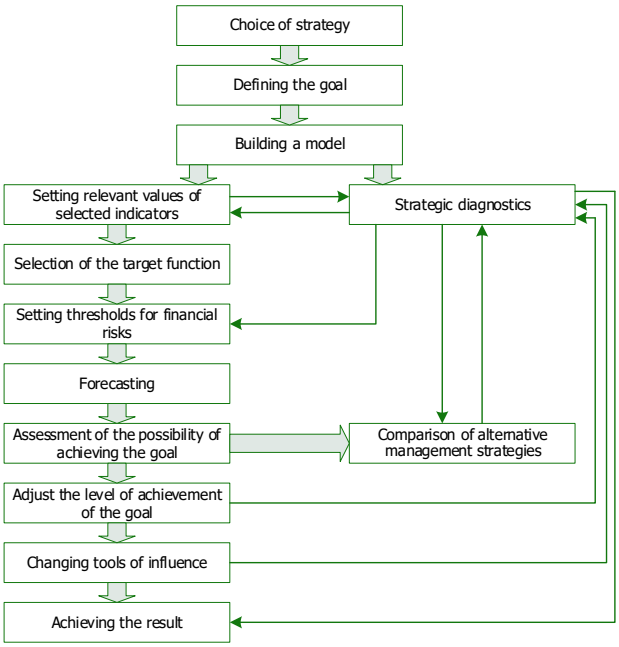

Figure 1. The structure of the system implementation of strategic diagnostics in the context of controlling the financial results of the enterprise.

Organizational measures to ensure effective strategic diagnostics should be: the creation of a coordination center for its implementation; development of appropriate regulatory and methodological support; provision of appropriate human, financial, technical resources and control of their intended use. The study found out that an important result of the implementation of the structure of strategic diagnostics in the system of controlling the financial performance of the enterprise is an additional synergy of departments, which should be used as a factor in increasing competitiveness.

The problem with the implementation of strategic diagnostics in the system of controlling the financial results of the enterprise is that these results are usually determined by the reporting period - month, quarter, or even half a year, year, whereas a rapid change of influence parameters with their significant amplitude, which can exceed the established safe values, requires prompt management response. That is, the definition of "strategic" in relation to the diagnosis is related to the strategic goal and task - to achieve the result and not the procedure for its implementation.

The practice of using support and decision-making systems that use strategic diagnostics in the context of controlling the financial results of the enterprise proves that the effectiveness of financial and production tasks ~ 65% depends on the relevance of management strategy, ~ 25% - on the quality of operational management and ~ 10% on the management

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to solve current tasks. The skill of systematic implementation of strategic diagnostics guarantees success in each of these aspects to a greater extent for strategic management, to a lesser extent for operational management, and to even less one for current management.

Strategic diagnostics is the cornerstone of financial controlling in the following areas: ensuring the accuracy of the information obtained as a result of diagnostics, which, in turn, determines the level of effectiveness of management decisions, including critical ones for the enterprise; conducting an operational analysis of the current state of the enterprise; ensuring the formation of the forecast without adjusting the results of controlling; modeling the state of the enterprise for the future, taking into account the results of financial controlling; comparing these options and helping to choose the management strategy of the enterprise that would provide the best result (see Fig. 1).

Therefore, in our opinion, it is a significant mistake to limit the diagnosis only to financial results, and the results of the reporting period. Diagnosis and control must be carried out continuously by all characteristics that affect this financial performance.

Not only the values of these characteristics should be monitored and analyzed, but also their trends with the formation of the current forecast based on the results of the analysis of the integrated impact of changes on the financial results for the current and subsequent periods.

To perform this task, the tools of financial diagnostics should include financial reporting data; integrated financial ratios; horizontal and vertical analysis of financial activities; characteristics of the impact on these results.

As a result, this toolkit represents a significant amount of information, the processing of which, even with the use of automated decision support systems, takes a lot of resources, including manpower and time. The time cost can, with some information, be so significant that diagnostic results will be delayed. And this can reduce the importance, urgency of diagnostic results and, in general, reduce its effectiveness. Therefore, a strategic diagnosis should be carried out using the principle of necessary sufficiency. For example, current diagnostics should not be conducted in relation to integrated financial indicators that are formed at the end of the year. But the ratio of gross profit to revenue must be monitored at all times to promptly respond to negative trends in the company's operations.

To a large extent, the effectiveness of strategic diagnostics is determined by the mathematical model used in the data processing system, which also provides the implementation of the algorithm for the formation of management decisions. As a mathematical model of strategic diagnostics and formalized approaches in the system of controlling financial results, we propose to use the definition of enterprise competitiveness using graph theory. For mathematical formalization it is offered to use a tensor coordinate representation of the author's mathematical model developed for the performance of the presented research:

$$AB = C \tag{1}$$

where tensor A *determines the coherence of the management structure, and, accordingly, is the invariant of the incidence tensor of the digraph of the enterprise management system;* B *is a tensor of alternative management strategies;* C is a tensor of system parameters that can be represented in deterministic, stochastic or fuzzy form.

This model greatly simplifies the practical implementation of the task. In particular, the application of the tensor approach opens up the possibility of step-by-step improvement of the accuracy of the mathematical model; the possibility of using linear (affine, vector) space to represent the response function, transformation matrices (or transition matrices) simplifies the use of the model.

The proposed algorithm is realized as follows. The formation of an undirected graph occurs in a step-by-step approach to the definition of the response surface of the objective function in the parameter space. The specified response surface has an analytical representation as:

$$f = F(x_1, x_2, x_3, \dots, x_m) \tag{2}$$

where f *is the objective function,* $x_1, x_2, x_3, \dots, x_m$ *the parameters,* $i = 1,2,3, \dots m$ *is the index of the corresponding parameter.*

Then, in accordance with the implementation of the algorithm, a refinement of the matrix of coefficients of system characteristics occurs line by line in accordance with the analytical representation of the following type:

$$\varphi_j = \sum_1^k a_{jk} y_{ik}^k \quad (3)$$

where φ_j are the corresponding parameters that are indexed by the values of $j = 1 \dots h$, a_{jk} is the numerical coefficients of the polynomials by which the values of the parameters are modeled, y_{ik}^k are the changes of the polynomials, $k = 0 \dots 6$ - is the degree of the variable.

According to the organizational stratification, it is proposed to perform the algorithm of strategic diagnostics in the following sequence.

The first step of the algorithm is the diagnosis of weaknesses of the enterprise, i.e. assessment of its competitive state. The second step of the algorithm is to determine the competitive position, competitiveness of the enterprise and its competitive stability. The third step of the algorithm is the assessment of financial, technical, technological, sales, resource and other characteristics. The fourth step of the algorithm is to identify the reasons for the slowdown in the pace of increasing competitiveness, the emergence of crisis trends. The next step is to determine the optimal attractor in the space of states to the specified goal. Each step is a stage of detailing the structure of the digraph.

Obviously, at the stage of assessing financial, technical, technological, sales, resource and other characteristics, a complex interconnected structure emerges, as one factor can affect a group of indicators, which, accordingly, will have a group of consequences during the fourth step. Therefore, there is an incidence condition in the presence of $1 \dots \pi$ vertices and $1 \dots \delta$ arcs of an undirected graph:

$$l_{\pi\delta} = \{1 - for\ vertex\ \pi\ edge\ \delta\ incident\ 0 - for\ vertex\ \pi\ edge\ \delta\ is\ not\ an\ incident \quad (4)$$

This condition is further used to construct a Boolean matrix of the graph. As a vector at the corresponding point of the attractor was used the function of "absolute competitive force" (abbreviated - ACF), which was calculated by the widely known formula:

$$\vec{ACF} = \sum_i^n (\vec{CF_i} - opt\vec{CF_i}) \quad (5)$$

where $\vec{ACF}$ is the vector of absolute competitive force, $\vec{CF_i} i$ is the vector of competitive force for the i-th indicator, $opt\vec{CF_i}$ is the value of the vector of competitive force at the extreme point (end point of the attractor or target point).

Strategic diagnostics of the financial indicators of the Eristov Mining and Processing Plant showed that there are significant restraining factors to achieve the optimal values of these indicators. For example, there is already a shortage of land for mineral waste. The company was fined a total of more than UAH 800 million for unconfirmed use of the land plot, where the enterprise places waste and for violation of environmental regulations.

Due to the availability of publicly available information only for the results of each year and to reduce the table with the results of the analysis, only data on the seven integrated indicators for which the analysis was conducted are given: CapEx (capital expenditure); Net Income (NI) analytical indicator of EBITDA (short for earnings before interest, taxes, depreciation and amortization) and the volume of iron ore production (excluding another type of product - pellets) - see Fig. 2. Indicators were calculated on the basis of financial statements.

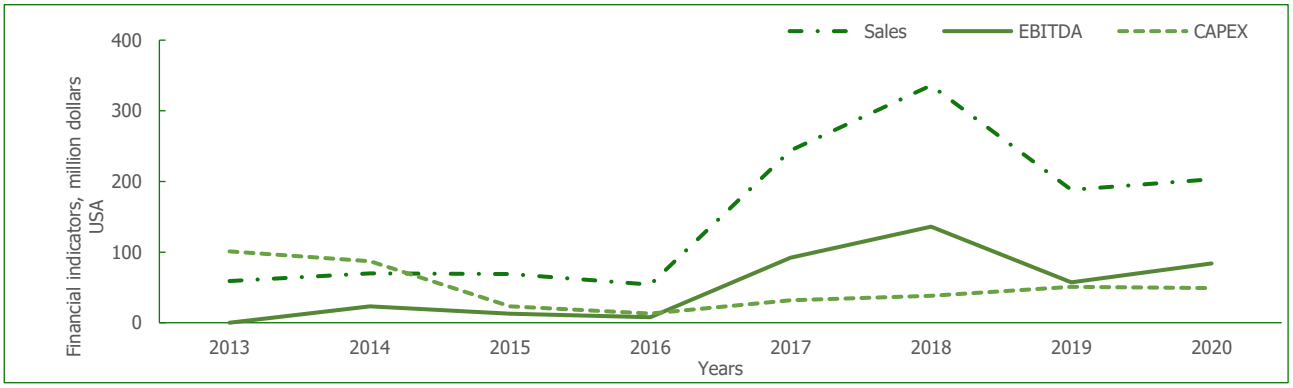

Figure 2. Dynamics of financial indicators of Eristov Mining and Processing Plant, USD million USA. *(Source: built on the basis of [20])*

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Net income was determined by the widely known formula:

$$NI = T_r - T_e \quad (6)$$

where T_r is total income; T_e is total costs.

As an example of the relevant analysis, the results of the calculation for the Eristov Mining and Processing Plant (MPP) are given. In 2012, this plant began to develop a deposit of ferrous quartzite with mineral reserves of 844-1000 million tons (proven reserves according to JORC - 623 million tons).

Analytical research (the fourth step of the above algorithm) indicates that the competitive potential of the field is high (see Table 1). This confirms the comparison with the Poltava MPP (PMPP), for example, on the indicator "yield of concentrate from a ton of ore". For EGC it is 470 kg, for PGEK - 400 kg. In contrast to the Poltava deposit, the ore of the Eristov deposit lies close to the surface, which significantly reduces costs, because mining is carried out in an open way.

Table 1. Dynamics of key indicators. Notes: *i=1…6. (Source: built on the basis of [20])*

№	Index and its designation	Years								$(\vec{ACF}_i)_{2017}$
		2013	2014	2015	2016	2017	2018	2019	2020	
1	Sales, mil dol (φ_1)	59	70	69	54	244	336	188	203	200
2	EBITDA, mil dol (φ_2)	0	23	13	8	92	136	57	84	96
3	EBITDA margin, % (φ_3)	0.8	32.4	18.8	14.3	37.9	40.6	30.4	41.4	14.2
4	Net income, mil dol (φ_4)	-28	-170	-105	-50	84	92	27	40	12
5	Net income margin, % (φ_5)	-46.8	-243.5	-152.2	-91	34.5	27.4	14.4	19.8	6.2
6	CapEx, mil dol (φ_6)	101	87	23	13	32	38	51	49	8.3
7	Iron ore mining, thous tons (φ_7)	7864	12302	14012	13103	11568	11947	11649	12585	16000

Data and results of the analysis of the degree of achievement of the optimal value of the indicators are given in Table 1 and Table. 2.

Table 2. Matrix of coefficients of system characteristics.

Index	Coefficients						
	a_{j0}	a_{j1}	a_{j2}	a_{j3}	a_{j4}	a_{j5}	a_{j6}
φ_1	- 1666	3801.1	2942.3	1043	- 179.8	14.41	-0.42
φ_2	301	- 445.1	206.4	- 35.0	1.996	-	-
φ_3	124.6	- 143.47	62.413	- 10.46	0.6034	-	-
φ_4	46.29	- 407.1	237.9	- 44.3	2.659	-	-
φ_5	- 176.5	- 175.8	137.58	- 27.08	1.6549	-	-
φ_6	290.9	- 310.8	130.7	- 26.0	2.587	-0.10	-
φ_7	5296.3	11005	- 4671.6	742.46	-39.803	-	-

The characteristics are given in Table. 1 are presented according to the proposed algorithm in Table. 2 in the form of a matrix of coefficients a_{ji} of polynomial equations of the 6th degree ($i = 1 \dots 6$).As can be seen from Fig. 2 which presents the dynamics of the above indicators, the period 2019-2020 began to be characterized by the growth of financial indicators, which is a result of the effective use of diagnostics in the system of controlling the financial performance of the enterprise.

CONCLUSIONS

The conducted research allowed to form a system of results to be obtained by effective implementation of strategic diagnostics in the system of controlling financial indicators and to determine its place and role in the organizational structure of the enterprise. It is established that an important result of the implementation of the structure of the strategic diagnostic is the additional synergy of departments, which can be used as a factor in increasing competitiveness.

The nomenclature of organizational measures for ensuring effective strategic diagnostics is formed and its directions are defined. In particular, it is proposed to include in these organizational measures the establishment of a coordination center for the implementation of strategic diagnostics; development of appropriate regulatory and methodological support; provision of appropriate human, financial, technical resources and control of their intended use

It is established that in order to obtain an effective management strategy, diagnostics must be conducted continuously by all characteristics that affect the financial performance of the enterprise. Not only the values of these characteristics but also their trends with the formation of the current forecast based on the results of the analysis should be monitored and analyzed. To perform this task, the tools of financial diagnostics should include financial reporting data; integrated financial ratios; horizontal and vertical analysis of financial activities and all the characteristics of the impact on these results.

The developed structure of application of strategic diagnostics in the system of controlling the financial results of the enterprise provided an opportunity to assess the place and role of diagnostics in the formation of effective management strategies. As it is proven by practice, the key to the success of strategic diagnostics is the creation of such a mathematical model and such formalized approaches to propose management actions based on strategic diagnostic data that would provide relevant results for the rational use of human and time resources. The competitiveness of the enterprise was used as the main objective function of the formalized approach with the use of strategic diagnostics.

A practical example of the use of the proposed methods, approaches and mathematical model was their application to the analysis of the results of the Eristov Mining and Processing Plant. The potential, degree of its realization and restraining factors of achievement of optimum values of activity indicators of the enterprise were estimated.

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АЛГОРИТМІЗАЦІЯ СТРАТЕГІЧНОЇ ДІАГНОСТИКИ В СИСТЕМІ КОНТРОЛІНГУ РЕЗУЛЬТАТІВ ФІНАНСОВОЇ ДІЯЛЬНОСТІ ПІДПРИЄМСТВА

Сформована система результатів ефективного виконання стратегічної діагностики впровадження контролінгу фінансових показників та визначені місце й роль діагностики в організаційній структурі підприємства. Установлено, що важливим результатом упровадження структури стратегічної діагностики стає додаткова синергія підрозділів, яка є фактором збільшення конкуренто підприємства. Сформована номенклатура організаційних заходів для забезпечення ефективного контролінгу та встановлені напрями стратегічної діагностики. Установлено, що для отримання ефективної управлінської стратегії діагностика має вестися безперервно за всіма характеристикам, які впливають на фінансові результати діяльності підприємства. Установлено, що контролю та аналізу підлягають не тільки значення згаданих характеристик, а і їх тренди. На основі цього аналізу формується прогноз діяльності підприємства. Розроблено структуру застосування стратегічної діагностики в системі контролінгу фінансових результатів. Це дозволило формалізувати місце й роль діагностики при формуванні ефективних управлінських стратегій. Створено математичну модель та формалізовані підходи для пропонування управлінських дій на основі даних стратегічної діагностики. Як основну цільову функцію формалізованого підходу із застосуванням стратегічної діагностики було використано показник конкурентоспроможності підприємства. Практичність запропонованих теоретичних підходів та математичної моделі доведено на прикладі аналізу результатів діяльності Єристівського гірничо-збагачувального комбінату. Оцінено потенціал виробництва, ступінь його досягнення та стримуючі фактори для отримання оптимальних значень показників діяльності комбінату. Результати дослідження і як цілісна організаційно-методична структура, і поелементно можуть бути використані з наукової метою і в практичній діяльності менеджменту підприємств.

Ключові слова: стратегічний контролінг, стратегічний менеджмент, інструменти контролінгу, рішення в контролінгу, стратегічний метод контролінгу, система контролінгу, стратегічна система показників, фінанси

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