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Scientific research methodology for modelling the financial security of an enterprise

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Abstract: The purpose of the study is to develop stages and justify the logical sequence of modelling the target level of financial security of enterprises using a system of financial indicators. In the course of the study, **the methods** of generalization, observation, comparison, analysis and synthesis, a systematic approach, and the method of strategic planning were applied. **Results.** As a result of the study, optimization conditions were formulated on the basis of the relevant ratios grouped in the following areas of financial indicators: liquidity and solvency (coverage ratio, absolute liquidity ratio, cash flow liquidity ratio); financial stability (financial independence ratio, long-term financial independence ratio, working capital maneuverability ratio); operating efficiency (return on assets, return on sales, profit reinvestment ratio); business activity (receivables/payables turnover ratio); debt burden (financial expenses to operating profit ratio); tax burden (tax burden to sales revenue ratio, tax burden to income tax ratio A system of indicators for assessing the financial security has been developed and a sequence of modeling the level of financial security of an enterprise has been determined. **Conclusions**. To enhance financial security and reach the desired level in the short term, it is important to consider various financial indicators such as the coverage ratio, absolute liquidity ratio, cash flow liquidity ratio, equity working capital maneuverability ratio, return on assets, return on sales, and the receivables/payables turnover ratio. Additionally, recommendations for modeling financial security should take into account indicators related to net profit, equity, and cash flows.

Keywords: financial security, methodology, management, research, modeling, financial indicators, target level, comprehensive assessment.

АКТУАЛЬНІ ПИТАННЯ ЕКОНОМІЧНИХ НАУК

Методика наукового дослідження моделювання фінансової безпеки підприємства

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Анотація: **Метою дослідження** є розробка етапів та обґрунтування логічної послідовності моделювання цільового рівня фінансової безпеки підприємств із використанням системи фінансових індикаторів. У процесі дослідження застосовано **методи** узагальнення, спостереження, порівняння, аналізу та синтезу, системний підхід, а також метод стратегічного планування.

Результати. У ході дослідження сформульовано оптимізаційні умови на основі відповідних коефіцієнтів, згрупованих за такими напрямами фінансових індикаторів: ліквідності та платоспроможності (коефіцієнт покриття, коефіцієнт абсолютної ліквідності, коефіцієнт ліквідності грошового потоку); фінансової стійкості (коефіцієнт фінансової незалежності, коефіцієнт довгострокової фінансової незалежності, коефіцієнт маневреності власного оборотного капіталу); ефективності діяльності (рентабельність активів, рентабельність продажу, коефіцієнт реінвестування прибутку); ділової активності (коефіцієнт співвідношення оборотності дебіторської та кредиторської заборгованостей); боргового навантаження (коефіцієнт покриття фінансових витрат операційним прибутком); податкового навантаження (коефіцієнт податкового навантаження доходів від реалізації продукції, коефіцієнт податкового навантаження із податку на прибуток). Розроблено систему індикаторів оцінки фінансової безпеки та визначено послідовність моделювання рівня фінансової безпеки підприємства. **Висновки**. Для зміцнення фінансової безпеки та досягнення її цільового рівня в короткостроковій перспективі за такими фінансовими показниками, як коефіцієнт покриття, коефіцієнт абсолютної ліквідності, коефіцієнт ліквідності грошового потоку, коефіцієнт маневреності власного оборотного капіталу, рентабельність активів, рентабельність продажу та коефіцієнт співвідношення оборотності дебіторської і кредиторської заборгованості, необхідно враховувати рекомендації щодо моделювання фінансової безпеки з урахуванням чистого прибутку, власного капіталу, кредиторської заборгованості, поточних зобов’язань, оборотних активів та грошових потоків.

Ключові слова: фінансова безпека, методика, управління, дослідження, моделювання, фінансові індикатори, цільовий рівень, комплексна оцінка.

Problem statement. To achieve a higher level of financial security for enterprises, it is essential to consider the overall situation in the country. Varnalii Z. S. and Bondarenko S. M. state that “In times of crisis and during the full-scale war in

Ukraine, the greatest threat to an enterprise is the destruction of its potential – encompassing production, technological, scientific, technical, and personnel resources – which are vital for the enterprise's survival and capabilities." The impact of both internal and external threats on the financial security of enterprises can lead to the cessation of their financial and economic activities, potential bankruptcy, and even liquidation. Therefore, to minimize threats to financial security, an effective financial management system is necessary. This system should strike a balance between the interests of enterprise development, maintaining sufficient cash flow, and ensuring solvency. [1, c. 112]. Ukrainian companies face significant challenges in ensuring an adequate level of financial security due to national threats: threat to Ukraine's national security as a result of Russian aggression; cyber-attacks on state structures and critical infrastructure, information warfare; Ukraine's energy dependence on energy suppliers; dependence on external creditors and economic threats. In view of this, one of the most promising and active areas of enterprise financial security management is modelling the level of financial security in the long term and in the short term (for the current year).

Analysis of recent research and publications. Many scientists have studied the problems of the financial security of enterprises and methods of modelling their level. In particular, Varnaliy Z.S. and Bondarenko S.M. [1] focused their article on the economic security of enterprises during the war and post-war recovery. They emphasised that the effectiveness of the financial security management system depends on a set of interrelated elements designed to establish and maintain an optimal level of financial security that can guarantee successful operations. Zhelikhovska M.V. [2] analysed the modelling of an entrepreneurial strategy for managing financial security in the context of digitalisation and migration risks. Zhyvko Z.B., Ovechkina O.O., Rodchenko S.S., Tsakun L.M. [3] created an innovative model of strategic development in economic security management in the context of strengthening foreign economic relations and digitalisation. Radush V.V., Lebedeva O.Yu., Kushnirenko N.I., Zorilo V.V. [4] emphasised that the formation of security policy is a very complex analytical process that is difficult to formalise, and

researched the simulation of organisational measures for creating security policy using business processes. Mazutynets G.V., Sharkadi M.M. [5] proposed methodological principles for combining elements of fuzzy logic theory and neural networks in modelling enterprise financial security management processes. Manoilenko O.V., Volosnikova N.M., Reshetnyak N.B. [7] developed a comprehensive simulation modelling system for assessing the effectiveness of financial resource management for an enterprise at the micro level. Sharkadi M.M. [8] proposed using a multilayer neural network in the financial and economic security management system, which would make it possible to determine the level of financial security of a company at different moments of its operation. The developed model allows each company to use its own set of financial indicators to determine the level of security. Kareem H.A., Olaniyi T.K., Olatubosun P.O. [12] proved that a significant drawback of using modern security management methods is insufficient consideration of sustainable development risks. In the research of Marusiak N.L., Bak N.A. [14] is determined that financial security is characterised by a financial condition in which an enterprise can withstand existing and potential threats through effective financial management to ensure the development of the enterprise's economic activity. The work of Piletska S.T., Korytko T.Yu., Khrapach V.O. [15] proves the relevance of managing the financial stability of an enterprise, which is associated with the need to search for new approaches to managing financial stability in the context of ensuring its economic security in the conditions of intensifying integration processes.

Identifying previously unresolved aspects of the overall problem is essential. Currently, defining the sequence for modelling the level of financial security remains an unresolved issue. Finding a solution to this problem will help ensure an adequate level of financial security, enhance the efficiency of its management, and allow for the development of effective measures to protect against threats, thereby facilitating the sustainable development of enterprises.

The purpose of the article. The article aims to outline the stages and justify the sequence for modelling the target level of financial security in enterprises using a system of financial indicators.

Research results. In assessing the existing methodological approaches to the analysis of the financial security of an enterprise [9], it was found that the optimal methodology based on a comprehensive assessment of such groups of indicators as liquidity and solvency, financial stability, performance, business activity, debt and tax burden of the enterprise [10]. The system of indicators for assessing financial security according to this methodology is shown in Figure 1. It was also noted that the advantage of this approach is the presence of critical values of financial security indicators at all levels [9, p. 107].

Indicators for assessing the financial security of an enterprise by areas	
by liquidity and solvency	coverage ratio (K_1)
	absolute liquidity ratio (K_2)
	cash flow liquidity ratio (K_3)
by financial sustainability	financial independence ratio (K_4)
	long-term financial independence ratio (K_5)
	working capital flexibility ratio (K_6)
by performance efficiency	return on asset (K_7)
	return on sales (K_8)
	profit reinvestment ratio (K_9)
by business activity	receivables to payables turnover ratio (K_{10})
by debt load	financial expenses to operating profit ratio (K_{11})
by the tax burden	tax burden ratio of income from sales of products (K_{12})
	income tax burden ratio (K_{13})

Figure 1. System of indicators for assessing the financial security of an enterprise

Source: compiled by the authors based on the source [10]

The financial effect of improving the quality of financial security management is to determine the target indicator. The study of transport companies' activities has established that, at present, the management of such indicators as liquidity, solvency, performance, financial stability and business activity, as well as relevant indicators, requires improvement (Figure 2):

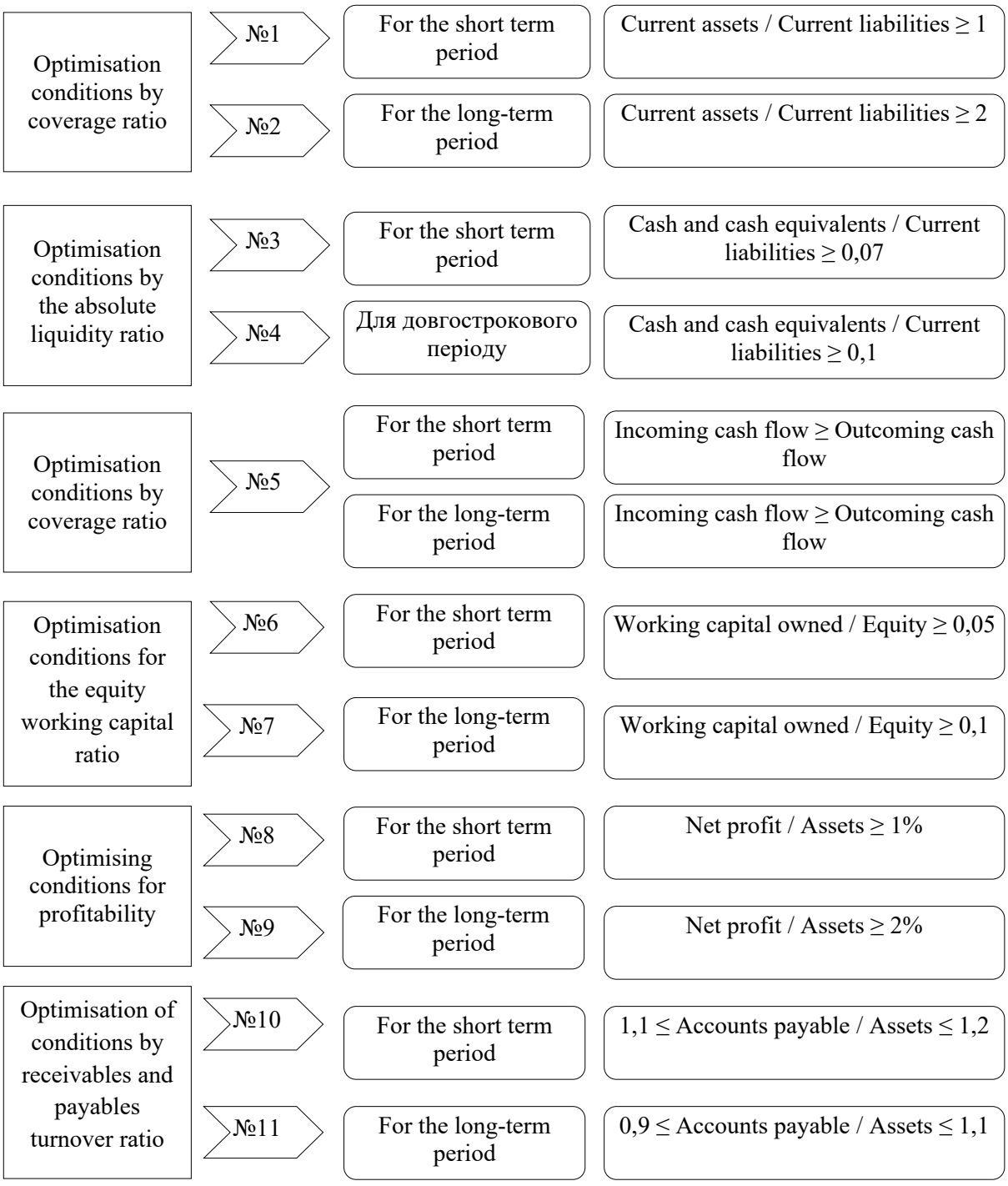

Figure 2 – Optimization conditions for individual financial indicators to ensure the financial security of the enterprise

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Source: created by the authors

- Coverage ratio (K1), in the long term should be more than 2 [9, p. 107], but in the short term, it is recommended to reach a value of 1 or more, which will correspond to the acceptable level of financial security. To achieve the acceptable level, it is necessary to review approaches to the formation of current assets and current liabilities. In the short term, the condition is an increase in current assets and a decrease in current liabilities, and their equality in the long term, current assets should exceed current liabilities by two times. Thus, the optimisation conditions for the coverage ratio for the short-term period are ≥ 1 and for the long-term period ≥ 2;

- Absolute liquidity ratio (K2), in the practice of financial management and financial security management, to improve the state of absolute liquidity, it is often recommended to change the composition and structure of current assets, for example, to optimise production stocks, intensify the sale of finished products from the enterprise's warehouses, and collect accounts receivable. In the long term, the absolute liquidity ratio should be more than 0.1 [9, p. 107], but in the short term, it is recommended to reach a value of 0.07 or more, which will correspond to the acceptable level of financial security. The optimisation conditions for the absolute liquidity ratio for the short-term period are ≥ 0.07, for the long-term period ≥ 0.1;

- Cash flow liquidity ratio (K3), it is impossible to achieve improved financial security management without optimising cash flows and exceeding incoming cash flows over outgoing cash flows. Enterprises need to introduce an efficient and effective cash planning system and implement the practice of net positive cash flow. The optimisation conditions for the cash flow liquidity ratio are shown in Figure 2;

– The working capital manoeuvrability ratio (K6) indicates that most enterprises suffer from a lack of working capital. This situation suggests that equity is insufficient to finance current assets, increasing risks to on-going operations and hindering the ability to invest in development strategies. Consequently, this issue negatively impacts overall financial security and necessitates a decision by business owners to increase equity to a positive level, which is essential for ensuring financial stability. In the long term, the working capital manoeuvrability ratio should exceed

0.1; however, in the short term, it is advisable to aim for a value of at least 0.05, which reflects an acceptable level of financial security. Therefore, optimization targets for the working capital manoeuvrability ratio are as follows: for the short term, it should be ≥ 0.05, and for the long term, it should be ≥ 0.1.

- the ratio of receivables and payables turnover (K10) indicates the general state of business activity can be improved by optimising the size and periods of turnover of receivables and payables, so the optimisation condition will be to comply with the recommended values [9, p. 107], the optimisation conditions for the ratio of receivables and payables turnover for the short term will be in the range from 1.1 to 1.2, for the long term from 0.9

- Return on assets (K7) and return on sales (K8) are important indicators that reflect the efficiency and effectiveness of a business in comparison to its main competitors and other market participants. In the long term, both return on assets (K7) and return on sales (K8) should exceed 2% [9, p. 107]. In the short term, it is advisable to achieve a value of at least 1%, which indicates an acceptable level of financial security. Therefore, the optimal conditions for profitability indicators are as follows: for the short term, a minimum of 1%, and the long term, a minimum of 2%.

The management of profitability (profitability) of transport enterprises should meet the needs for building economic development potential and create a reserve for achieving the goals of ensuring efficient operation. Profit growth is possible not only by increasing the volume of transport services and ensuring maximum commercial load but also by restructuring assets and optimising management systems. Therefore, the increase in profitability (profitability) should be carried out both extensively and intensively, and should not only ensure growth in revenues from the sale of transport services but also take into account their specific, industry-specific characteristics that affect the prospects for growth of competitive status and provide opportunities for sustainable development.

The optimisation conditions, taking into account the permissible level of certain financial indicators to ensure the financial security of an enterprise in the short and long term, are presented in Figure 2.

The sequence of modelling the financial security of an enterprise in the short term (assuming that the main weaknesses are financial stability, business activity, liquidity and efficiency), taking into account the proposed recommendations, is shown in Figure. 3.

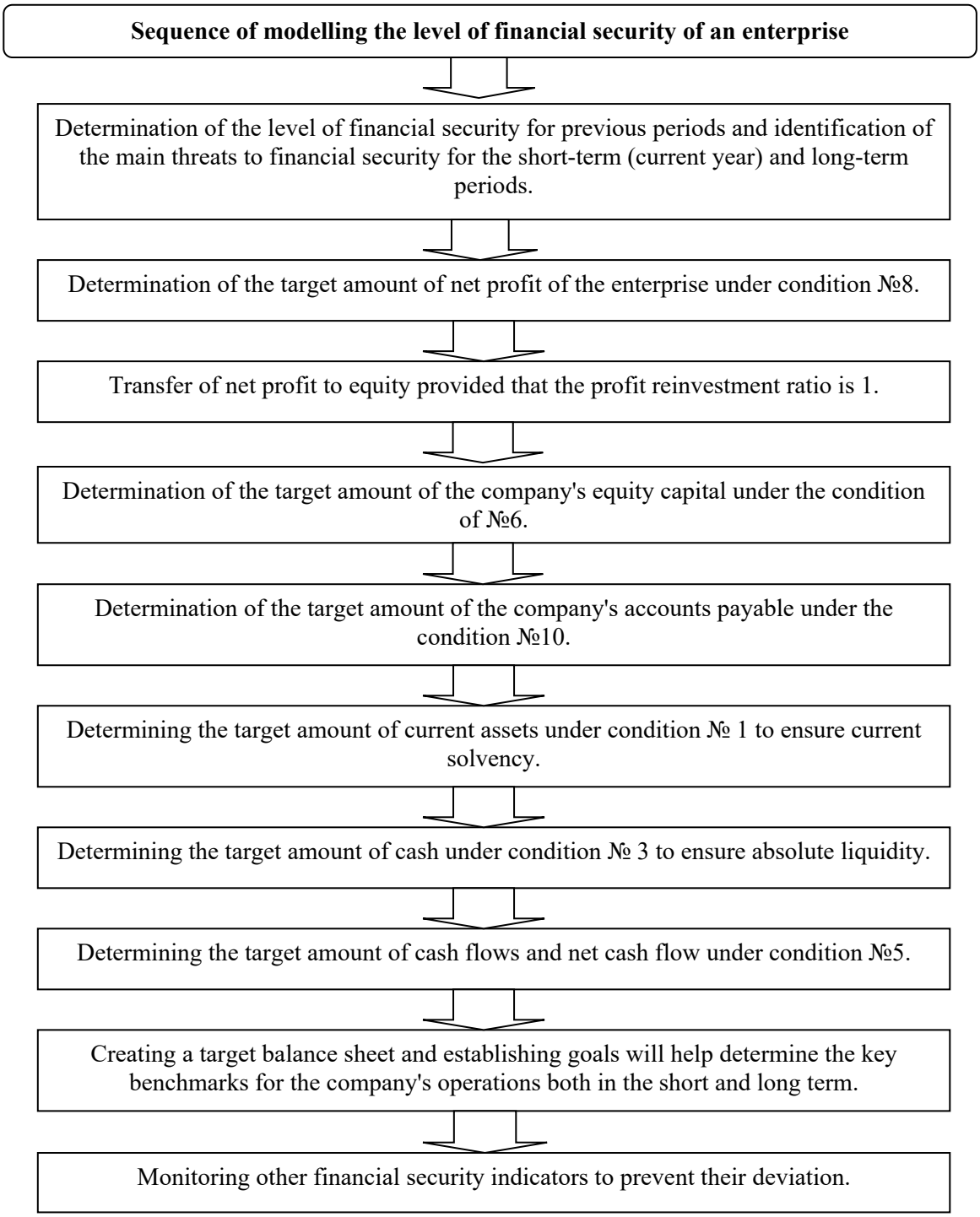

Figure 3. Sequence of modelling the level of financial security of an enterprise

Source: created by the authors

According to the results of the study of transport enterprises, the following indicators are strong points: financial independence ratio (K4), long-term financial independence ratio (K5), and financial expenses to operating profit ratio (K11). The first two of these ratios should improve their values and stop the negative dynamics, subject to the proposed recommendations and optimisation conditions №6 and №7. The ratio of financial expenses to operating profit (K11) should improve its values and stop the negative dynamics, provided that the proposed recommendations and optimisation conditions № 8 and № 9 are taken into account when net profit increases to the recommended values.

Therefore, when modelling the level of financial security, it is also necessary to assess the state of the following indicators: profit reinvestment ratio (K9), income tax burden ratio (K13), financial independence ratio (K4), long-term financial independence ratio (K5), and financial expenses to operating profit ratio (K11).

Consequently, to improve financial security and achieve its target level in the short term by such financial indicators as coverage ratio, absolute liquidity ratio, cash flow liquidity ratio, equity working capital ratio, return on assets, return on sales, receivables/payables turnover ratio, it is necessary to take into account recommendations on modelling the level of financial security by net profit, equity capital. Modelling the level of financial security of an enterprise in the long-term period should use the stages shown in Fig. 3 stages and the proposed sequence, but take into account the relevant optimisation conditions specified in Fig 1 for the long-term period.

It is also worth noting that among the available conditions and systems of equations, it is necessary to determine the priority, since some conditions may contradict each other:

- condition № 6 and condition № 8 (condition № 8 has the priority and priority of calculation, since the determination of a safe level of net profit directly affects the amount of equity, provided that the profit reinvestment ratio (K9) is equal to 1.0);

- condition № 10 and conditions № 1, № 4 (condition No. 10 has priority and priority since it is necessary to reduce the number of accounts payable and only then

determine the amount of current solvency), etc.

Under the condition of optimising the ratio of receivables to payables turnover (K10), the maximum permissible value is a 1.2 times prevalence of payables.

The target value of current assets for the short-term period should be equal to the value of current liabilities, which corresponds to optimisation condition № 1.

The target value of cash for the short-term period should be at least 7% of current liabilities, which corresponds to optimisation condition № 3. This is the amount by which incoming cash flows should exceed outgoing cash flows in the short term, thus defining optimisation condition № 5.

Conclusions. To achieve the target level of financial security at enterprises, the following areas of management efficiency improvement can be identified:

- reduction of fixed costs, including reduction of management personnel;
- reduction of variable costs;
- reduction of capital investments, including overhaul costs;
- accelerating the turnover of working capital by generating sufficient working capital, taking into account the positive amount of own working capital;
- reducing the volume of services that are not in sufficient demand, with a corresponding reduction in the required amount of financial resources, etc;
- extending the terms of accounts payable for commodity transactions and maintaining payment discipline in settlements with partners, the budget, and employees;
- postponement of payment of accrued dividends, remuneration, etc. until a sufficient amount of equity and working capital is formed;
- optimising the structure of working capital by determining the optimal proportions of stocks, receivables, cash, etc;
- reorganisation of the company's relevant services to improve their efficiency and increase the volume of services provided;
- refinancing of receivables and entering into factoring agreements with commercial banks or factoring companies to reduce their total volume (currently, factoring operations are offered by Raiffeisen Bank, Pivdenny Bank, Ukreximbank,

OTP Bank, Sens Bank, Globus Bank, Tascombank, etc;).

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