УДК 005.9:658.11

Cherchyk Larysa,
Doctor of Economics, Professor
Lesya Ukrainka Volyn National University,
Professor of Department of Management
Lutsk, Ukraine;
ORCID ID 0000-0002-3901-216X
e-mail: cherchyk.larysa@vnu.edu.ua

Shponyak Artem,
agraduate of the second (master's) level of higher education
Lesia Ukrainka Volyn National University
Lutsk, Ukraine;
ORCID ID 0009-0009-0338-7398
e-mail: shponiak.artem2024@vnu.edu.ua

https://doi.org/10.29038/2786-4618-2025-01-125-130

COMPONENTS OF INFORMATION AND ANALYTICAL SUPPORT OF THE ENTERPRISE MANAGEMENT SYSTEM IN THE CONDITIONS OF DIGITALIZATION

Introduction. *Modern information and analytical support of the enterprise management system should be formed using digital technologies and tools.*

Purpose of the article*: justification of the essence and components of information and analytical support of the enterprise management system in the conditions of digitalization.*

Methods. *Using a system approach, generalization and synthesis methods, the essence of information and analytical support of the enterprise management system was determined; to substantiate its structure, system-structural and compositional approaches, analysis and decomposition methods were used.*

Results. *The essence of information and analytical support of the enterprise management system was clarified. The author's vision of the structure of information and analytical support was substantiated: data collection infrastructure; analytics tools for processing large volumes of data and creating relevant forecasts; integration solutions for interaction between different subsystems and management levels; data protection mechanisms.*

Conclusions. *The development and implementation of intellectual and computer technologies, artificial intelligence as a competitive advantage require the improvement of information and analytical support of the enterprise management system using digital technologies, which will significantly reduce the time spent on the process of making management decisions, increase their validity and efficiency of the enterprise management system.*

Keywords*: information and analytical support, digitalization, data collection infrastructure, analytics, data processing, integration solutions, data protection mechanisms, digital technologies, management decision-making.*

Черчик Лариса,
доктор економічних наук, професор
Волинський національний університет імені Лесі Українки,
професор кафедри менеджменту
м. Луцьк, Україна

Шпоняк Артем,
здобувач другого (магістерського) рівня вищої освіти
Волинський національний університет імені Лесі Українки
м. Луцьк, Україна

СКЛАДОВІ ІНФОРМАЦІЙНО-АНАЛІТИЧНОГО ЗАБЕЗПЕЧЕННЯ СИСТЕМИ МЕНЕДЖМЕНТУ ПІДПРИЄМСТВА В УМОВАХ ЦИФРОВІЗАЦІЇ

Вступ. *Основними трендами сучасності є агресивність і мінливість зовнішнього середовища, високий*

ISSN 2786-4618 (Online), ISSN 2786-460X (Print)

ризик здійснення господарської діяльності, цифровізація всіх сфер діяльності та застосування штучного інтелекту. Використання цифрових технологій та штучного інтелекту дає значні конкурентні переваги. Тому сучасне інформаційно-аналітичне забезпечення системи управління підприємством має формуватися з використанням цифрових технологій та засобів.

***Мета**: обґрунтування сутності та складових інформаційно-аналітичного забезпечення системи управління підприємством в умовах цифровізації.*

***Методи.** Використано системний підхід, методи узагальнення та синтезу для визначення сутності інформаційно-аналітичного забезпечення системи менеджменту підприємства; системно-структурний та композиційний підходи, методи аналізу та декомпозиції для обґрунтування його структури.*

***Результати**. На основі узагальнення вітчизняних напрацювань з'ясовано сутність інформаційно-аналітичного забезпечення системи управління підприємством в умовах цифровізації як сукупності технічних та інтелектуальних засобів, методів, інструментів, технологій збору, обробки, аналізу та зберігання даних, які дозволяють забезпечити своєчасну, точну та актуальну інформацію для прийняття управлінським персоналом обґрунтованих рішень. Обґрунтовано авторське бачення структури інформаційно-аналітичного забезпечення системи управління підприємством на основі композиційно-функціонального підходу, який передбачає виокремлення чотирьох функціональних блоків: інфраструктури збору даних, яка може включати як внутрішні, так і зовнішні джерела; інструменти аналітики для обробки великих обсягів даних і створення відповідних прогнозів; інтеграційні рішення для взаємодії між різними підсистемами та рівнями управління; механізми захисту даних для забезпечення конфіденційності та інформаційної безпеки. Інструментальний супровід кожного блоку передбачає використання цифрових технологій, що значно скоротить витрати часу на прийняття управлінських рішень, підвищить їх обґрунтованість та ефективність системи управління підприємством.*

***Висновки**. Агресивні умови навколишнього середовища, високий рівень ризиків у зв'язку з його змінами, обмеженість внутрішніх ресурсів, розробка та впровадження інтелектуальних та комп'ютерних технологій, штучний інтелект як конкурентна перевага вимагають удосконалення інформаційно-аналітичного забезпечення системи менеджменту підприємства із застосуванням цифрових технологій, що значно скоротить витрати часу на процес прийняття управлінських рішень, підвищить їх обґрунтованість та ефективність системи управління підприємством.*

***Ключові слова**: інформаційно-аналітичне забезпечення, цифровізація, інфраструктура збору даних, засоби аналітики, обробка даних, інтеграційні рішення, механізми захисту даних, цифрові технології, прийняття управлінських рішень.*

Jel Classification: M15, O33

Introduction. Currently, domestic enterprises operate under challenging conditions influenced by numerous factors. On the one hand, these include transformational changes, regulatory inconsistencies, a significant tax burden, and a high level of competition. On the other hand, there are risks and challenges from the external environment, which have significantly intensified due to the war. Under such circumstances, the issue of not just informational but analytical-informational support for managerial decision-making becomes extremely relevant. Timely identification of changes and weak signals will help minimize or avoid risks and achieve desired results.

Another modern trend is the digitalization of all areas of activity and the use of artificial intelligence (AI). The application of digital technologies and AI provides significant competitive advantages. Therefore, the modern information-analytical support system for enterprise management should be developed using digital technologies and tools.

Analysis of Recent Research and Publications. The issues of information-analytical support in enterprise management processes have been covered in the works of many domestic scholars. These studies define the role of information-analytical support in management processes, examine sources and types of information, and explore methods for processing, storing, and using information for decision-making. Most studies highlight two key structural components of this system – informational and analytical [1, 2]. Within these components, the following elements operate: information resources, tools for data collection, processing, and transmission, as well as data analysis methods and technologies [1]. In the works [2, 3] various approaches to defining the essence of information-analytical support have been generalized, and its operating principles have been identified.

Approaches to Defining the Essence of Information-Analytical Support:

- set of data, indicators, and analytical assessment methods used for decision-making regarding effective business development directions [3];
- set of technologies and methods for collecting and processing information, diagnosing, analyzing, and assessing the consequences of decision-making [4];
- system of methods, measures, and tools that shape the processes of information collection, transmission, processing, storage, dissemination, and usage [5];
- specific type of intellectual activity that generates secondary information. This activity based on processes such as searching, accumulating, storing, processing, and analyzing primary data, with the result being analytical documents for managerial decision-making [1].

As an interconnected logical system for selecting and systematizing information about the state of a management object, aimed at evaluating and diagnosing relevant data for making timely and effective managerial decisions [2].

Unresolved Issues and Research Objectives At the same time, many questions remain unresolved regarding the structuring, organizational, and technical support of the information-analytical support processes for the enterprise management system in the context of digitalization.

Purpose of this article is to substantiate the essence and components of information-analytical support for the enterprise management system in the digitalization environment.

Materials and Methods. The study used a systemic approach, methods of generalization and synthesis to determine the essence of the information and analytical support of the enterprise management system; system-structural and compositional approaches, methods of analysis and decomposition to substantiate the content of its structural blocks, for which both the results of research by scientists in this field and materials from sites that promote information and analytical support tools were used.

Research results. The analysis of the above definitions reveals the following key aspects of interpreting information-analytical support: systematic approach, compositional structure, and goal-oriented management system, as well as instrumental content (tools, methods, and technologies).

Thus, in our opinion, information-analytical support for the enterprise management system in the digitalization environment is a combination of technical and intellectual means, methods, tools, and technologies for collecting, processing, analyzing, and storing data. These enable timely, accurate, and relevant information to be provided to managerial personnel for informed decision-making. In modern conditions of digital transformation, this support relies on digital platforms, automation tools, big data, artificial intelligence, and other digital technologies that enhance the speed and quality of data processing, reduce errors, and contribute to process optimization and forecasting.

We propose an alternative structure for information-analytical support, which includes the following main components: Data collection infrastructure, which may include both internal and external sources; Analytical tools for processing large volumes of data and generating relevant forecasts; Integration solutions for interaction between various subsystems and management levels; Data protection mechanisms to ensure the confidentiality and security of information.

Elements of information and analytical support for enterprise management work as a single ecosystem, where each component performs its function, ensuring effective management of business processes. Interaction begins with the collection of data that comes from both internal and external sources. Internal systems, such as ERP and CRM, accumulate information about operational activities, finances, customers and personnel, while external sources – analytical platforms, market research, social networks and IoT devices – supplement this data with relevant external factors.

The collected information is transferred to analytical tools, where it is processed using machine learning algorithms, statistical models and BI systems. This allows you to identify patterns, predict trends and support strategic decision-making. Analytical platforms integrate with other systems, which provides managers with access to updated reports in the form of dashboards or automated analytical models.

To ensure that information flows between different subsystems work in harmony, integration solutions such as API gateways, middleware technologies and enterprise service buses (ESB) are used. They ensure

continuous information exchange between financial, logistics, production and other modules of the enterprise, creating a single information environment. Thanks to this, management receives a comprehensive view of the enterprise's activities, which allows it quickly respond to market changes and internal challenges.

Since all these processes are based on the processing of large volumes of data, it is critically important to ensure their confidentiality and protection. Cybersecurity mechanisms such as encryption, access control systems and real-time threat monitoring are used. Protection tools are integrated into other system components, ensuring secure data exchange between management levels and preventing leaks or unauthorized access.

Thus, all elements of information and analytical support act as a single system, where each complements the others, ensuring effective interaction of data, analytics, integration and security for making informed management decisions [4, 6].

Let's consider these elements in more detail.

1. Data Collection Infrastructure

The data collection infrastructure consists of a set of technical tools, software, procedures, and resources that enable the acquisition, accumulation, processing, and transmission of information necessary for the enterprise management system.

It has a multi-level structure and includes the following key components:

- Data sources, which can be internal (data on production, procurement, sales, financial transactions, human resources) and external (market data, suppliers, customers, competitors, government agencies, social media);
- Data collection and processing systems, including hardware and software for recording, filtering, sorting, and preliminary data processing;
- Cloud solutions and data warehouses for storing and processing large volumes of information;
- Integration platforms, which facilitate data exchange between different modules, ensuring access to up-to-date information from all sources;
- Data analysis tools for forecasting, modeling, and trend detection;
- Data security systems to protect information from loss, unauthorized access, or cyber-attacks;
- Visualization and reporting platforms, which allow managers and employees to access comprehensible analytical results.

Together, these elements of the data collection infrastructure create a flexible, fast, and reliable information-analytical support system. This enables enterprises to make precise and well-grounded managerial decisions based on current data in the digitalization environment.

2. Analytical Tools for Processing Large Data Volumes and Creating Relevant Forecasts

Analytical tools encompass platforms and technologies that enable deep data analysis and forecasting based on information from various sources. They are used to identify trends, assess risks, and make strategic decisions.

The key analytical tools include:

- Business intelligence platforms (Power BI, Tableau, Qlik Sense) [6, 7], which integrate data from multiple sources, set up dashboards, and allow for convenient data interpretation;
- Big data processing technologies (Hadoop, Apache Spark, Apache Flink), which support parallel processing and data scaling;
- Database management systems (NoSQL databases such as MongoDB, Cassandra, HBase);
- Machine learning and artificial intelligence tools (Google TensorFlow, IBM Watson, Azure Machine Learning), which enable the development and customization of predictive analytics algorithms;
- Statistical analysis tools for in-depth data examination; Real-time data processing and analysis tools (Apache Kafka, Amazon Kinesis, Google Cloud Dataflow);
- Predictive analytics tools (SAS Forecasting, IBM SPSS Modeler), which focus on predictive modeling using modern statistical methods, machine learning, and forecasting algorithms;
- Cloud services such as Amazon Web Services (AWS), Google BigQuery, and Microsoft Azure enable parallel processing, scalable computing power, and the storage of large volumes of data with high-speed access [6-10].

The integration of these tools allows enterprises to accumulate, process, and analyze large amounts of information, enhancing the accuracy of forecasts and the speed of decision-making.

3. Integration Solutions for Interoperability Between Different Subsystems and Management Levels

Integration solutions refer to a set of tools, technologies, and methods that ensure the seamless operation of all subsystems within an organization. Their primary function is to enable continuous information exchange between different departments, functional areas, and management levels, allowing for coordinated problem-solving and goal achievement.

Key Components of Integration Solutions:

- Integration Platforms (Middleware). These platforms allow subsystems to interact without modifying their internal structures, providing a unified method of data exchange;

- Application Programming Interfaces (APIs): APIs facilitate seamless communication between software applications, enabling real-time data exchange;

- Business Process Management (BPM) Systems: These systems help automate, model, and control business processes by integrating various subsystems. BPM solutions facilitate cross-functional process integration, ensuring smooth collaboration across departments;

- Enterprise Resource Planning (ERP) Systems: Platforms such as SAP, Oracle ERP, and Microsoft Dynamics unify key business processes (finance, production, supply chain, etc.) into a single system. ERP solutions store all data at a centralized level, ensuring accessibility for all subsystems and increasing operational transparency;

- Service-Oriented Architecture (SOA): SOA involves developing separate services for each business function, allowing for modular and flexible integration through standardized interfaces;

- Big Data Integration Tools: Technologies such as Apache Kafka and Apache NiFi enable real-time data streaming and processing between subsystems;

- Cloud Integration Tools: Solutions like MuleSoft and Dell Boomi provide ready-made connectors and mechanisms for integrating with cloud services, ensuring on-demand access to data regardless of physical resource locations [6-10].

These integration solutions enable both horizontal (between departments) and vertical (between management levels) interactions, optimizing management processes, reducing data duplication, and accelerating decision-making. As a result, enterprises can enhance their efficiency, agility, and digital transformation readiness.

4. Data Protection Mechanisms to Ensure Confidentiality and Security

Data security and confidentiality require a comprehensive set of technical, organizational, and administrative measures aimed at preventing unauthorized access, data leaks, loss, or modifications.

Core Data Protection Mechanisms:

- Data Encryption: Encrypts data during storage and transmission, converting it into an unreadable format that can only be accessed with the correct decryption key;

- Authentication and Authorization: Ensures user identity verification (authentication) and role-based access control (authorization) to prevent unauthorized access;

- Identity and Access Management (IAM) Systems: IAM platforms manage user roles and permissions, ensuring secure access to enterprise data;

- Firewalls and Intrusion Detection/Prevention Systems (IDS/IPS): These systems monitor network traffic, blocking unauthorized access attempts and cyber threats;

- Security Monitoring and Analytics Systems: Continuous monitoring detects real-time security threats and enables rapid response to suspicious activities;

- Data Backup and Recovery: Regular backups and disaster recovery plans ensure business continuity and data availability in case of cyberattacks or system failures;

- Endpoint Security Management: Protects user devices accessing enterprise systems, preventing malware infections and data breaches;

- - data security culture and staff training – an important aspect is training employees in cyber hygiene rules and practices for the safe use of corporate data and systems to prevent phishing, social engineering, and other threats [4, 9].

By implementing these security mechanisms, businesses can ensure compliance with cybersecurity

regulations, protect sensitive information, and minimize operational risks in an increasingly digitalized environment.

Conclusions and prospects for further research. The harsh conditions of the external environment, the high level of risks due to its changes, the limited internal resources, the development and implementation of intellectual and computer technologies, artificial intelligence as a competitive advantage enhance the expediency of scientific research on improving the information and analytical support of the enterprise management system in the context of digitalization.

Traditional process and component approaches are transformed into a composite approach with a targeted direction, which involves the separation of four functional blocks: data collection infrastructure, which can include both internal and external sources; analytics tools for processing large volumes of data and creating relevant forecasts; integration solutions for interaction between different subsystems and management levels; data protection mechanisms to ensure confidentiality and information security.

The instrumental support of each block involves the use of digital technologies, which will significantly reduce the time spent in the process of making management decisions, increase their validity and the effectiveness of the enterprise management system.

Prospects for further research include the development of an organizational mechanism for transforming the information and analytical support of the enterprise management system in the context of digitalization.

References

1. Syvytska, I. H. (2024) Informatsiino-analitychne zabezpechennia protsesiv pryiniattia upravlinskykh rishen [Information and analytical support of the decision-making process of management]. *Informatsiia ta sotsium*: zbirnyk materialiv IKh Mizhnarodnoi naukovo-praktychnoi konferentsii (m. Vinnytsia, 07 chervnia 2024 r.) – *Information and Society*: Collection of Materials of the IX International Scientific and Practical Conference (Vinnytsia, June 7, 2024). Vinnytsia: DonNU imeni Vasylia Stusa, 128-130. URL: https://jias.donnu.edu.ua/article/view/16325 [in Ukrainian] (date of application: 03.01.2025)

2. Khvalchyk I. L., Voloshchuk L. O. (2020) Sutnist informatsiino-analitychnoho zabezpechennia upravlinnia pidpryiemstvom [The Essence of Information and Analytical Support for Enterprise Management]. *Ekonomika: realii chasu – Economics: Realities of the Time*. 1 (47). 84–90. DOI: https://doi.org/10.15276/ETR.01.2020.10 [in Ukrainian]

3. Voloshchuk L.O. (2011) Oblikovo-analitychne zabezpechennia upravlinnia innovatsiinym rozvytkom pidpryiemstva [Accounting and analytical support for the management of innovative development of the enterprise]. *Pratsi Odeskoho politekhnichnoho universytetu – Proceedings of Odessa Polytechnic University.* 2. 329-334. [in Ukrainian]

4. Praktychni elementy informatsiino-analitychnoi roboty (2007) [Practical elements of information and analytical work]: metod. rekom. Kyiv: Vyd-vo NADU, 60 [in Ukrainian]

5. Parkhomenko O.V. (2006) Informatsiino-analitychne zabezpechennia protsesu pryiniattia rishen v systemi naukovo-tekhnichnoi informatsii [Information and analytical support of the decision-making process in the system of scientific and technical information]: dys. ... kand.ekon. nauk : 08.02.02. Kyiv, 211 [in Ukrainian]

6. Karter D. (2025) 14 Naikrashchykh instrumentiv analizu danykh [Best Data Analysis Tools]. URL: 14 НАЙКРАЩИХ інструментів аналізу даних (2025) [in Ukrainian] (date of application: 08.01.2025)

7. Ranadidze P. (2025) 10 instrumentiv i prohramnoho zabezpechennia dlia velykykh danykh [10 tools and software for big data]. URL: 10 інструментів і програмного забезпечення для великих даних (2025) [in Ukrainian] (date of application: 08.01.2025)

8. Ofitsiinyi sait «TechUkraine.net». 26 naikrashchykh prohram dlia analizu danykh [26 best programs for data analysis]. URL: 26 найкращих програм для аналізу даних - techukraine.net [in Ukrainian] (date of application: 08.01.2025)

9. Pantielieieva N.M., Didkovskyi R.M. (2020) Suchasni tekhnolohii obrobky danykh i znan dlia realnoho sektoru ekonomiky: tekhnolohichnyi, ekonomichnyi ta sotsialni aspekty [Modern data and knowledge processing technologies for the real sector of the economy: technological, economic and social aspects]. *Vcheni zapysky TNU imeni V. I. Vernadskoho. Seriia: Ekonomika i upravlinnia – Scientific notes of the V. I. Vernadskyi TNU. Series: Economics and Management*. 31 (70). 4. 145-150. DOI: https://doi.org/10.32838/2523-4803/70-4-49 [in Ukrainian]

10. Web Academy Media. URL: ТОП 10 інструментів для Аналітиків Даних - Web Academy Media [in Ukrainian] (date of application: 08.01.2025)

Одержано статтю 27.01.2025 р.
Прийнято до друку 14.02.2025 р.