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PROBLEMS OF MODELING FINANCIAL PROCESSES AT ENTERPRISES IN MODERN CONDITIONS

The article examines the current state and challenges of modeling financial processes in enterprises under modern conditions. Its purpose is to systematize the main problems of enterprise financial modeling and to identify directions for improving methodological support, taking into account the specifics of an unstable economic environment. Financial modeling is defined as a key tool for both strategic and operational management, providing a formalized representation of cash flows, assessing financial condition, forecasting the consequences of managerial decisions, and selecting optimal financing and investment options. It is demonstrated that traditional models developed for stable economic environments increasingly exhibit limited predictive capacity, underscoring the need to enhance methodological instruments. The principal groups of models used in financial analysis are systematized: factor and multiplicative, discriminant, regression and econometric, scenario and simulation, as well as models based on digital technologies and artificial intelligence. Their comparative characteristics are presented in terms of purpose, advantages, and limitations of application in contemporary conditions. Particular attention is paid to key problems, including: technical errors in the structure of models, methodological shortcomings, problems with the quality of input data and assumptions, as well as human and organizational factors. It has been established that each of these groups creates barriers to the effectiveness of financial modeling, diminishes its practical value, and may lead to strategic errors in managerial decision-making. The article identifies directions for improving methodological support of enterprise financial modeling, namely: the transition from annual budgeting to short-term scenario forecasting, the use of combined models, the formation of inflation and liquidity buffers within working capital, the expansion of the information base through open digital platforms and monitoring tools, and the enhancement of financial managers' skills in applying modern analytical instruments.

Keywords: financial processes, enterprise, modeling, model, methodological tools, unstable economic environment.

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ПРОБЛЕМИ МОДЕЛЮВАННЯ ФІНАНСОВИХ ПРОЦЕСІВ НА ПІДПРИМСТВАХ В СУЧАСНИХ УМОВАХ

У статті розглянуто сучасний стан та проблематику моделювання фінансових процесів підприємств в сучасних умовах. Метою статті є систематизація основних проблем моделювання фінансових процесів підприємств у сучасних умовах та визначенні напрямів удосконалення методичного забезпечення фінансового моделювання з урахуванням специфіки нестабільного економічного середовища. Фінансове моделювання визначено як ключовий інструмент стратегічного й оперативного управління, що забезпечує формалізований опис руху грошових коштів, оцінку фінансового стану,

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прогнозування наслідків управлінських рішень та вибір оптимальних варіантів фінансування й інвестування. Показано, що традиційні моделі, розроблені для стабільних економічних умов, дедалі частіше демонструють обмежену прогностичну спроможність, що актуалізує потребу у вдосконаленні методичного інструментарію. Здійснено систематизацію основних груп моделей, що застосовуються у фінансовому аналізі: факторних та мультиплікативних, дискримінантних, регресійних та економетричних, сценарних та імітаційних, а також моделей на основі цифрових технологій і штучного інтелекту. Проведено їх порівняльну характеристику за призначенням, перевагами та обмеженнями використання в сучасних умовах. Особливу увагу приділено ключовим проблемам, серед яких: технічні помилки у структурі моделей, методологічні недоліки, проблеми якості вхідних даних та припущень, а також людський та організаційний фактор. Встановлено, що кожна з цих груп формує бар'єри для ефективності фінансового моделювання, знижує його практичну цінність та може призводити до стратегічних помилок у прийнятті управлінських рішень. Визначено напрями вдосконалення методичного забезпечення фінансового моделювання підприємств, а саме: перехід від річного бюджетування до короткострокового сценарного прогнозування, використання комбінованих моделей, формування інфляційних та ліквідних буферів у структурі оборотного капіталу, розширення інформаційної бази за рахунок відкритих цифрових платформ та інструментів моніторингу, а також підвищення кваліфікації фінансових менеджерів у застосуванні сучасного аналітичного інструментарію.

Ключові слова: фінансові процеси, підприємство, моделювання, модель, методичний інструментарій, нестабільне економічне середовище

Statement of the problem and its connection with important scientific and practical tasks. Financial modeling is one of the key instruments of both strategic and operational enterprise management, allowing the formalization of cash flow movements, the assessment of financial condition, the forecasting of the consequences of managerial decisions, and the selection of optimal financing and investment options. At the same time, the contemporary economic environment is characterized by a high degree of turbulence: the full-scale war in Ukraine, global energy and logistics shocks, the accelerated digitalization of financial processes, and the rapid spread of artificial intelligence technologies are substantially changing the conditions under which traditional financial analysis and forecasting models operate.

At the same time, the modern economic environment is characterized by a high level of turbulence and uncertainty. The full scale war in Ukraine, global energy and logistics shocks, accelerated digitalization of financial processes, as well as the rapid spread of artificial intelligence technologies, are significantly transforming the conditions of business operations. Under such circumstances, traditional models of financial analysis and forecasting, which were developed for relatively stable macroeconomic environments, increasingly demonstrate limited predictive capacity and low adaptability to rapidly changing conditions. This underscores the need for a systematic study of the problems that arise in the construction and application of enterprise financial models, as well as the search for directions to improve the relevant methodological toolkit.

Analysis of recent publications on the problem. The theoretical and methodological foundations of enterprise financial modeling are addressed in the works of domestic scholars. In particular, D. Mazur, O. Mazur, H. Mazur, and A. Kovbiy reveal the possibilities of financial modeling for evaluating investment projects, man-

aging risks, and forecasting company cash flows [1]. The issue of a conceptual approach to modeling the impact of financial indicators on enterprise profit is examined in a study devoted to developing a model for assessing and forecasting an enterprise's performance results under changing financial indicators [2, 3].

The problem of constructing a formalized assessment of an enterprise's financial condition and forecasting based on short time series is addressed in studies that systematize the types of economic-mathematical models used in financial analysis, in particular factor-based, multiplicative, and ratio-based models [4]. The application of modern information technologies, in particular Application Programming Interface (API) methods and the Python programming language combined with discriminant analysis and the Altman model for studying the financial stability of enterprises based on open-source databases, is presented in a study demonstrating the potential of digitalizing financial modeling [5].

The issue of financial support for the sustainability and recovery of domestic business entities under wartime uncertainty is also examined in a study that clarifies the definition of enterprise financial support as an integrated system of organizational-economic and financial-managerial mechanisms [6, 7, 8].

A particular research interest lies in publications indexed in the international scientometric databases Scopus and Web of Science, dedicated to modeling enterprise financial processes under crisis conditions. L. Katan, O. Dobrovolska, and J. M. Recio Espejo, using structural modeling methods, determined the necessary amount of financing for the agrarian sector through budget financing, bank lending, and agricultural insurance, establishing that the actual volume of bank lending to agrarian enterprises is significantly lower than the modeled values, while budget financing creates conditions for ensuring the financial sustainability of enterprises [9]. I. Boiarko, L. Hrytsenko, O. Tverezovska, H. Saltykova, and K. Kyrychenko, based on econometric modeling, examined the impact of the full-scale war on the market value of Ukrainian industrial enterprises, revealing statistically significant changes in market capitalization dynamics under the influence of war-related risks [10]. In turn, M. Karpushenko, T. Momot, I. Kraivska, G. Shapoval, and O. Karpushenko proposed a comprehensive analytical approach to modeling the investment attractiveness of enterprises under wartime conditions, combining quantitative financial indicators with the assessment of non-financial risk factors [11].

Thus, there is a discernible tendency toward the complication of the classical methodological toolkit of financial modeling through the incorporation of additional blocks for assessing military, institutional, and macroeconomic risks. This, in turn, necessitates further generalization of the problems associated with its application in enterprises under contemporary conditions.

The purpose of the article is to systematize the main problems of modeling enterprise financial processes under modern conditions and to identify directions for improving the methodological support of financial modeling, taking into account the specifics of an unstable economic environment.

Presentation of the main results and their justification. Enterprise financial modeling is understood as the process of formalized representation of a company's financial and economic activity using mathematical, statistical, and information tools for the purpose of analyzing the current state, forecasting future results, and supporting

managerial decision-making. Financial modeling is used to evaluate investment projects, manage financial risks, forecast cash flows and the dynamics of an enterprise's financial condition, perform the financial calculations of a business plan, determine optimal financing options, and model business development scenarios, including mergers and acquisitions [1].

In the practice of financial analysis and management, a wide range of models is used, which can be usefully grouped as follows:

- factor-based and multiplicative models – applied to expand and reduce factor models using methods of factor analysis of economic indicators [4];
- discriminant models for bankruptcy forecasting and financial stability assessment (in particular, the Altman model) – used to estimate the probability of an enterprise's financial insolvency [5];
- regression and econometric models – applied to construct integral indicators and forecasting models of financial condition based on historical data;
- simulation models and scenario-analysis models – used to assess the consequences of managerial decisions under various development scenarios, including under conditions of wartime uncertainty [8];
- models based on digital technologies and artificial intelligence – combine programming methods (e.g., Python, API) with classical financial-analysis methods for the automated processing of large data sets [5].

A generalized comparative characterization of these groups of models, by purpose, advantages, and limitations of application under modern conditions, is presented in Table 1.

Table 1. Comparative characteristics of model groups for enterprise financial processes, compiled by the authors

Model group	Purpose	Advantages	Limitations under modern conditions
Factor-based and multiplicative models	Analyzing the impact of factors on financial indicators	Simplicity, transparency of calculations	Low adaptability to structural changes in the environment
Discriminant models (Altman model)	Forecasting bankruptcy, assessing financial stability	Rapid integral risk assessment	Developed on foreign samples, require adaptation
Regression / econometric models	Constructing forecast and integral indicators	Statistical robustness	Dependence on the stationarity and length of the time series
Simulation and scenario models	Assessing the consequences of decisions under different scenarios	Flexibility, accounting for uncertainty	High labor intensity, subjectivity of scenarios
Digital-technology and AI-based models	Automated analysis of large volumes of financial data	High accuracy, processing of large data volumes	Limited interpretability, need for high-quality data

The features of financial process modeling in modern conditions are determined by a high level of uncertainty, rapid digitalization, and the need to process large

amounts of information in real time. Static calculations that dominated in previous decades have given way to flexible and adaptive systems capable of providing an instant response of businesses and financial institutions to external shocks. Modern financial modeling is characterized by a number of key features. First, it operates in conditions of high uncertainty and non-stationarity, which is caused by geopolitical crises, military threats, and macroeconomic instability. This requires abandoning the use of standard historical trends and focusing on scenario analysis, which allows planning “what if” options. Secondly, there is an integration of Big Data and artificial intelligence technologies, which provides real-time data collection, the formation of more accurate short-term forecasts and the detection of hidden patterns in market behavior. Thirdly, nonlinear mathematical methods are used, in particular econometric models and fuzzy set theory, which allow formalizing qualitative expert assessments in conditions of a shortage of accurate numerical data. Fourthly, automation and the use of specialized notations, such as BPMN, are actively being introduced, which integrate with enterprise ERP systems and provide automatic model updates. Finally, modern modeling is focused on risk management, the main goal of which is not only to forecast future profits, but also to assess the resistance of enterprises to destabilizing factors.

The use of modeling for the description and analysis of financial processes in enterprises under contemporary conditions encounters a range of methodological and practical challenges¹². These challenges can be systematically classified into four major groups, each reflecting a distinct dimension of limitations and risks inherent in the application of financial modeling tools (Fig. 1). Such a typology not only facilitates a more structured understanding of the weaknesses of existing approaches but also provides a conceptual framework for further refinement of analytical instruments. The identification of these groups is essential for enhancing the reliability of financial models, improving their adaptability to turbulent environments, and ensuring their relevance for managerial decision making in enterprises.

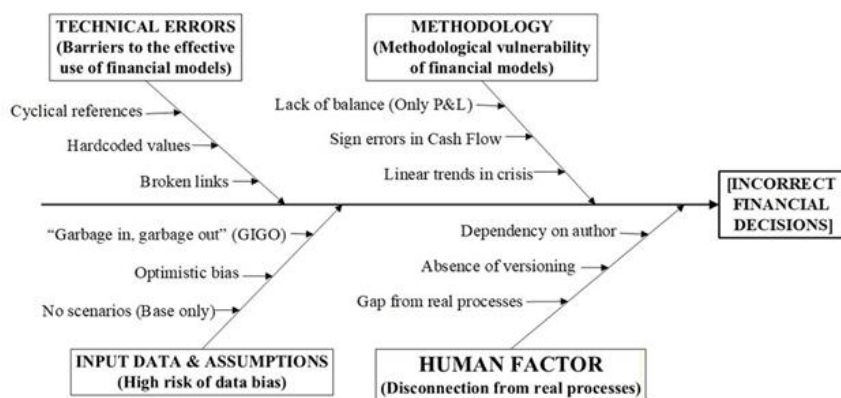


Figure 1. Problems of modeling financial processes at enterprises, built by the authors

Technical errors. One of the key problems of financial modeling is the presence of technical errors and chaos in the structure of models, which significantly reduces their reliability and practical value (Table 2). First, cyclic references and formula failures lead to a looping of calculations, as a result of which automatic data updating in programs such as Excel becomes impossible. Second, incompatibility and a break in connections between individual elements of the model, in particular when changing the formula in only one row without correct propagation to the entire data array, destroys the logic of calculations and creates systematic errors. The third problem is hardcoding, when instead of formulas, static values are entered into cells, which makes the model inflexible and unable to adapt to changing parameters. Finally, overloaded architecture and lack of structure lead to the creation of overly complex files that are difficult to check and verify, which contradicts modern modeling standards (for example, FAST). Taken together, these problems form barriers to the effective use of financial models in management practice and require the development of clear methodological and technical regulations for their construction.

Table 2. Financial modeling problems associated with technical errors and chaos in the structure, compiled by the authors

Problem	Essence	Consequences for the model	Example	Ways to overcome
Cyclic references and formula failures	Calculation looping in the software environment	Inability to automatically update data, model stops working	The formula in Excel refers to itself	Use of error checking functions; regular formula audit; use of the "Trace Dependents" and "Error Checking" tools
Incompatibility and broken connections	Calculation logic is broken due to partial changes	Occurrence of system errors, incorrect results	Changing the formula in only one line without copying to the entire array	Use of consistent ranges; standardization of formulas; use of structured tables
Hardcoding	Using static numbers instead of formulas	Loss of flexibility, inability to adapt to new parameters	Entering a fixed value into a cell instead of a calculation	Prohibition of hardcoding in corporate standards; use of parameters and variables; creating separate sheets for input data
Architecture overload	Excessive complexity and unstructured files	Difficulties in verification, low transparency, violation of standards	Lack of structure according to FAST principles	Compliance with modeling standards (FAST, SMART); modular model construction; documentation of calculation logic

Thus, technical problems can be minimized through process standardization, regular model auditing, and the use of structured approaches to their construction.

Methodological shortcomings in financial modeling constitute one of the most critical groups of problems that directly affect the reliability and practical value of the results (Table 3). First, a common sign error in Cash Flow calculations is when capital expenditures (CapEx) or changes in working capital are shown as positive instead of negative values, which leads to a significant distortion of the final cash flow. Second, ignoring balance sheet indicators (Balance Sheet) and focusing only on income and expenses (P&L) leads to the omission of cash gaps, which are critically important for assessing the liquidity of the enterprise. The third problem is the static nature of models in crisis conditions, when the use of linear trends without taking into account macroeconomic instability, inflationary processes, currency fluctuations or geopolitical risks reduces their predictive ability. Taken together, these shortcomings form the methodological vulnerability of financial models, which requires improving approaches to building and adapting models in accordance with real economic conditions.

Table 3. Methodological problems of financial modeling and their consequences, compiled by the authors

Problem	Essence	Consequences for the model	Example	Ways to overcome
Sign errors in Cash Flow	Incorrect reflection of capital expenditures or changes in working capital	Distortion of the final cash flow, incorrect management conclusions	Entering CapEx as a positive value	Using standardized Cash Flow templates; double-checking formulas; applying the "sign convention" principle
Ignoring the balance sheet (Balance Sheet)	Modeling only revenues and expenses without a balance sheet forecast	Omitting cash gaps, underestimating liquidity	Building a model based only on P&L	Integrating the forecast balance sheet into the model; applying a three-report approach (P&L, Balance Sheet, Cash Flow)
Staticity in crisis conditions	Using linear trends without taking into account macroeconomic risks	Decreased predictive ability, inconsistency with real conditions	Ignoring inflation, currency fluctuations, geopolitical factors	Using scenario analysis; stress test modeling; consideration of macroeconomic indicators and risks

Thus, methodological shortcomings not only distort the results of modeling, but can also lead to strategic errors in decision-making. They can be overcome through standardization of approaches, integration of comprehensive financial reports and the use of scenario analysis.

An important group of problems in financial modeling are the shortcomings associated with the quality of input data and the correctness of the assumptions that

form the basis of the calculations (Table 4). First, the principle of “garbage in, garbage out” (GIGO) operates, according to which the use of inaccurate, outdated or subjective data makes the entire forecast unreliable and devoid of practical value. Second, excessive optimism is widespread, caused by a cognitive bias of the confirmation bias type, when sales growth rates are overestimated and operating expenses are underestimated in accordance with the expectations of investors or management. Third, the lack of scenario analysis limits the model to only one “baseline” scenario, which does not allow taking into account possible pessimistic or optimistic scenarios and reduces the adaptability of management decisions [6]. Collectively, these problems undermine the analytical value of financial models, reduce their predictive power, and create risks for strategic planning of enterprises.

Table 4. Financial modeling problems related to input data and assumptions and their consequences, compiled by the authors

Problem	Essence	Consequences for the model	Example	Ways to overcome
The principle of “garbage in, garbage out” (GIGO)	Use of inaccurate, outdated or subjective data	Unreliability of forecasts, loss of practical value	Introduction of statistics without checking relevance	Implementation of a data validation system; use of verified sources; regular updating of databases
Excessive optimism (Confirmation Bias)	Overestimation of sales growth rates and underestimation of costs	Distortion of financial results, incorrect management decisions	Forecasting unrealistic revenue growth to meet investor requirements	Application of independent audit of models; use of conservative assumptions; involvement of external experts
Lack of scenario analysis	Calculation of only one “baseline” development option	Low adaptability of the model, failure to take into account risks	Model construction without pessimistic and optimistic scenarios	Use of scenario and sensitivity analysis; stress test modeling; development of alternative forecasts

Thus, problems with input data and assumptions are critical for the reliability of financial models. They can be overcome through systematic data verification, avoidance of cognitive biases, and implementation of a multi-scenario approach.

A significant part of the limitations of financial modeling are formed by human and organizational factors that directly affect the quality and viability of models (Table 5). First, the key problem is dependence on a single developer: the model is often created under the specific logic of one person, and after his dismissal or absence, other employees cannot understand the structure and functioning of the file. Second, the lack of a versioning and control system leads to the fact that several managers edit the file simultaneously, creating conflicts and losing current versions of

data. Third, the model is often disconnected from real business processes: financiers build calculations without sufficient understanding of the specifics of production, logistics or sales, which reduces the practical relevance of the results. Taken together, these factors form organizational barriers that reduce the effectiveness of financial modeling and require the implementation of corporate standards, systematic training of personnel and integration of models into real management processes.

Table 5. Financial modeling problems related to input data and assumptions and their consequences, compiled by the authors

Problem	Essence	Consequences for the model	Example	Ways to overcome
Key dependency on the developer	The model is created according to the logic of one person	Loss of work capacity after dismissal or absence of the author	No one can understand the file structure	Documentation of logic; standardization of approaches; collective development of models
Lack of versioning and control	Simultaneous editing of a file by several managers	Data conflicts, loss of current versions	Different versions of the same file in circulation	Use of version control systems (Git, SharePoint); centralized storage; regulated access
Isolation from real processes	Models are built without taking into account the specifics of the business	Reduction of the practical relevance of the results	Financiers do not take into account production or logistics features	Integration between financial and operational units; involvement of production and sales experts; cross-functional communication

Thus, human and organizational factors can be no less critical than technical or methodological problems. Overcoming them requires the implementation of corporate standards, systematic training of personnel, and the integration of financial models into real business processes.

Based on the generalization of the identified problems and taking into account the directions outlined in [5, 7, 13, 14], it is possible to outline the key directions for improving the methodological support of financial modeling of enterprises. First, the transition from traditional annual budgeting to short-term scenario and sliding forecasting is relevant, which ensures operational adaptation to changes in the macro-economic environment. Second, it becomes necessary to use combined models that integrate classical methods of financial analysis (in particular, discriminant and factor) with modern technologies of automated data collection and processing based on API and programming languages. Third, an important area is the formation of inflationary and liquid buffers in the structure of the working capital of the enterprise, which is a component of financial stability management models. Fourth, it is advisable to expand the information base of modeling by involving open databases and dig-

ital tools for monitoring the financial condition of enterprises. Finally, the fifth direction involves improving the skills of financial managers in the application of modern analytical tools and interpretation of the results of models built using artificial intelligence technologies.

Conclusions and prospects for further research. Financial modeling in modern conditions is an important tool for enterprise management, providing analysis of financial condition, forecasting of results and decision-making support. The use of different groups of models – from factor and discriminant to scenario and digital – allows for a comprehensive assessment of risks and development prospects, but each of them has limitations that are exacerbated in conditions of economic instability. The main challenges remain technical errors, methodological shortcomings, problems with the quality of input data and the human factor, which reduce the reliability and practical value of models. Overcoming these barriers requires a transition to short-term scenario forecasting, integration of classical and digital methods, formation of financial buffers, expansion of the information base and advanced training of financial managers. The effectiveness of financial process modeling is determined by a combination of technological innovations, methodological standardization, and human capital development, which ensures the adaptability of enterprises to a turbulent economic environment.

Further research in the field of modeling financial processes of enterprises should be focused on those areas that ensure increased stability and practical value of models in a turbulent economic environment. First of all, it is important to improve methods for assessing the financial stability of enterprises by forming inflationary and liquidity buffers in the structure of working capital, which allows to increase the ability of companies to withstand macroeconomic risks. No less relevant is the expansion of the modeling information base through the use of open digital platforms, databases and financial condition monitoring tools, which provides a complete and more reliable basis for analytical calculations. An important area is the implementation of standardized methodologies for building models, such as FAST or SMART, which reduce the likelihood of technical errors, increase the transparency of calculations and contribute to the unification of approaches in corporate practice. Special attention deserves the study of the effectiveness of combined models that combine classical methods of financial analysis with modern digital technologies, because they are capable of providing a balance between traditional reliability and innovative accuracy. The combined implementation of these areas creates the basis for the formation of more adaptive, flexible, and practically oriented financial models that meet the challenges of modern economic dynamics.

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