

DOI: <https://doi.org/10.34069/AI/2023.70.10.5>

How to Cite:

Yakaitis, I., Shakhovnina, N., Nikoliuk, O., Shestakovska, T., Haryha-Hrykhno, M., & Matiukha, V. (2023). Application of information technologies and modeling in management operating systems for improving efficiency and safety. *Amazonia Investiga*, 12(70), 51-62. <https://doi.org/10.34069/AI/2023.70.10.5>



## Application of information technologies and modeling in management operating systems for improving efficiency and safety

### Застосування інформаційних технологій та моделювання в операційних системах управління для підвищення ефективності та безпеки

Received: August 1, 2023

Accepted: September 24, 2023

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#### Abstract

The article examines the essence of information technology in the contemporary world and its impact on management operating systems. The authors define the concept of "information technology" and the basic principles of its functioning. In addition, the paper identifies the most common methods and approaches to modeling management operating systems. The authors analyzed the impact of information technologies on the development of Ukrainian enterprises. They also presented the latest information technologies in enterprise management and their essential contribution to the economy, exports, and employment. The study analyzed the dynamics of IT services development in Ukraine and their impact on its economy. It also presented a general analysis of operating systems in Ukraine and

#### Анотація

У статті розглядається сутність інформаційних технологій у сучасному світі та їх вплив на операційні системи управління. Авторами визначено поняття «інформаційна технологія» та основні принципи її функціонування. Крім того, визначено найбільш поширені методи та підходи до моделювання управління операційними системами. Автори проаналізували вплив інформаційних технологій на розвиток українських підприємств. Вони також представили новітні інформаційні технології в управлінні підприємствами та їхній вагомий внесок в економіку, експорт та зайнятість. У дослідженні проаналізовано динаміку розвитку ІТ-послуг в Україні та їх вплив на її економіку.

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considered the possibilities of integrating information technology and innovative educational approaches. In addition, the paper examines the impact of information technology on the management of operating systems' security and presents the economic and technological effects that arise from implementing information technologies. This research aims to highlight the importance of information technologies in improving the efficiency and security of management operating systems.

**Keywords:** information technologies, modeling, management operating system, innovative approaches, entrepreneurship, competitiveness, productivity, management.

## Introduction

Effective management is more critical than ever in today's fast-paced and competitive world. High competition, globalization, technological development, and the increasing information flow create new challenges for businesses and organizations. One of the key components of successful management is the ability to use information technology and modeling in management operating systems in a timely and effective manner.

Information technologies have become not only a tool for data processing but also a strategic resource that enables informed decision-making, event prediction, and the improvement of business processes. With them, it is possible to enhance efficiency, reduce risks, and increase competitiveness.

Modeling, in turn, provides the capability to analyze scenarios, determine optimal solutions, and evaluate their consequences without a direct impact on real business operations. This tool becomes vital for strategy development, resource planning, and project management. In this context, the issues of using information technology and modeling in management operating systems are becoming relevant and require detailed consideration.

This study aims to review and analyze the use of information technologies and modeling in management operating systems to improve efficiency and security in organizations and enterprises.

Також було представлено загальний аналіз операційних систем в Україні та розглянуто можливості інтеграції інформаційних технологій та інноваційних освітніх підходів. Крім того, у статті розглядається вплив інформаційних технологій на управління безпекою операційних систем і представлені економічні та технологічні ефекти, які виникають від впровадження інформаційних технологій. Це дослідження має на меті підкреслити важливість інформаційних технологій для підвищення ефективності та безпеки операційних систем управління.

**Ключові слова:** інформаційні технології, моделювання, операційна система управління, інноваційні підходи, підприємництво, конкурентоспроможність, продуктивність, менеджмент.

The research goals are as follows:

- to substantiate the impact of information technologies on security in management operating systems;
- to analyze examples of effective use of models in management operating systems;
- to formulate requirements for further development of the methodology for implementing information technologies in management operating systems.

## Literature review

Implementation of information technologies and the use of modeling in management operating systems are becoming increasingly important aspects in today's business environment. Facilitation of processes, increase in efficiency, and security have become essential tasks for enterprises of all sizes and specializations. Constantly evolving information technologies provide an opportunity to introduce new approaches to managing operational processes. They help to improve the productivity and competitiveness of companies.

Setiawati, R., Eve, J., Syavira, A., Ricardianto, P., and Endri, E. (2022) investigate the relationship between information technologies and business flexibility. Their article aims to explore the aspects of using information technologies and their impact on companies' business flexibility and competitiveness. Scientists consider both internal and external factors, as well as the role

of top management and employees in achieving business flexibility.

The research by Vasylieva, N. V., Vasylieva, O. I., Prylipko, S. M., Kapitanets, S. V., and Fatkhutdinova, O. V. (2020) emphasizes the need for integrating innovative approaches to personnel training in the field of public administration for the successful implementation of decentralization reforms in Ukraine. According to their findings, the new model of public service should be based on transparency, efficiency, and collaboration with the public. Also, this model should be based on innovative methodologies and technologies in the professional development of civil servants. The authors believe it will help curb corruption, increase public trust, and ensure the qualitative delivery of public services.

Shaposhnykov, K., Kochubei, O., Grygor, O., Vyshnevskaya, O., Protsenko, N., and Dzyubina, A. (2021) examined the dynamics of the growth of Ukrainian information technologies exports. They established a connection between the components of the IT product market and the main and auxiliary stages of its creation. For their development and promotion, the authors proposed a methodology of iterative software development based on prototyping with elements of the Scrum system. Based on a proven flexible development technology, this approach allowed for the introduction of specific mechanisms that helped neutralize several negative factors associated with other methods.

Kotelevets, D. O. (2022) focuses on current trends in the development of the digital economy in Ukraine, particularly regarding the implementation of modern information and communication technologies in the activities of domestic enterprises. The author emphasizes the necessity of digital transformation to ensure the competitiveness of businesses and create favorable conditions for sustainable economic development.

Vyhaniailo, S. M. (2021) investigated the relationship between information technologies and business analysis. He analyzed the key stages of business analysis and classified software for business analysis. The research identified the primary goal of business analysis - to provide business consulting services using modern information technologies. The study also explored the use of IT technologies for contemporary business analysis methods. The author identified the prospects of information

technology development to enhance business management system efficiency.

Vankovych, L. Ya., Mysiuk, R. V., Dobush, T. I., Bobko, O. V., Konyk, O. V., Shyian, S. M., and Tsvyk, S. R. (2023) examined key aspects of the impact of information technologies on the functioning and development of enterprises in the contemporary business environment. The authors emphasized the role of IT in providing flexibility and responsiveness to market changes, as well as the automation of labor processes through information technology. They also looked at its influence on costs and productivity, the increased availability of information for managers, and its impact on decision-making processes.

### Methods

The following methods were used in the course of this study:

- A literature review was employed to identify key concepts, approaches, and methods related to the use of information technologies and modeling in management operating systems.
- The generalization method was used to analyze the results of the study of Ukrainian information technologies' export dynamics and establish connections between different components of the IT product market.
- Statistical data analysis was employed to assess the trends in information technology development and its impact on management operating systems, as well as to identify patterns in the utilization of these technologies in enhancing efficiency and security.
- Case studies of effective model utilization in management operating systems demonstrated that the implementation of information technologies and modeling can lead to increased productivity and overall security improvement in organizations.

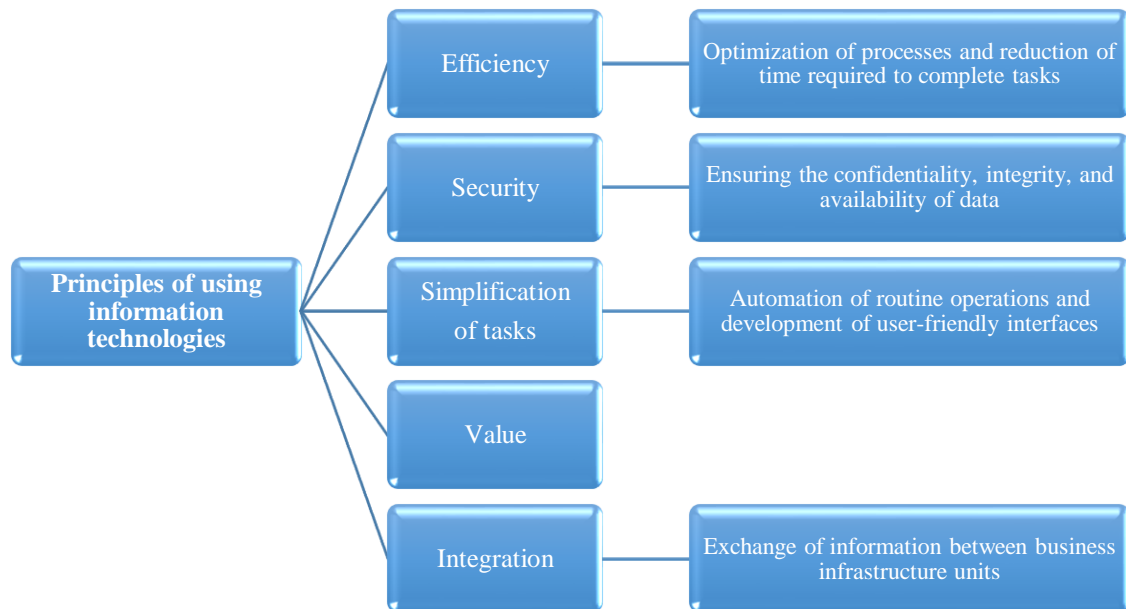
### Results

The use of information technologies (IT) has become a necessity in the modern world. In these circumstances, they have evolved into a powerful tool for achieving success in various fields of activity. Information technologies have influenced how we work, learn, communicate, and manage various aspects of life.

Information technology is an organized process of data processing using computer systems and

software aimed at ensuring fast access to information, its processing, storage, and transmission, regardless of its location. Information technologies encompass methods, production processes, as well as software and hardware tools that contribute to optimizing the use of information resources. Besides, they improve the productivity and flexibility of information processes (Setiawati et al., 2022).

The essence and significance of using IT become evident when considering their fundamental principles (see Figure 1). These principles define basic approaches to using technologies and their impact on our internal and external environment. They determine how IT contributes to enhancing efficiency, security, and the development of various spheres of our lives.



**Figure 1.** The principles of using information technologies.  
Source: Compiled by the authors based on (Tarasiuk, 2011).

Thus, modeling in management operating systems becomes a key tool for achieving a high level of efficiency and competitiveness for organizations. It enables the analysis, optimization, and improvement of various aspects of operational management, including supply, production, logistics, customer service, and many others. In this context, the assessment of methods and approaches to modeling in management operating systems becomes particularly relevant. The use of scientific methods, innovative tools, and advanced software allows for the creation of accurate and realistic models of operational processes, as well as the analysis of their efficiency and improvement (Hrynevych et al., 2020).

According to recent research on the impact of information technologies on the development of enterprises, Ukrainian scientists have concluded that information systems can transform organizations, providing them with greater competitiveness and efficiency. They enable the restructuring of structure, scope, and management tools, transforming work processes,

products, and services. New possibilities include global coordination of dispersed teams through the following means:

- email and video conferencing;
- the creation of virtual organizations without physical constraints;
- increased flexibility in responding to market changes;
- the automation of labor processes.

All these means make information technologies powerful tools for achieving success in modern business (Vankovych et al., 2023).

Therefore, the methods and approaches to modeling management operating systems are important tools for improving the efficiency and optimization of business processes in modern companies. The main ones are as follows:

#### 1. System Modeling.

System dynamics allows modeling the behavior of a system over time and determining the relationships between its components. It enables the analysis of the impact of various factors on the system's dynamics and the development of management strategies.

In turn, systems analysis is used to analyze and optimize complex systems, treat the system as a holistic entity, and analyze the interactions between its components.

## 2. Mathematical Modeling.

Deterministic modeling involves using mathematical equations to model operational processes, allowing for precise analysis and outcome prediction. Conversely, simulation modeling employs stochastic models to replicate real operating systems, with its main advantage being the ability to model random events and uncertainty.

## 3. Process Modeling.

Business process modeling is used to model business processes and optimize them. It helps determine the sequence of actions, resources, and other aspects of operational systems. Project management and performance analysis also use process modeling.

## 4. Optimization Modeling.

Linear programming is used to find optimal solutions in cases where the objective function and constraints are linear. Dynamic programming allows solving optimization problems by breaking them down into smaller tasks and finding optimal solutions for each of them.

## 5. Other approaches.

Expert systems leverage expert knowledge for decision-making and analyzing operational systems. Agent-based modeling employs individual agents that interact with each other to model a system (Klymchuk, 2021).

In addition, the field of information technology is considered the most dynamic, with advancements occurring every day. The use of technical tools provides interactive access for users to information resources. Technological progress is constantly changing; new software is emerging, and new data search and processing methods are being developed. As a part of improving the information technology sector,

cutting-edge information systems have started to evolve in enterprise management, incorporating the use of artificial intelligence (AI) and machine learning. They allow information systems to analyze large volumes of data, make predictions, and make decisions based on analysis. Furthermore, there is a growing trend of transitioning to cloud technologies as they allow real-time data storage and processing, as well as reducing equipment and maintenance costs (Dalyk et al., 2023).

Blockchain technology, on the other hand, offers a high level of security and reliability for transactions and data exchange in information systems. It finds applications in financial management, logistics, and many other fields. Cybersecurity has become extremely important with the increasing number of cyberattacks and threats. Information systems must be protected from potential threats and ensure the confidentiality and integrity of data (Asaul et al., 2019).

It should be noted that currently, some researchers propose an innovative approach to developing and implementing IT products. This approach is based on the methodology of iterative software development, using prototyping principles and Scrum system elements. Like other Lean and Agile methods, Scrum optimizes limited resources and enhances efficiency. This method is developed based on tried and tested flexible development technologies. It allows for the addition of several mechanisms to neutralize several negative factors that are characteristic of other software development approaches. With the help of this approach and the Scrum methodology, software development becomes more flexible and adaptive to changes. It can ensure the successful implementation of a project and meet clients' needs (Shaposhnykov et al., 2021).

It is also important to improve such a methodology within the framework of the growing dynamics of exports of global and, in particular, Ukrainian information technologies. Currently, a connection is being established between the components of the IT product market and the primary and auxiliary stages of their creation. Therefore, it is worth expanding the Scrum methodology, emphasizing strategic planning and collaboration with higher management levels. That will help ensure greater alignment of the developed products with the company's strategic goals.



It is also worth delving into the latest trends in the development of information technology for business analysis. The most effective among them include, for example:

- "Seeneco." It is a cloud service for financial control within the company with integration with banks, revenue, and expense planning, as well as Excel import and export.
- "Tibco Spotfire," an analytical data analysis and visualization platform tailored to specific business processes.
- "Watson Analytics," operating based on the IBM Watson supercomputer with a voice interface (Vyhaniailo, 2021).

Therefore, implementing these information technologies into a business allows for the creation of an effective mechanism for financial control and meticulous revenue and expense planning. This, in turn, contributes to maintaining the organization's balanced financial state. In addition, it provides the opportunity to analyze accumulated data and present it in a user-friendly format. This mechanism facilitates a better understanding of the current situation and aids in making informed and strategically important decisions. Automated data analysis processes become more precise thanks to the use of the IBM Watson computer and a voice interface. Thus, technology integration helps businesses enhance financial management efficiency, analyze data for decision-making, and implement innovative approaches to improving business processes (Oliinyk et al., 2021).

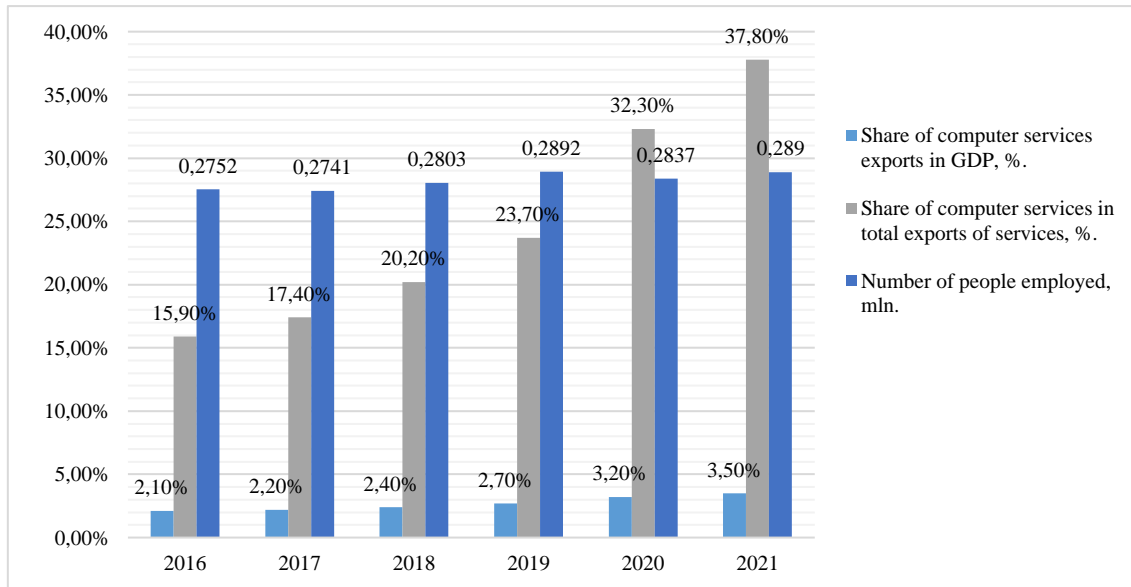
Innovative technologies are currently closely linked to the development of the financial technology sector. Fintech impacts the development of information technology by creating a demand for innovative solutions and developing technological infrastructure for modern financial services. However, it is essential to emphasize that this interaction works in both directions. On the one hand, information technologies provide fintech companies with tools for creating and improving financial products and services. On the other hand, these companies are constantly advancing information technologies to enhance their financial solutions' efficiency, speed, and security. They actively implement artificial intelligence, blockchain, big

data, and other innovations to automate financial processes and improve the consumer experience (Shevchenko & Rudych, 2020).

Among the most technologically advanced banks in Ukraine, such as Oschadbank, UkrGasBank, Raiffeisen Bank Aval, Alfa-Bank, UkrSibbank, PUMB, OTP Bank, and Megabank, there are numerous collaborative initiatives with fintech companies. An exception to this is PrivatBank, which boasts a significant in-house development center. PrivatBank is actively working on digitalizing its services and financial offerings, which have long extended beyond traditional banking. They are setting a new standard in Ukraine by building a digital ecosystem that integrates financial services, retail trade, and e-commerce (Kholiavko et al., 2022). Additionally, the neobank segment in Ukraine is rapidly evolving, introducing new players to the fintech market. Monobank, which is now a part of Universal Bank, stands out among them. Throughout 2020, there was substantial growth in Ukrainian neobanks, including Sportbank, the launch of O. bank, beta testing of Izibank, and the anticipated debut of Neobank (National Bank of Ukraine, 2020).

A significant step in developing the fintech industry is the active involvement of the National Bank of Ukraine. The bank not only acts as the main regulator but also actively promotes the initiation and development of fintech projects. In January 2020, the National Bank of Ukraine approved the "Strategy for the Development of the Financial Sector of Ukraine until 2025." In this document, one of the strategic directions is the development of the fintech and information technology market (National Bank of Ukraine, 2020).

Today, Ukraine's information technologies sphere remains one of the most dynamic segments of the economy. The export of IT sector services from the country has grown by over 25% in the last five years (see Figure 2). At the international level, there is a significant number of outsourcing companies providing their services in various countries. Moreover, in Ukraine, more than 100 highly qualified companies represent the IT development sector (Prasad, 2022).



**Figure 2.** IT in the Ukrainian economy.  
Source: (IT Ukraine Association, 2022).

In general, the data in the table indicate a positive trend in the development of IT services in the country and their significant contribution to the economy, exports, and employment. It should be noted that the development of IT is equally vital for the security of management operating systems within the state. It contributes to ensuring the protection of confidential information, minimizing the risks of cyberattacks and data breaches, strengthening control over critical infrastructures, and improving the ability to respond to cyber threats.

A comprehensive analysis of operating systems in Ukraine, including desktop computers, mobile devices, tablets, and game consoles, shows that Windows is the leading operating system. It is favored on 59.8% of the mentioned devices. Windows remains the leader in Ukraine when considering desktop computers separately, as it is used on 83.73% of computers. OS X operating systems are used on 13.1% of devices, while Linux holds a 1.8% share.

In the mobile device segment, preference is given to the Android operating system, which is present on 82.1% of smartphones. The iOS operating system is used on 17.5% of mobile devices. This means that nearly every sixth smartphone operates on this platform. Regarding tablets, the Android operating system also tops the chart and is used on 54.9% of all tablet devices. At the same time, iOS is installed on 44.9% of tablets. It is worth noting the gaming console market, which has gained significant popularity. Today, the Ukrainian market has seen the emergence of PlayStation consoles. They are used on 71.5% of

devices, while Xbox represents 28.42% of all gaming consoles (Yudin, 2020).

With the proliferation of digital technologies, electronic document management, and other information innovations, security has become a top priority in ensuring the stability, efficiency, and resilience of governance within the state. Information technologies serve as a key catalyst for innovative societal and economic development. They unlock new possibilities, such as production flexibility and individualization. However, these advancements bring new challenges, including rapid technological changes and high complexity (Law of Ukraine No. 851-IV, 2003). Ukraine is currently actively integrating into global digitization processes. Yet certain aspects, such as the governmental sector, management, technology accessibility, and the risk associated with investing in the digital sphere, remain less developed in Ukraine (Shlaifer & Todoshchuk, 2022).

Studying the impact of information technologies on the security of management operating systems is a prerequisite for enhancing the effectiveness of state authorities. It ensures resilience against internal and external threats and strengthens societal trust in government institutions (see Table 1). This issue demands in-depth analysis, scientific justification, and the development of specific measures to increase security levels in management operating systems. It also involves the utilization of modern information technologies to improve the quality of public service delivery and achieve strategic goals.

**Table 1.**

*The impact of information technologies on the security and efficiency of management operating systems.*

Component	Positive impact	Negative impact
Cyber threats and cyber attacks	- Ensuring better detection and protection against cyber threats - Enhancing monitoring and anomaly detection	- Increase in the number of successful cyberattacks - Threat of data privacy loss
Information confidentiality	- Protection of information confidentiality through encryption and other methods - Ability to restrict access to confidential data - Guarantee of data integrity during transmission and storage	- Risk of confidential information leakage due to security breaches
Information integrity	- Protection against unauthorized data modification - Ensuring control over access to critical information	- Threat to data integrity due to malicious attacks
Data access	- Identification and authentication of users to prevent unauthorized access - Continuous monitoring of operating systems and detection of potential threats	- Risk of unauthorized access to confidential data - Possibility of data failure due to loss of identification data
Threat monitoring and detection	- Responding to anomalies and threats - Increased staff awareness about cyber threats and security measures	- Exaggerated alarms and false positives can disrupt monitoring systems
Safety culture	- Involvement of staff in identifying threats and vulnerabilities	- Ignoring security rules by staff can lead to cyber breaches - Risk of social engineering and phishing

Source: compiled by the authors based on (Kotelevets, 2022).

The impact of information technologies on security in management operating systems is a complex and multifaceted phenomenon. It requires continuous monitoring, analysis, and improvement. The introduction of innovative solutions and the use of information technologies in the field of public administration in Ukraine have yielded certain positive results. Thus, the introduction of information technologies into the sphere of citizen services, document circulation, healthcare, etc. (Kotelevets, 2022) played a crucial role in enhancing the efficiency and security of Ukraine's management operating systems.

According to the findings of Ukrainian researchers, the new model of public service should be based on transparency and active cooperation with the public. Therefore, it is essential to implement information technologies that ensure data accessibility and openness, as well as contribute to improving the quality of public service delivery. Additionally, it is necessary to consider the impact of various information technology innovations as tools for optimization and effective cost savings in the field of management. Innovative methodologies and learning technologies can also play a key role in preparing officials for the challenges associated with decentralization and reforms. They ensure a high level of competence among the staff and prepare them for new tasks in modern management (Vasylieva et al., 2020).

Therefore, the integration of information technologies and innovative learning approaches can become a significant factor in improving the efficiency and security of management operating systems. They can contribute to the successful implementation of decentralization reform in Ukraine. As part of a further study of successful examples of the use of information technology and modeling in management operating systems, it is worth noting that not only the public administration sector but also business representatives have achieved success.

In Ukraine, the information systems implemented in domestic enterprises belong to software products of well-known foreign companies that adhere to the highest global standards. Among these systems are "Oracle Corporation" with its "Oracle Application" system, "SAP AG" with its "SAP R/3" system, "Scala" and "Baan Company" with its "Baan IV" system. These systems are implemented in enterprises of various industries and enable the execution of a standard set of functions represented by a functional module set for effective enterprise management (Svystun, 2021).

In addition to the adoption of foreign solutions, Ukraine has also developed its own ERP system called "IT Enterprise." This system is tailored to the needs of large and medium-sized industrial enterprises. It encompasses a wide range of modules for automating various business



processes, including production management (MRPII, MES, APS), finance, budgeting, controlling, supply chains, quality, maintenance, accounting, tax accounting, personnel management, payroll calculation, OLAP analysis, and other functions that contribute to optimizing enterprise operations.

Such information systems have been applied in various Ukrainian enterprises. Among them are such vital enterprises as "Zorya Gas Turbine Engineering Research and Production Complex" - "Mashproekt," "Nyzhnodniprovskiy Pipe Rolling Plant," "Rosava" (Bila Tserkva), "Azot" (Cherkasy), "Ferrexpo Poltava Mining," "Khimvolokno" (Chernihiv), "Yenakiieve Iron and Steel Works," and many others. The advantages of working with these systems include:

- the availability of qualified team members to implement the system in the regions of Ukraine;
- well-proven business solutions;
- developed methodologies for the successful implementation of complex automation projects at enterprises (Onyshchenko, 2019).

Furthermore, it should be noted that information technologies enable efficient resolution of various tasks. This includes rapid processing of primary documents, automation of calculations, generation of general ledger, balance sheet, and other financial reports. Accounting systems represent comprehensive software solutions designed to automate both individual accounting tasks and complex processes related to planning, monitoring, analysis, management, and decision-making for strategic management. Therefore, the implementation of IT requires systematic monitoring, assessment of their effectiveness, and continuous improvement.

The economic impact of implementing information technologies depends on assessing the cost-effectiveness and productivity of IT utilization. This analysis aspect is based on the correlation between the achieved benefits and the expenses incurred to obtain them. Thus, the main components of the study are the effects arising from information technologies and the costs related to their implementation. It is necessary to consider the complete life cycle of intelligent information technologies to assess their integrated effectiveness fully. Given that most expenses are incurred during the operation phase, it is vital to analyze all stages of the information technology life cycle (Pererva et al., 2021).

In turn, the assessment of the technological effect of implementing information technologies is carried out by comparing labor productivity and production processes when using new software and technical tools with their predecessors. This effect evaluation is based on several criteria, such as technological advancement, innovation, reliability, ease of use, and flexibility. Productivity improvement is considered a key indicator of the technological effect. It is essential to have specialized regulations, methodologies, standards, and norms that help improve information technologies' technical and operational parameters to achieve a positive effect.

In general, the technological effect also has a social impact aimed at improving the working conditions of personnel, enhancing the quality and comfort of life, and promoting the harmonious development of people. Performance indicators determine the suitability of the information system to perform its tasks and the overall optimal level of its functioning. This includes reliability, accuracy, and security, which depend on local indicators (Larchenko, 2020).

Therefore, it should be noted that the successful use of information technologies in the field of management, including public administration and corporate systems, has a significant impact on improving the efficiency and security of operating systems. Innovative solutions and the use of information technologies enable data accessibility and transparency, improve service delivery to citizens, and enhance document management and healthcare management. Besides, they prepare personnel for challenges related to reforms and decentralization.

## Discussion

The use of information technologies and modeling in management operating systems has become an essential component in the modern world, where demands for efficiency and safety are constantly growing. In this context, special attention should be paid to the necessity of integrating innovative approaches to training personnel in the field of public administration for the successful implementation of decentralization reforms in Ukraine. Therefore, we agree with the statements of Vasylieva N. V., Vasylieva O. I., Prylipko S. M., Kapitanets S. V., and Fatkhutdinova O. V. (2020) regarding the need for the integration of innovative approaches to personnel training in the field of public administration for the successful implementation

of decentralization reforms in Ukraine. With the help of this new approach to the functioning of the civil service, the quality of services for citizens, document circulation, healthcare, and more has been improved.

We do not fully agree with the statement of Shaposhnykov, K., Kochubei, O., Grygor, O., Vyshnevskaya, O., Protsenko, N., and Dzyubina, A. (2021) regarding the methodology of iterative software development based on prototyping using elements of the Scrum system as a single and comprehensive solution for the development of Ukrainian information technologies. This is because the choice of software development methodology is a complex task. Also, we cannot assert that the methods of iterative software development based on prototyping using elements of the Scrum system are the only versatile solution for all Ukrainian information technologies.

In addition, we agree with the statement of Kotelevets, D. O. (2022) regarding the current trends in the development of the digital economy in Ukraine and the implementation of modern information and communication technologies in the activities of Ukrainian enterprises. Currently, digital transformation is essential for the competitiveness of enterprises and the creation of conditions for sustainable economic development.

We agree with the conclusion of Vyhaniailo, S. M. (2021) concerning the importance of interconnection between information technologies and business analysis. His research, which included an analysis of the main stages of business analysis and a classification of business analysis software, revealed several key aspects. The prospects for the development of information technologies to improve the efficiency of the business management system demonstrate that this area has great potential to enhance the competitiveness of enterprises and promote their sustainable development.

At the same time, we agree with the statements of Vankovych, L. Ya., Mysiuk, R. V., Dobush, T. I., Bobko, O. V., Konyk, O. V., Shyian, S. M., and Tsvyk, S. R. (2023). Their study identified the points of information technologies' influence on the functioning and development of enterprises in the market. The authors highlighted the role of IT in ensuring the flexibility of enterprises and their ability to respond to changes in the market. In addition, the authors identified the importance of increasing

the level of information availability for managers and its impact on the decision-making process in the modern management context.

## Conclusions

The use of information technologies and modeling in management operating systems is becoming a key factor in improving efficiency and safety in modern business and other areas of activity. These two aspects interact and influence each other, contributing to higher levels of productivity and reliability in management processes.

The use of information technologies, such as data collection and analysis systems, simplifies the collection and processing of information. This is a key to making informed management decisions. Modeling, in turn, allows analyzing possible scenarios, forecasting results, and determining the best courses of action. Optimization of management operating systems based on the models helps to allocate resources effectively, as well as minimize costs and risks.

The following discussion emphasizes that information technology is becoming the main tool for ensuring security in management operating systems. They help to detect threats, monitor the system's health, and respond to potential risks faster and more efficiently.

In addition, modeling allows for solving complex problems, predicting the consequences of various management decisions, and introducing new approaches to optimizing management systems. This helps to increase overall efficiency and reduce potential risks. Based on this assessment, it can be concluded that the use of information technologies and modeling in management operating systems is an urgent and necessary task for achieving higher efficiency and safety indicators. Such technologies have become a catalyst for the development of modern management. They help companies and organizations achieve their strategic goals in a competitive environment.

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