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### **Integration of Artificial Intelligence into the System of Management Diagnostics and Operational Management of an Enterprise**

**Abstract. Introduction.** This study examines the integration of artificial intelligence into management diagnostics and operational management at an enterprise. The need for digital processing of data on resources, costs, quality, personnel, supplies, work completion deadlines and the enterprise's actual performance indicators has been substantiated. It has been established that the increasing volume of management information complicates the timely assessment of the operational system's status, the identification of the causes of deviations and the preparation of management decisions using traditional means of analysis. Artificial intelligence is considered as a means of analytical support for management, enabling the processing of large data sets, the identification of recurring patterns, the forecasting of changes and the formation of an information basis for expert assessment.

**Purpose.** The aim of this article is to substantiate the theoretical principles and develop a structural-functional model for integrating artificial intelligence into a system of management diagnostics and operational management within an enterprise. To achieve this aim, the role of management diagnostics in assessing an enterprise's operational activities has been defined, the possibilities of digital processing of management information have been explored, and a sequence for the transition from data analysis to management decision-making has been established.

**Results.** Management diagnostics is considered as the analytical basis for assessing an enterprise's operational activities. It has been established that its use makes it possible to identify deviations, determine the causes of management problems, assess the links between decisions taken and actual performance indicators, and prepare a diagnostic report. Areas for the application of artificial intelligence in operational management have been identified, specifically the analysis of data on resources, costs, quality, personnel, supply, completion times, forecasting potential changes, comparing decision options, and preparing information for expert analysis. A structural-functional model for integrating artificial intelligence into managerial diagnostics and the enterprise's operational management is proposed. The model combines the enterprise's information base, digital data processing, management diagnostics, expert analytics, management decision-making and monitoring of changes in the enterprise's operations. It is demonstrated that this model enables the alignment of digital analysis with the professional interpretation of the data obtained and the manager's accountability for the consequences of management decisions.

**Conclusions.** It has been established that artificial intelligence broadens the analytical basis of operational management, accelerates the processing of management information and facilitates an informed assessment of the enterprise's condition. It has been determined that digital data processing cannot replace a manager's professional judgement, as the final management decision requires consideration of the enterprise's condition, the acceptable level of risk, the organisational structure, staff competence and the conditions for implementing the decision. The proposed model can be used for operations planning, resource utilisation, quality control, supply chain management and the preparation of well-founded management decisions. Further research should focus on developing a methodology for assessing enterprises' readiness to use artificial intelligence in operations management and on establishing a system of management diagnostic indicators for enterprises of various types.

**Keywords:** operations management; artificial intelligence; management diagnostics; expert analytics; management decisions; digital management; operational processes.

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### **Інтеграція штучного інтелекту в систему управлінської діагностики та операційного менеджменту підприємства**

**Анотація.** В статті досліджено теоретичні положення інтеграції штучного інтелекту в систему управлінської діагностики та операційного менеджменту підприємства. Обґрунтовано, що зростання обсягів управлінської інформації ускладнює опрацювання даних про ресурси, витрати, якість, персонал, постачання, строки виконання робіт і фактичні показники роботи підприємства. Розглянуто управлінську діагностику як аналітичну основу оцінювання операційної діяльності підприємства, що забезпечує виявлення відхилень, встановлення причин управлінських проблем, оцінювання зв'язків між прийнятими рішеннями і фактичними показниками, а також підготовку діагностичного висновку. Визначено можливості штучного інтелекту щодо аналізу значних масивів даних, виявлення повторюваних зв'язків, прогнозування змін, порівняння варіантів рішень і формування інформаційної основи для подальшого експертного оцінювання. Установлено, що використання штучного інтелекту в управлінській діагностиці потребує поєднання цифрового опрацювання даних із професійним тлумаченням одержаних результатів, оскільки остаточне управлінське рішення пов'язане з відповідальністю керівника, станом підприємства, допустимим рівнем управлінського ризику та умовами реалізації рішення. Запропоновано структурно-функціональну модель інтеграції штучного інтелекту в управлінську діагностику та операційний менеджмент підприємства, яка передбачає послідовний перехід від інформаційної бази підприємства до цифрового опрацювання даних, управлінської діагностики, експертної аналітики, прийняття управлінського рішення та контролю змін у роботі підприємства. Визначено, що запропонована модель може бути використана для планування операцій, раціонального використання ресурсів, контролю якості, управління постачанням і підготовки обґрунтованих управлінських рішень. Подальші дослідження доцільно спрямувати на розроблення методики оцінювання готовності підприємств до використання штучного інтелекту в операційному менеджменті та формування системи показників управлінської діагностики для різних типів підприємств.

**Ключові слова:** операційний менеджмент; штучний інтелект; управлінська діагностика; експертна аналітика; управлінські рішення; цифрове управління; операційні процеси.

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**Formulation of the problem.** The development of digital technologies is significantly altering the conditions of enterprise management, the nature of information processing and the process of formulating management decisions. Under these conditions, operations management requires a precise analysis of production, organisational, resource, human resources and information processes, as deviations in any one link of the management chain affect the overall state of the enterprise. At the same time, the increasing complexity of management tasks necessitates the combination of traditional methods of analysis with digital data processing tools.

Management diagnostics plays a vital role in operational management, as it enables the examination of the organisation's actual state, the identification of the causes of deviations, the assessment of resource utilisation, and the establishment of links between management decisions and changes in operational processes. Its importance is growing as large volumes of data accumulate, which management utilises during the planning, organisation, control and coordination of the organisation's operations. The quality of management

diagnostics influences the soundness of conclusions, the accuracy of problem assessment and the appropriateness of subsequent management decisions.

Artificial intelligence expands the possibilities for processing management information; however, its use in operational management requires a combination of digital analysis with management diagnostics and expert interpretation of the results obtained. Digital analysis enables the identification of relationships, deviations and potential changes within an organisation's operational system. However, determining the causes of management problems, assessing acceptable risk and selecting a management decision require the professional judgement of a manager, which highlights the need to justify the role of artificial intelligence within the diagnostic cycle of an organisation's operational management.

**Analysis of recent research and publications.** Academic works on artificial intelligence in operations management demonstrate the expanding role of digital data processing in resource planning, supply chain management, quality control, risk assessment and the preparation of management decisions. In particular, the study by Belhadi A. et al. [1] justifies the use of artificial

intelligence to enhance the analytical capabilities of operations management, specifically in terms of data processing, forecasting disruptions in production and supply processes, and supporting decisions regarding resource utilisation. Cannas V. G. et al. [2] examine artificial intelligence in relation to operational planning, the coordination of production processes, monitoring of work performance and the assessment of the state of an enterprise's operational system. The work by Helo P. and Hao Y. [5] focuses on the use of artificial intelligence in supply chain management, demand forecasting, the analysis of resource flows, and the identification of potential supply disruptions. Rocha I. F. and Kissimoto K. O. [8] explore the potential applications of artificial intelligence for analysing operational processes, preparing management information and improving the accuracy of control in an enterprise's operational activities. Toorajipour R. et al. [9] systematise the areas of application of artificial intelligence in supply management, risk assessment, forecasting changes and supporting management decisions in complex operational systems.

A separate area of research comprises works in which artificial intelligence is regarded as a factor in transforming the managerial decision-making process. Di Vaio A. et al. [3] link the use of artificial intelligence to analytical support for management, the preparation of information for senior management, and the enhancement of the soundness of decisions. Dwivedi Y. K. et al. [4] explore the impact of artificial intelligence on management work through the acceleration of data processing, the expansion of the management information base and the comparison of possible decision options. Jarrahi M. H. [6] examines the interaction between humans and algorithms in management work and emphasises the combination of artificial intelligence's computational capabilities with a manager's professional judgement. Mundlos P. [7] focuses on the allocation of managerial attention in a digital environment and on the role of artificial intelligence in the selection, structuring and interpretation of managerial information. Urbanovič M. and Holubčík M. [10] examine artificial intelligence in the context of organising business operations, preparing management decisions and developing analytical support for management.

Expert analytics in operations management is regarded as the analytical basis for justifying management decisions, ensuring the systematisation of management information, the assessment of the causes of deviations, and the preparation of conclusions for decision-making [11]. A review of the scientific literature provides grounds for identifying two main areas of research into artificial intelligence in operations management: the digital processing of operational data and information support for management decisions. The integration of artificial intelligence into the managerial diagnosis of an enterprise's operational activities remains insufficiently explored, particularly its role in the transition from digital

data analysis to identifying the causes of managerial problems, expert evaluation of diagnostic conclusions, and managerial decision-making. The author's perspective involves distinguishing between the digital processing of operational data, managerial diagnostics, expert analytics and managerial decision-making as sequential elements of the operational management diagnostic cycle. Within the framework of the author's perspective, artificial intelligence is regarded as a digital tool for generating the analytical indicators necessary to identify the causes of deviations, prepare a diagnostic conclusion and determine management interventions.

**Formulation of research goals.** The aim of this article is to substantiate the theoretical principles of integrating artificial intelligence into managerial diagnostics and operational management within an enterprise, as well as to develop a structural-functional model for its use in the digital processing of operational data, the diagnostic assessment of deviations, expert justification and the making of managerial decisions. To achieve this aim, scientific generalisation, comparative analysis, systematisation and structural-functional modelling were employed, which made it possible to define the role of artificial intelligence in operational management, to distinguish between digital data processing, management diagnostics, expert analytics and management decision-making, and to construct a model for integrating artificial intelligence into the diagnostic cycle of enterprise management.

**Presentation of the main research material.** In operations management, management information has both scientific and practical value provided it is used to identify the causes of deviations and determine subsequent management actions. The traditional comparison of actual and planned indicators remains necessary; however, its potential is limited in the presence of heterogeneous data on resources, costs, quality, personnel, work completion times and deliveries. Under these conditions, artificial intelligence should be regarded as a means of digitally processing operational data, enabling the identification of recurring patterns, the preliminary assessment of deviations and the preparation of an information base for management diagnostics.

Management diagnostics in operations management facilitates the transition from merely recording actual performance indicators to identifying the causes of management problems. It should be regarded as the analytical basis for evaluating an organisation's operational performance, as it is aimed at examining the production, resource, personnel, financial and information interrelationships that determine the state of the operational system. Through management diagnostics, actual performance indicators acquire managerial significance: deviations are interpreted, their causes are identified, and the information becomes the basis for decision-making.

The integration of artificial intelligence into management diagnostics and an enterprise's operational

management requires the streamlining of the flow of management information, from its initial collection through to decision-making and the subsequent monitoring of changes. From this perspective, artificial intelligence performs an analytical function involving the

processing of operational data, the identification of recurring patterns, the preliminary assessment of deviations, and the preparation of information for diagnostic and expert evaluation (Fig. 1).

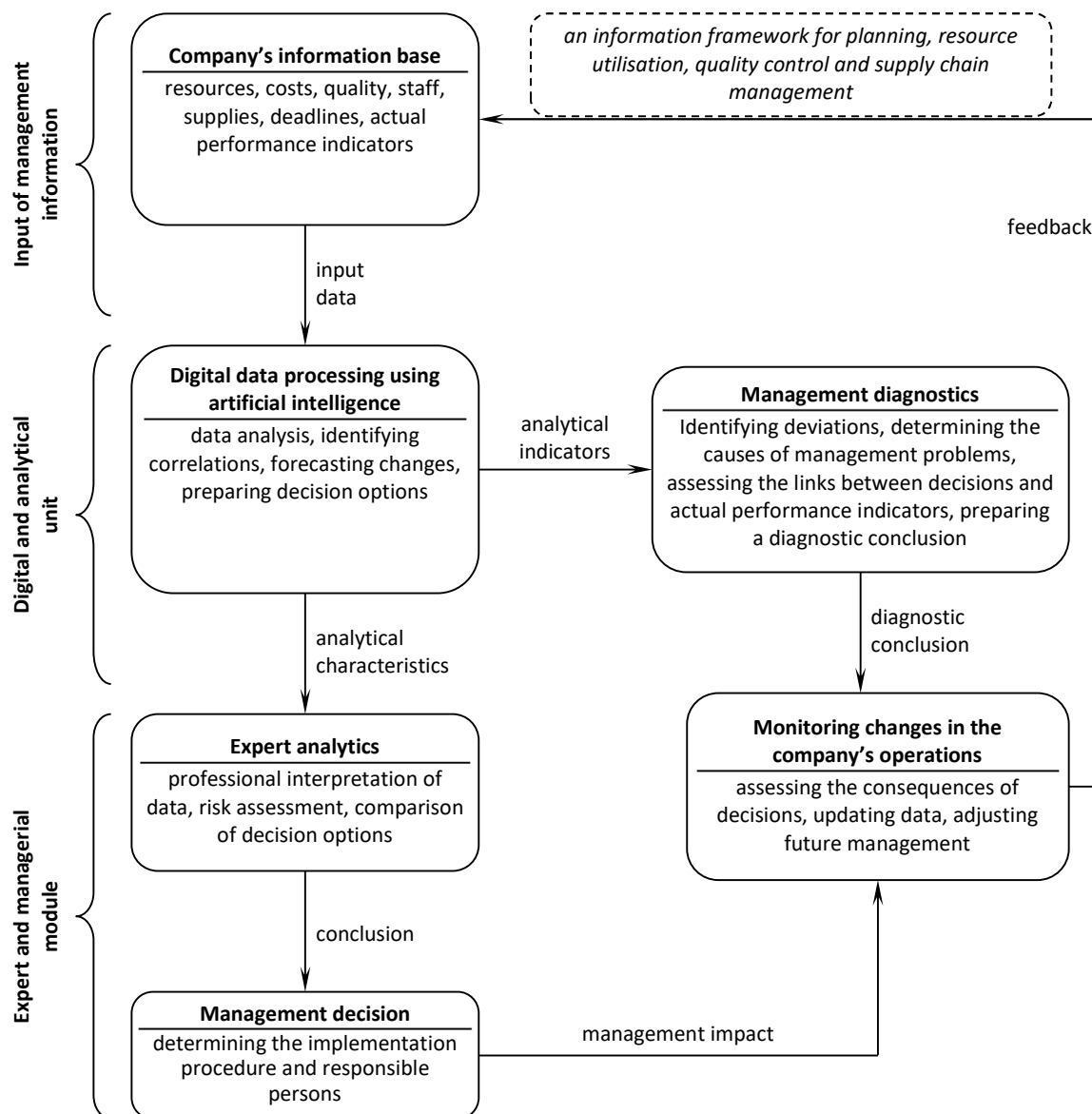


Figure 1 – **Structural and functional model of integrating artificial intelligence into management diagnostics and operational management of an enterprise**

Source: compiled by the authors.

The structural content of the model comprises the enterprise's information base, the digital-analytical unit, the management diagnostics unit, the expert-management unit, management decisions and change control. The functional content of the model is revealed through the stages of data collection, digital processing, identification of analytical indicators, determination of the causes of deviations, expert interpretation, definition of managerial influence, and the return of updated data to the management system.

The proposed model clarifies the role of artificial intelligence in the management diagnostics of an enterprise's operational activities. Its scientific significance lies in distinguishing between the digital-analytical and expert-management modules of the diagnostic cycle. The result of digital data processing is regarded as the information basis for the diagnostic conclusion, expert assessment and the determination of managerial impact. Under these conditions, the managerial decision remains linked to the manager's

professional judgement, the acceptable level of risk, the organisation's structure and the conditions for implementing the decision.

The scope of artificial intelligence's application in management diagnostics is best illustrated through the areas of operational management in which digital data

processing enables the assessment of deviations, the identification of the causes of management problems and the preparation of information for expert evaluation. A summary of the relevant areas, the scope of diagnostic assessment and the capabilities of artificial intelligence is presented in Table 1.

**Table 1 – The role of artificial intelligence in management diagnostics and operational management within an organisation**

| Area of operational management | Content of diagnostic assessment                                                                                                                          | Capabilities of artificial intelligence                                                                                                     |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Operations planning            | Assessment of work volumes, completion deadlines, resource requirements, production workload and potential deviations from the plan                       | Forecasting workload, comparing operational plan options, identifying the risk of missing deadlines                                         |
| Resource utilisation           | Analysis of material, financial, human and information resources; assessment of their adequacy, structure and allocation across operations                | Identifying shortages, surpluses, uneven distribution of resources, recurring losses and unproductive expenditure                           |
| Organisation of staff work     | Assessing staff workload, labour productivity, the coordination of task execution and the occurrence of downtime                                          | Grouping data on work performance, identifying overloads, downtime and uneven distribution of tasks                                         |
| Quality control                | Analysing defects, complaints, repeat enquiries, deviations from established requirements and the causes of reduced quality                               | Identifying recurring causes of defects, categorising non-conformities by type, and forecasting the likelihood of repeated quality failures |
| Supply chain management        | Assessing lead times, volumes, costs, supply disruptions and the impact of delays on the operational system                                               | Forecasting delays, identifying high-risk operations, analysing resource flows, and assessing the likelihood of supply disruptions          |
| Management decision-making     | Comparing alternatives, assessing potential consequences, acceptable risk levels and the relationship between decisions and actual performance indicators | Formulating analytical conclusions, scenario-based forecasting, assessing deviations, and preparing information for expert evaluation       |

*Source: compiled by the authors.*

The content of Table 1 demonstrates that the use of artificial intelligence in operations management has different diagnostic implications depending on the area of management. In operations planning, it is aimed at forecasting workload and timelines; in resource utilisation, at identifying losses and imbalances; in quality control, at identifying recurring causes of defects; and in supply chain management, at forecasting delays and high-risk operations. Artificial intelligence generates various types of analytical indicators for further diagnosis, assessment of the causes of deviations and preparation of management decisions.

The use of artificial intelligence in management diagnostics is transforming the way management information is handled. Traditional diagnostics rely primarily on comparing actual and planned indicators, expert interpretation of deviations and the justification of decisions. Diagnostics using artificial intelligence expands this process through the automated identification of recurring patterns, the grouping of causes of deviations, the forecasting of changes and the preliminary formulation of management alternatives. As a result, management receives a structured information base for the expert assessment of the state of the operational system.

For operational management, it is important to combine quantitative analysis with qualitative managerial assessment. Quantitative analysis involves processing data sets relating to resources, costs, timelines, quality, labour productivity and supply. Qualitative assessment makes it possible to take into account the organisation's structure, staff competence, managerial authority, the nature of production or service operations, as well as acceptable limits of managerial risk. Artificial intelligence provides digital analytical support for this process, whilst expert analytics offers a managerial interpretation of the data obtained.

It is worth noting that the use of artificial intelligence in management diagnostics also has certain limitations. The reliability of digital analysis depends on the completeness, timeliness and comparability of the input data. Results obtained algorithmically may reflect errors, inaccuracies or distortions present in the organisation's information base. Some management situations have qualitative characteristics that are difficult to fully capture through quantitative indicators. In view of this, the results of digital analysis require expert verification and cross-referencing with the actual operating conditions of the organisation.

The integration of artificial intelligence into managerial diagnostics and the enterprise's operational management ensures a structured transition from the collection of operational data to its digital processing, diagnostic assessment, expert interpretation and managerial decision-making. Within the proposed model, digital analysis enables the identification of deviations, the assessment of the causes of management problems, the preparation of decision options and the formation of an information basis for expert evaluation. The final management decision is taken by the manager, taking into account the state of the enterprise, its organisational structure, the acceptable level of risk and the expected consequences of management actions.

**Conclusions.** The study conducted has made it possible to justify the role of artificial intelligence in the diagnostic cycle of an enterprise's operations management and to define its role as a means of digitally processing operational data, which precedes management diagnostics, expert interpretation and the adoption of management decisions. Operations management requires the continuous processing of data on resources, costs, quality, completion times, supplies and personnel. Given the increasing volume of management information, digital analytical support

enhances the accuracy of assessing the enterprise's condition and preparing management decisions.

It has been established that management diagnostics in operations management should be aimed at identifying the causes of deviations in a company's performance arising from inconsistencies between resources, operations, management decisions and actual performance indicators. Artificial intelligence expands the capabilities of diagnostic assessment by rapidly processing large volumes of information, identifying recurring patterns, forecasting changes and generating decision options that require further expert interpretation.

The proposed structural-functional model integrates the organisation's information base, digital data processing, management diagnostics, expert analytics, management decisions and the monitoring of changes in the organisation's operations. Its use enables the streamlining of the flow of management information, from the recording of operational indicators to the identification of the causes of deviations and the preparation of management interventions. Further research should focus on developing a methodology for assessing enterprises' readiness to use artificial intelligence in operational management and on establishing a system of management diagnostic indicators for different types of enterprises.

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