

**МЕНЕДЖМЕНТ**  
**MANAGEMENT**

**УДК 658.012.4:004.738.5:330.341.1**

doi: <https://doi.org/10.15330/apred.1.21.34-40>

*Буртняк І.В.<sup>1</sup>, Халудило Т.В.<sup>2</sup>*

**ЦИФРОВА ТРАНСФОРМАЦІЯ УПРАВЛІННЯ ПІДПРИЄМСТВАМИ:  
ІННОВАЦІЙНІ МОДЕЛІ, ПРОГНОСТИЧНІ СЦЕНАРІЇ ТА СУЧАСНІ  
ВИКЛИКИ МОДЕРНІЗАЦІЇ ЕКОНОМІКИ**

Карпатський (Прикарпатський) національний університет  
імені Василя Стефаника,  
Міністерство освіти і науки України,  
кафедра економічної кібернетики,  
вулиця Шевченка, 57, м Івано-Франківськ,  
76000, Україна,  
<sup>1</sup>тел.: (097)-98-62-632,  
e-mail: [ivan.burtnyak@pnu.edu.ua](mailto:ivan.burtnyak@pnu.edu.ua),  
ORCID: <https://orcid.org/0000-0002-9440-1467>

<sup>2</sup>тел.: (073)-16-63-930,  
e-mail: [haludylo12345@gmail.com](mailto:haludylo12345@gmail.com),  
ORCID: <https://orcid.org/0009-0001-3004-9134>

**Анотація.** У статті обґрунтовано теоретичні засади цифрової трансформації управління підприємствами в умовах динамічних ринкових змін і глобалізації. Показано, що традиційна модель управлінських процесів та окремі заходи з впровадження цифрових технологій конфліктують із сучасними викликами – глобальними економічними кризами, напруженням у міжнародних відносинах та стрімким розвитком ІТ, що знижує здатність підприємств адаптуватися до зовнішніх потрясінь.

Мета дослідження – систематизувати та поглибити теоретичні основи цифрової трансформації управління з позицій інтеграції ШІ, машинного навчання, аналітики великих даних і хмарних сервісів для модернізації економіки та підвищення конкурентоспроможності бізнесу. Автори виявляють основні бар'єри впровадження цифрових технологій у систему управління та пропонують ефективні підходи до їх подолання задля забезпечення стабільності й гнучкості управлінських рішень.

У роботі використано загальнонаукові методи: абстрагування, аналіз, синтез, логічне узагальнення і порівняння. Етапи переходу від традиційних підходів – до цифрових моделей розглянуто за допомогою функціонального аналізу в контексті суспільного відтворення – виробництва, розподілу, обміну та споживання; поєднано історичний огляд розвитку управлінської думки з аналізом сучасних практик.

Розглянуто ключові аспекти цифровізації: інтеграцію інноваційних технологій у системи управління, використання комп'ютерних алгоритмів для обробки великих даних та створення інтерактивних платформ для оперативного прийняття рішень. Окрема увага приділена зовнішнім факторам – глобальним кризам, міжнародно-політичним викликам і внутрішнім структурним змінам у компаніях.

Наукова новизна полягає в розробці функціонального концепту цифрової трансформації управління, який враховує вплив зовнішніх економічних умов і внутрішніх інноваційних процесів на адаптивність підприємств. Отримані результати сприятимуть підвищенню точності прогнозування, швидкості реагування на зовнішні зміни та зміцненню конкурентоспроможності підприємств.

**Ключові слова:** цифрова трансформація, управління підприємствами, інноваційні моделі, прогностичні сценарії, штучний інтелект, машинне навчання, аналіз великих даних, хмарні технології, ефективність управління, сучасна економіка

*Burtnyak I.V.<sup>1</sup>, Khaludilo T.V.<sup>2</sup>*

**DIGITAL TRANSFORMATION OF BUSINESS MANAGEMENT:  
INNOVATIVE MODELS, FORECAST SCENARIOS AND CURRENT  
CHALLENGES OF ECONOMY MODERNIZATION**

Vasyl Stefanyk Carpathian (Precarpathian) National  
University,  
Ministry of Education and Science of Ukraine,  
Department of Economic Cybernetics,  
Shevchenko Str., 57, Ivano-Frankivsk,  
76000, Ukraine,  
<sup>1</sup>tel.: (097)-98-62-632,  
e-mail: ivan.burtnyak@pnu.edu.ua,  
ORCID: <https://orcid.org/0000-0002-9440-1467>

<sup>2</sup>tel.: (073)-16-63-930,  
e-mail: haludylo12345@gmail.com,  
ORCID: <https://orcid.org/0009-0001-3004-9134>

**Abstract.** The theoretical foundations of digital transformation in enterprise management have been substantiated in the article under conditions of dynamic market changes and globalization. It has been demonstrated that the traditional model of managerial processes and certain measures for the implementation of digital technologies are conflicted with contemporary challenges – global economic crises, tensions in international relations, and the rapid development of information technologies– which reduces enterprises’ ability to adapt to external shocks.

The aim of the study has been defined as the systematization and deepening of the theoretical basis for digital transformation in management from the standpoint of integrating artificial intelligence, machine learning, big data analytics, and cloud services for the modernization of the economy and the enhancement of business competitiveness. The principal barriers to the implementation of digital technologies within management systems have been identified by the authors, and effective approaches for their overcoming have been proposed in order to ensure the stability and flexibility of managerial decisions.

General scientific methods—abstraction, analysis, synthesis, logical generalization, and comparison—have been employed in the work. The stages of transition from traditional approaches to digital models have been examined through functional analysis in the context of societal reproduction—production, distribution, exchange, and consumption – while a historical review of the evolution of management thought has been combined with an analysis of contemporary practices.

Key aspects of digitalization, including the integration of innovative technologies into management systems, the utilization of computer algorithms for processing large volumes of data, and the creation of interactive platforms for prompt decision-making, have been examined in the article. Special attention has been paid to external factors – global crises, international-political challenges, and internal structural changes within companies.

The scientific novelty has been constituted by the development of a functional concept of digital transformation in management, which takes into account the influence of both external economic conditions and internal innovation processes on enterprises’ adaptability. The results obtained are expected to contribute to increased forecasting accuracy, accelerated responsiveness to external changes, and strengthened competitiveness of enterprises.

**Key words:** digital transformation, enterprise management, innovative models, predictive scenarios, artificial intelligence, machine learning, big data analytics, cloud technologies, management efficiency, modern economy.

**Introduction.** In the modern era of rapid development in information technology and the globalization of economic processes, the digital transformation of enterprise management

assumes a decisive role in modernizing the economy and ensuring the competitiveness of companies. The transition from traditional management methods to innovative models – based on the integration of artificial intelligence, machine learning, big data analytics, and cloud services – has become an integral component of enterprises' successful adaptation to the dynamic conditions of the market.

The significance of this transformation lies not only in the optimization of internal processes and the improvement of decision-making effectiveness but also in the creation of strategic platforms that facilitate in-depth analysis of market trends and the forecasting of future development scenarios. This process requires a comprehensive reassessment of traditional approaches since the accumulated experience of classical management methods can no longer fully address the complexities and dynamics of modern economic conditions.

The scientific conceptualization of digital transformation as a phenomenon is rooted in multifaceted theoretical foundations developed by representatives of various economic schools of thought. At the same time, practical experience shows that the successful implementation of innovative technologies in enterprise management demands a holistic approach that includes legal, socio-economic, technical, and organizational measures. The specifics of modern digital transformation are also shaped by external challenges – global economic crises, shifts in international markets, and local factors triggered by various political and security influences.

The research dedicated to analyzing innovative models and predictive scenarios in the field of enterprise management is both timely and highly relevant. It is aimed not only at synthesizing the current experience in the implementation of digital technologies in business practices but also at determining the prospects for their further adaptation in response to the challenges of today's market. The integration of cutting-edge technologies into the management system not only enables the automation of routine processes but also ensures a more flexible and adaptive functioning of enterprises, which is critically important in conditions of economic instability.

**Research Task.** The study involves the development and testing of a comprehensive approach for the comparative assessment of the efficiency of traditional enterprise management methods and innovative digital solutions. The main objective is to compare traditional methods with innovative approaches and to integrate techniques of big data analysis, machine learning, and artificial intelligence to enhance flexibility, forecasting accuracy, and the promptness of managerial decision-making under current market conditions.

**Results.** Digital transformation of enterprise management is an integrated process that acts as a system-forming factor for the implementation of modern technological solutions, significant changes in internal organizational structures, and new approaches to decision-making. Large-cap companies fully integrate traditional management methods into unified systems, where information technologies, data analytics, and cloud services serve as the primary tools for optimizing operations and adapting to fluctuating market conditions [7].

The primary goal and tool for modernization is the implementation of artificial intelligence systems for demand forecasting and market trend analysis, the automation of routine processes, and the creation of interactive platforms for managing communication among employees. By leveraging a machine learning framework, a set of traditional methods can be utilized – these methods will be embodied in an audio-video recording that is provided to a specific AI for analysis and for updating the dataset to support further autonomous operations [5].

The use of digital tools is increasingly becoming the fundamental mechanism for developing predictive scenarios, thereby enabling businesses to respond more accurately to external challenges and internal changes. Consequently, the integration of cutting-edge

technologies modernizes the management process and lays the foundation for transitioning companies to more flexible and adaptive operational models, ensuring their competitiveness in the modern market.

The formulation of the research task is aimed at developing a comprehensive approach for the comparative evaluation of traditional enterprise management methods and innovative digital solutions. The main objective of the study is to determine the efficiency of each approach by applying proprietary computational models that consider both quantitative and qualitative indicators.

Traditional management methods typically employ classical financial and operational metrics such as profitability, capital turnover, and the cost-to-revenue ratio. Formally, the efficiency of the traditional approach can be outlined as a function  $E_t = \frac{\sum_{i=1}^n (R_i - C_i)}{C_t}$ , where  $R_i$  – revenues,  $C_i$  – represents expenses for individual areas of activity, a  $C_t$  – stands for total expenses [2].

In contrast, innovative management methods involve the use of modern technologies – such as big data analytics, machine learning algorithms, and artificial intelligence – that not only facilitate the evaluation of the current state but also enable the forecasting of future trends. Here, efficiency can be represented in the form of a model in which the key element is a dynamic component [6]:

$$E_i = \alpha * f(D) + \beta * g(P) + \gamma * h(S),$$

where  $f(D)$  represents the data analysis function,  $g(P)$  denotes the model's predictive capability, and  $h(S)$  indicates the system's adaptability to changes in the external environment. The coefficients  $\alpha$ ,  $\beta$ , and  $\gamma$  are determined experimentally to most accurately reflect the actual impact of each element.

Author's methodology is based on the synthesis of analytical skills and econometric models, complemented by the active use of modern programming languages and artificial intelligence algorithms. Using this methodology, an analysis was conducted to evaluate the efficiency of both traditional and innovative methods. The analysis is based on a sample of 1,000 generated values and on the formulas described above – the model's efficiency is calculated accordingly. The development was carried out using the Python programming language in the Idle Shell 3.8.9 environment [1,3].

The first five generated income and expense values were used to calculate the efficiency indicators of traditional management methods. The results of the calculations are presented in the form of a table with examples of income, expenses and calculated efficiency coefficients (see Table 1).

Table 1

**Calculating the effectiveness of traditional methods**

Examples of income (first 5 values)	1124.17853825	965.43392471	1161.92213453	1380.7574641	941.46165632
Examples of expenses (first 5 values)	1080.87108732	985.92673658	812.92607398	671.61264446	940.64466272
Calculated efficiency of traditional methods	0.23267098512495502				

Source: author's development

The results of the analysis of the traditional method (see Table 1) indicate the following: for the first five sample elements, income ranges from approximately 941 to 1381 monetary units, while expenses vary from about 672 to 1081 units. The calculated efficiency of the traditional approach is 0.23267, indicating that the total profit (the difference between income and expenses) is roughly 23.3% of the total expenses. This evaluation suggests that while there is some profitability associated with the application of classical management methods, it also underscores the limitations of this approach in the context of the high dynamism of the modern market.

The next table summarizes the first five values of data-analysis, forecasting, and system-adaptability metrics, culminating in the overall efficiency score for innovative management methods. This comparison highlights the enhanced stability, predictive accuracy, and adaptability afforded by digital technologies (see Table 2).

Table 2

**Calculation of the effectiveness of innovative methods**

Examples of data analysis (first 5 values)	0.84967142	0.78617357	0.86476885	0.95230299	0.77658466
Examples of forecasting (first 5 values)	0.95990332	0.88869505	0.75894456	0.65295948	0.8547335
Examples of system adaptability (first 5 values)	0.86624109	0.89277407	0.860379	0.88460192	0.80531927
Calculated efficiency of innovative methods	0.8050817986134027				

Source: author's development

The results of the innovative approach (see Table 2) indicate a high potential for the use of digital technologies in optimizing enterprise management. An analysis of the first five data analysis metric values demonstrates the stability of the algorithms[4], with values ranging from 0.7766 to 0.9523, which indicates the system's sufficient capacity to process and analyze large volumes of information. The forecasting metrics, reflecting the system's ability to construct scenarios of future changes, range from 0.6530 to 0.9599, suggesting a high potential for predicting market trends. Similarly, the system adaptability values (ranging from 0.8053 to 0.8928) reflect the system's ability to respond rapidly to both external and internal changes.

The calculated overall efficiency of innovative methods is 0.80508, which indicates a significant optimization of managerial processes compared to traditional approaches. This evaluation supports the assertion that the application of integrated digital solutions not only automates routine tasks but also enhances adaptability and forecast accuracy – critical factors for dynamically responding to the evolving conditions of the modern market.

Comparing the obtained results, a clear conclusion can be drawn regarding the advantages of employing innovative methods over traditional ones. On the one hand, the traditional approach – based on the analysis of classical financial metrics (income and expenses) – yielded a calculated efficiency of approximately 0.23267. This suggests that the enterprise's profit is about 23.3% of total expenses, which may be acceptable under certain circumstances but does not guarantee high adaptability and competitiveness in today's dynamic environment.

The innovative approach, which integrates data analysis, forecasting capabilities, and system adaptability, produced a significantly higher result – an efficiency level of 0.80508.

This value demonstrates a more robust capability of the system to analyze market conditions, accurately predict changes, and respond swiftly to external challenges. In this case, innovative technologies not only automate routine processes but also substantially improve the quality of managerial decisions through in-depth data analysis and the ability to model future scenarios[6].

When considering the application of these methods in practical settings, the traditional approach may be useful for enterprises operating in a stable environment with minimal external influences, where historical data remains relevant. However, modern enterprises that face rapidly changing market conditions and numerous external factors have a greater incentive to implement innovative methods. The use of digital technologies enables a more flexible, accurate, and adaptive set of management tools, ultimately contributing to enhanced competitiveness and responsiveness in decision-making.

The innovative approach outperforms the traditional one in every parameter – from analysis and forecasting to adaptability to environmental changes. The use of modern digital technologies allows for the creation of high-quality predictive scenarios, which are critically important for enterprises striving to remain competitive amid the instability of the modern market.

Digital transformation in enterprise management is a decisive factor in enhancing their competitiveness in today's market conditions. Research demonstrates that traditional management methods based on classical financial indicators yield rather limited efficiency, as reflected in a comparatively low profitability metric[8]. In contrast, the integration of modern digital technologies—particularly machine learning algorithms and artificial intelligence – contributes not only to a deeper data analysis but also to more accurate market change predictions, enabling enterprises to respond promptly to external and internal challenges. Transitioning to innovative management models ensures the creation of a more flexible and adaptive system, which is a key condition for the modernization and successful operation of businesses today.

**Conclusions.** The work encapsulates the essence of transformational processes in modern entrepreneurship, where innovative approaches serve as a catalyst for the profound reorganization of management systems. It demonstrates that digitalization is not merely the automation of routine operations but also the development of new mechanisms for analysis, forecasting, and adaptation, which enable enterprises to respond effectively to rapidly changing market conditions. Compared to traditional methods, which are focused on classical financial indicators, the modern approach offers significantly greater dynamism and flexibility in the management process, facilitating the creation of resilient strategic platforms for business development. Thus, the implementation of digital solutions becomes an integral prerequisite for the modernization and competitiveness of companies in the global economic environment, opening new horizons for integrated development and sustainable economic growth.

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Дата подання: 30.04.2025