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JEL Classification: G32*Kirdina Olena, Steshenko Olena, Pohrebniak Anna***SYSTEM APPROACHES TO FINANCIAL AND ANALYTICAL MODELING OF  
MANAGEMENT DECISIONS USING DIGITAL TECHNOLOGIES****Ukrainian State University of Railway Transport, Kharkiv, Ukraine**

The theoretical and practical principles of integrating financial analysis with the process of making managerial decisions in conditions of dynamic economic development are considered. The relevance of the study is due to the high level of uncertainty of the market environment, increased competition and the increased role of risks in the strategic development of enterprises. The purpose of the article is to substantiate the conceptual approach to the integration of classical financial and analytical tools with modern methods of predictive modeling and digital technologies to form an effective system of support for managerial decisions. To achieve the set goal, comparative analysis (to assess the strengths and weaknesses of traditional approaches to financial analysis), factor analysis (to identify the main determinants of changes in financial indicators), econometric methods (to build quantitative dependencies and make forecast calculations), scenario modeling (to take into account the variability of enterprise development in conditions of risk) were used. The scientific novelty of the article lies in the development of a conceptual model of financial analysis, which combines classical methods with tools of the digital economy. The introduction of Big Data technologies for processing large amounts of information, artificial intelligence algorithms and machine learning for forecasting financial results and generating development scenarios, as well as the use of interactive digital platforms to provide access to key indicators in real time are proposed. The practical significance of the results lies in the possibility of their application in the field of corporate governance to optimize financial decisions. The proposed approach creates the prerequisites for the formation of an integrated analytical system that contributes to increasing the efficiency of enterprise management and ensuring their financial stability in the long term.

**Keywords:** financial analysis, management decisions, econometric models, scenario forecasting, factor analysis, digital technologies, artificial intelligence, Big Data, financial sustainability, strategic management.

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***Introduction and problem statement in general  
and its connection with important scientific or practical  
tasks***

The modern economic environment is characterized by high dynamics, uncertainty of market conditions, increased competition and increased

financial risks. In such conditions, the success of enterprises largely depends on the ability to make sound management decisions that take into account both internal and external development factors. Traditional financial analysis is a key tool for assessing the financial condition of the enterprise, determining

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reserves, forecasting results and minimizing risks.

The relevance of the research is due to the need to integrate financial and analytical tools with modern methods of modeling management decisions. The combination of analytical assessment of the financial condition with forecasting models creates the basis for an adaptive management system that can effectively respond to changes in the economic environment and increase the efficiency of the enterprise. Scientific understanding of this area contributes to the development of methodological recommendations for optimizing management processes and increasing competitiveness.

***Analysis of recent research and publications that initiated the solution to this problem and on which the author relies***

A significant contribution to the development of theoretical provisions and practical proposals regarding the financial and analytical support of management decisions and the use of digital technologies in management processes was made by the works of such researchers as W. Anggrainib, I. Basantsov, M. Bormotova, S. Byelov, Ch. Liu, T. Mashoshyna, G. Nawairc, O. Okfalisa, S. Saktiotod, S. Teslia, A. Tkachenko, O. Troinikova, K.Y. Wong, M. Yeromina, V. Zdir, O. Zorina, E. Zubareva and others [1-8].

These publications are dedicated to the study and disclosure of issues related to the transformation of financial analysis, management of the financial condition of business entities, the introduction of digital technologies into financial and accounting processes, the development of financial inclusion, as well as the adaptation of financial mechanisms in the transport industry in the context of European integration and digitalization.

***The identified article focuses on previously unresolved parts of the general problem***

Despite the large number of publications, the scientific discourse still lacks comprehensive studies that combine systems analysis, financial modeling, and digital technologies into a single management concept. This study aims to bridge this scientific gap.

***Formulation of the article's objectives (task statement)***

The purpose of the article is to form a scientifically sound basis for improving financial analysis through the implementation of modern technologies, hybrid models and digital platforms.

***Presentation of the main research material with a full justification of the obtained scientific results***

Financial analysis is considered as a set of methods and procedures aimed at assessing the financial condition, solvency, profitability and

efficiency of resource use of an enterprise. Its application allows for a systematic assessment of the state of the enterprise and to form a basis for making management decisions. In the scientific literature, three main areas of analysis are distinguished:

- retrospective analysis – assessment of past financial results to identify trends and problem areas;
- forecasting analysis – building models to assess possible results of future activities;
- strategic analysis – determination of long-term goals of the enterprise and the resources necessary to achieve them.

Traditional methods of financial analysis include ratio analysis, factor analysis, econometric and regression models and scenario analysis. Ratio analysis remains one of the most common methods due to its simplicity and speed of obtaining results. It allows you to assess the key financial indicators of the enterprise, including liquidity, solvency, profitability and financial stability. At the same time, its application is limited to forecasting tasks, since the ratios reflect the current state and do not take into account the relationship between indicators and external economic factors. Despite this, this method serves as the basis for further more complex analytical procedures, forming an initial orientation in the financial condition of the enterprise.

Factor analysis allows you to determine in detail the impact of individual factors on changes in financial indicators. It provides the ability to assess the determinants of growth or decline in profitability, liquidity and capital efficiency. This method is especially useful for forecasting and assessing the sensitivity of financial results to internal and external changes. At the same time, the accuracy of conclusions depends on the reliability and completeness of the initial data, which makes factor analysis resource-intensive in terms of preparing the information base and its verification.

Econometric models provide a high level of accuracy by taking into account correlation and functional relationships between financial variables. They allow building predictive models that reflect market dynamics, macroeconomic factors, and internal company parameters. However, the complexity of their application is associated with the need for specialized knowledge in statistics and econometrics, as well as significant computing resources for modeling and interpreting the results.

Scenario analysis is characterized by its flexibility and ability to evaluate alternative scenarios. It allows modeling optimistic, baseline, and pessimistic scenarios, which contributes to the development of preventive measures to minimize negative consequences and

exploit potential opportunities. To conduct a high-quality scenario analysis, significant information, time, and human resources are required, which makes its application more complex compared to classical methods.

The integrated application of these methods provides a comprehensive assessment of the financial condition and increases the validity of management decisions. The combination of speed and clarity of coefficient analysis, depth of factor analysis, accuracy of econometric models and flexibility of scenario forecasting creates an integrated analytical platform that allows not only to assess current financial indicators, but also to predict their changes in a dynamic external and internal environment.

The integration of these methods into corporate information systems and automated financial analysis platforms increases the efficiency of processing large data sets and the reliability of forecasts. This allows managers and analysts to make informed decisions regarding capital management, investment projects, current assets and financial risks. The combined use of methods contributes to increasing the transparency of financial management, resource optimization and the formation of an enterprise strategy focused on stable and sustainable growth in a changing economic environment.

Comparison of the effectiveness of various methods of financial analysis and modeling demonstrates that only comprehensive application allows to ensure a balance between the speed of obtaining information, the accuracy of estimates, the flexibility of forecasting and resource consumption, creating a scientifically sound basis for making management decisions and increasing the financial efficiency of the enterprise.

Despite the advantages of each of the above methods and the possibility of their combined use, the practice of financial analysis reveals a number of problematic aspects that limit the full realization of the potential of analytical tools. The use of coefficient, factor, econometric and scenario analysis faces difficulties associated with both the internal resources of the enterprise and the quality of the source information, which directly affects the accuracy of estimates and the reliability of forecasts. The integrated use of these methods provides a comprehensive assessment of the financial condition, the identification of reserves and the improvement of management efficiency, which forms the basis for the next stage - modeling of management decisions.

In modern decision-making practice, several types of models are distinguished. Deterministic models are used in cases where all data are known and accurate,

providing predictable results. Probabilistic models integrate the probabilities of events and the variability of financial indicators, allowing to assess risks and uncertainty. Scenario models are focused on building alternative development strategies and predicting their economic effect, which allows management to choose the most effective options for action.

Modern information systems and software expand modeling capabilities by integrating ERP systems, what-if methods, optimization and predictive models. This allows not only to form an effective cost and resource structure, but also to increase the accuracy of forecasts, reduce the influence of subjective factors and ensure the scientific validity of management decisions.

Therefore, the results of financial analysis become the basis for building models that reflect the relationships between financial indicators and strategic goals of the enterprise. Integration of analytics into decision-making models allows you to identify critical points in the financial condition, assess the effect of management measures and predict the consequences of alternative decisions in conditions of economic uncertainty. Scenario modeling is especially effective, which takes into account changing market conditions, price fluctuations and cost structures, helping management make informed decisions on optimizing costs, investments and working capital management. This approach forms a holistic management system that ensures increased efficiency, adaptability and stability of the enterprise.

Such integration of financial analysis and decision-making models not only forms an analytical basis for strategic planning, but also creates opportunities for practical application of the obtained results in the daily activities of the enterprise. The obtained models allow management not only to predict financial consequences, but also to directly influence the optimization of resources, cash flow planning, working capital management and assessment of investment projects. Thus, the results of analytical work become an effective tool for making specific management decisions that ensure increased efficiency, stability and competitiveness of the enterprise.

The practical application of financial and analytical methods in the activities of enterprises is a fundamental element of management practice and provides a systematic assessment of the economic efficiency of resource use. In the context of modern market conditions, characterized by high volatility of financial indicators, increased competition and the dynamics of the external environment, the integration of financial analysis into management processes becomes a key factor in ensuring sustainable

development. The use of analytical tools allows enterprises to carry out a comprehensive assessment of the financial condition, forecast cash flows, optimize the structure of assets and liabilities, and also determine the directions of long-term development in accordance with the concepts of strategic management.

The assessment of investment projects, carried out using discounted cash flow methods, profitability analysis, payback periods, and the internal rate of return, allows for a comprehensive determination of the effectiveness of capital investments and the risk-return ratio. The use of scenario analysis and methods for modeling probable fluctuations in market parameters ensures the prediction of potential losses and the development of measures to minimize them, which corresponds to the principles of financial risk management defined in corporate governance standards. Working capital management, including inventory optimization in accordance with accounting standards and the regulation of receivables and payables, allows maintaining the required level of liquidity and ensures the solvency of the enterprise. Factor analysis of changes in the volume of current assets and their structural components allows identifying key determinants of financial results and reasonably adjusting financial policy.

Cash flow planning, which is based on forecasting and modeling methods of receipts and payments, ensures the maintenance of financial stability and timely fulfillment of obligations. Forecasting negative scenarios, assessing the likelihood of financial crisis situations and developing preventive measures correspond to modern approaches to risk management, including the Value at Risk (VaR) methodology and sensitivity analysis of financial indicators. In combination with strategic planning, which involves determining long-term financial goals and resource policy, financial analysis provides a balance between short-term efficiency and strategic orientation towards sustainable development of the enterprise.

An important element of financial analysis is financial risk management, which is integrated into the planning and decision-making processes. The main categories of risks that affect the financial results of the enterprise include market, credit, operational and liquidity risks. Market risks are associated with fluctuations in prices for raw materials, goods and financial instruments, exchange rates and interest rates. Credit risks arise in the event of insolvency of counterparties or customers, which leads to a delay in cash flows or losses. Operational risks are caused by internal processes of the enterprise, including technological failures, personnel errors or imperfection

of management systems. Liquidity risks arise in the event of insufficient cash resources to meet short-term obligations.

Modern software complexes of automated financial analysis significantly increase the accuracy and efficiency of data processing, ensure the integration of information from different divisions of the enterprise and allow for multi-level factor and scenario analysis. The use of digital platforms allows you to model financial flows, assess the effect of alternative management decisions and predict changes in key indicators, which significantly reduces the risk of making unfounded decisions and improves the quality of capital management. The integration of such tools into corporate information systems creates conditions for a prompt response to external and internal changes, ensures the adaptability of financial management and allows you to optimize the use of resources in accordance with established accounting and financial reporting standards.

The use of financial and analytical methods acts as a comprehensive mechanism for managing the finances of an enterprise, ensuring the interconnected performance of the functions of assessing investment efficiency, controlling working capital, planning cash flows and strategic forecasting. Its implementation allows you to increase the accuracy of assessing the financial condition, identify risks in a timely manner, optimize resource management and lay the foundation for increasing the competitiveness and sustainable development of the enterprise in a dynamic market environment. The use of automated analytical systems, digital platforms and modern financial forecasting methods creates a scientifically sound basis for making management decisions and developing the financial culture of the enterprise, which meets the current requirements of corporate governance and financial reporting standards.

Each approach is characterized by specific capabilities and limitations, and their combination creates a comprehensive analytical system capable of providing a comprehensive assessment of financial indicators and increasing the validity of management decisions. Such an integrated approach meets the modern requirements of financial management and allows the enterprise to respond promptly to changes in internal and external economic conditions.

One of the key problems of financial analysis is the limited data used for its conduct. Insufficient detailing of financial statements, incomplete or outdated data limit the possibilities of factor and econometric analysis, complicate the construction of reliable models and increase the risk of erroneous conclusions. In addition, the complexity of integrating different

methods creates additional difficulties, especially for small and medium-sized enterprises, which lack sufficient human and technical resources for the comprehensive application of analytical tools.

Another important limitation is the influence of external factors on financial results, including fluctuations in market prices, political instability, changes in the regulatory environment and macroeconomic fluctuations. These factors complicate forecasting and increase the uncertainty of outcomes, requiring additional resources for building scenario models and risk analysis.

An equally significant aspect is the insufficient automation of analysis processes. Despite the availability of modern software complexes, many enterprises do not use their potential to the full, which leads to an additional burden on analytical personnel and increases the likelihood of human errors. The human factor remains critical, since the effectiveness of financial analysis depends on the qualifications of analysts, their objectivity and ability to work with large volumes of data.

In general, the problematic aspects of modern financial and analytical practice indicate the need to improve the methodology, implement complex digital platforms, improve data quality and personnel qualifications. Solving these problems will not only increase the accuracy of financial condition assessment, but also ensure the efficiency and validity of management decisions, which is critically important for the sustainable development of the enterprise in a dynamic economic environment.

Taking into account the identified limitations and problematic aspects of modern financial and analytical practice, there is a need to develop and implement improved approaches and methods. One of the promising areas is the integration of Big Data and artificial intelligence technologies, which allows for more accurate forecasting of financial indicators, automate the processing of large amounts of information and reduce the likelihood of human errors. The use of machine learning algorithms and automated models allows for the analysis of large volumes of historical data, identification of patterns and assessment of the impact of external factors on financial results.

The second area is the development of hybrid analytical models that combine the advantages of coefficient, factor, econometric and scenario analysis. Such a comprehensive approach provides a balance between the speed of information acquisition, depth of analytics and forecasting flexibility, which allows for a more effective response to changes in internal and external conditions.

No less significant is the increase in the level of automation and digitalization of analytical processes. The creation of interactive control panels, corporate financial hubs and data visualization systems provides operational access to key indicators, facilitates the adoption of management decisions and allows for the assessment of the effect of alternative development scenarios.

An equally important direction of development is the standardization of financial analysis methods and the unification of accounting and reporting procedures. This ensures comparability and reproducibility of results between enterprises of different sizes and industries, increases the transparency of financial management and contributes to the formation of trust on the part of investors and creditors.

Based on research [1-8] and our own scientific views on the issue of financial and analytical support for the development of business entities, a conceptual model of financial analysis in the context of digital transformation has been formed, which reveals the goal, component and algorithmic and process support, where classical analysis methods are integrated with digital economy tools - in particular, Big Data technologies for multi-level information processing, artificial intelligence and machine learning algorithms for predicting financial results and forming development scenarios, as well as interactive digital platforms that provide access to key indicators in real time, contributing to the prompt adoption of management decisions (Fig.).

Thus, the introduction of modern technologies, hybrid models and digital platforms creates a scientifically sound basis for improving financial analysis. This allows enterprises to increase the accuracy of forecasts, optimize capital management, reduce financial risks and ensure sustainable development in a dynamic economic environment, which corresponds to the current concepts of corporate governance and risk management.

#### ***Conclusions from this research and prospects for further research in this direction***

Thus, the integration of financial analysis and decision-making models into the practical activities of the enterprise creates a holistic financial management system that provides a balance between operational efficiency, strategic planning and risk management. The use of modern analytical tools, digital technologies and scenario modeling allows the enterprise to increase financial stability, adaptability and competitiveness in a dynamic economic environment, laying a scientifically sound basis for sustainable development and increasing the efficiency of management decisions.

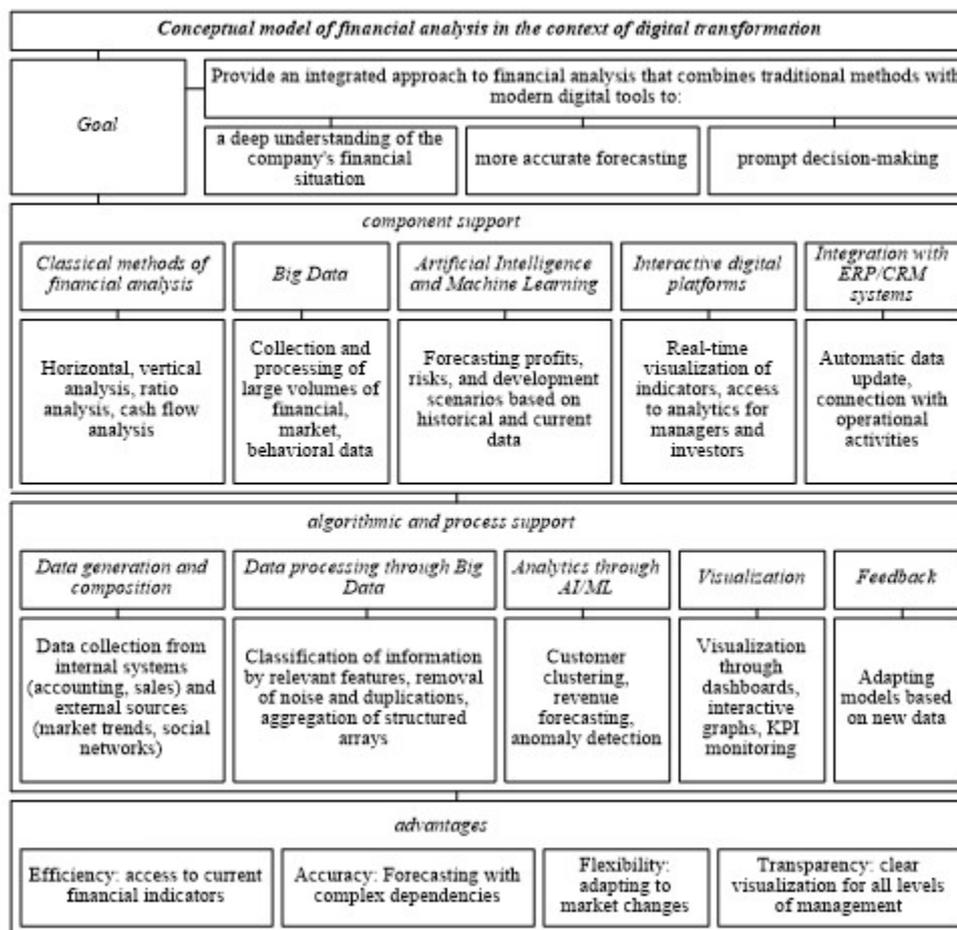


Fig. Conceptual model of financial analysis in the context of digital transformation

Source: developed by authors

The complex application of financial analytical tools and models provides a comprehensive assessment of the financial condition of the enterprise, increases the accuracy of forecasts and the validity of management decisions. The main problems remain limited data, insufficient detail of financial reports and outdated information, which complicates the construction of reliable models and increases the risk of erroneous conclusions. The complexity of integrating different methods creates additional difficulties, especially for small and medium-sized enterprises, which lack the human and technical resources for the comprehensive application of analytical tools. The impact of external factors, such as market price fluctuations, political instability, changes in the regulatory environment and macroeconomic fluctuations, increases the uncertainty of results, which

requires additional resources for building scenario models and risk analysis. Insufficient automation of analysis processes and the human factor also remain critical, since the effectiveness of analysis depends on the qualifications of analysts and their ability to work with large volumes of data.

The identified problematic aspects, in particular, data limitations, the complexity of integrating methods and the impact of external factors, emphasize the need to improve analytical approaches. The implementation of Big Data technologies, artificial intelligence, hybrid models and digital platforms creates a scientifically sound basis for increasing the efficiency of financial management, reducing risks and ensuring sustainable development of the enterprise in a dynamic economic environment.

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## СИСТЕМНІ ПІДХОДИ ДО ФІНАНСОВО-АНАЛІТИЧНОГО МОДЕЛЮВАННЯ УПРАВЛІНСЬКИХ РІШЕНЬ ІЗ ВИКОРИСТАННЯМ ЦИФРОВИХ ТЕХНОЛОГІЙ

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Розглянуто теоретичні та практичні засади інтеграції фінансового аналізу з процесом прийняття управлінських рішень в умовах динамічного розвитку економіки. Актуальність дослідження зумовлена високим рівнем невизначеності ринкового середовища, зростанням конкуренції та підвищеною роллю ризиків у стратегічному розвитку підприємств. Метою статті є обґрунтування концептуального підходу до інтеграції класичних фінансово-аналітичних інструментів із сучасними методами прогнозного моделювання та цифровими технологіями для формування ефективної системи підтримки управлінських рішень. Для досягнення поставленої мети використано порівняльний аналіз (для оцінки сильних та слабких сторін традиційних підходів до фінансового аналізу), факторний аналіз (для визначення основних детермінант змін фінансових показників), економіметричні методи (для побудови кількісних залежностей і здійснення прогнозних розрахунків), сценарне моделювання (для врахування варіативності розвитку підприємства в умовах ризику). Наукова новизна статті полягає у розробленні концептуальної моделі фінансового аналізу, яка поєднує класичні методи з інструментами цифрової економіки. Запропоновано впровадження технологій Big Data для обробки великих обсягів інформації, алгоритмів штучного інтелекту та машинного навчання для прогнозування фінансових результатів і формування сценаріїв розвитку, а також використання інтерактивних цифрових платформ для забезпечення доступу до ключових показників у режимі реального часу. Практичне значення результатів полягає в можливості їх застосування у сфері корпоративного управління для оптимізації фінансових рішень. Запропонований підхід створює передумови для формування інтегрованої аналітичної системи, яка сприяє підвищенню ефективності управління підприємствами та забезпечує їхню фінансову стабільність у довгостроковій перспективі.

**Ключові слова:** фінансовий аналіз, управлінські рішення, економіметричні моделі, сценарне прогнозування, факторний аналіз, цифрові технології, штучний інтелект, Big Data, фінансова стійкість, стратегічне управління.

SYSTEM APPROACHES TO FINANCIAL AND ANALYTICAL MODELING OF MANAGEMENT DECISIONS USING DIGITAL TECHNOLOGIES

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