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THE IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE FOR RISK FORECASTING AND IMPROVING THE EFFECTIVENESS OF IT PROJECT MANAGEMENT

This article explores the potential for integrating artificial intelligence technologies into IT project management processes with the aim of improving the effectiveness of risk forecasting and optimizing management decisions. It analyzes modern approaches to IT project management and identifies their limitations in conditions of high uncertainty and a dynamic environment. It examines the application of machine learning, data analytics, and neural networks for identifying, assessing, and forecasting risks.

A conceptual model for integrating artificial intelligence into the IT project management system is proposed, which includes data collection and processing levels, an analytical level, a results interpretation level, and a management decision-making level. The feasibility of using AI to transition from reactive to proactive project management is substantiated.

The practical significance of the study is confirmed by the example of implementing the proposed approach in the operations of the IT company European Regional Agency LLC. It has been established that the use of AI allows for reducing risk levels, increasing planning accuracy, optimizing resource utilization, and improving the quality of management decisions.

The results obtained can be used to develop intelligent IT project management support systems and improve risk management methods in the context of digital transformation.

Keywords: artificial intelligence, IT project management, risk forecasting, machine learning, data analytics, management efficiency, project management, digital transformation.

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ВПРОВАДЖЕННЯ ШТУЧНОГО ІНТЕЛЕКТУ ЩОДО ПРОГНОЗУВАННЯ РИЗИКІВ І ПІДВИЩЕННЯ ЕФЕКТИВНОСТІ УПРАВЛІННЯ ІТ-ПРОЄКТАМИ

У статті досліджено можливості впровадження технологій штучного інтелекту в процеси управління ІТ-проєктами з метою підвищення ефективності прогнозування ризиків та оптимізації управлінських рішень. Проаналізовано сучасні підходи до управління ІТ-проєктами та визначено їх обмеження в умовах високої невизначеності та динамічності середовища. Розглянуто застосування методів машинного навчання, аналітики даних і нейронних мереж для ідентифікації, оцінювання та прогнозування ризиків.

Запропоновано концептуальну модель інтеграції штучного інтелекту в систему управління ІТ-проєктами, яка включає рівні збору та обробки даних, аналітичний рівень, рівень інтерпретації результатів і рівень прийняття управлінських рішень. Обґрунтовано доцільність використання AI для переходу від реактивного до проактивного управління проєктами.

Практичне значення дослідження підтверджено на прикладі впровадження запропонованого підходу в діяльність ІТ-компанії ТОВ «Європейська Регіональна Агенція». Встановлено, що використання AI дозволяє знизити рівень ризиків, підвищити точність планування, оптимізувати використання ресурсів та покращити якість управлінських рішень.

Отримані результати можуть бути використані для розробки інтелектуальних систем підтримки управління ІТ-проєктами та вдосконалення методів ризик-менеджменту в умовах цифрової трансформації.

Ключові слова: штучний інтелект, управління ІТ-проєктами, прогнозування ризиків, машинне навчання, аналітика даних, ефективність управління, проєктний менеджмент, цифрова трансформація.

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A GENERAL OVERVIEW OF THE PROBLEM AND ITS RELATIONSHIP TO IMPORTANT SCIENTIFIC OR PRACTICAL ISSUES

IT project management is a complex and multifaceted process that encompasses planning, resource allocation, schedule control, cost estimation, and risk management. Despite the widespread use of traditional project management methodologies (Waterfall, Agile, Scrum), the high level of uncertainty and rapid changes in the technological environment remain significant challenges.

The main issues are:

1) high levels of risk and uncertainty—incorrect estimates of timelines, costs, or resources can lead to budget overruns, delays in execution, and a decline in the quality of results;

2) the limited capabilities of traditional approaches – classic risk management and forecasting models are often based on historical data or expert estimates, which do not always reflect the dynamic nature of modern IT projects.

Suboptimal use of resources – the lack of effective tools for forecasting risks and performance often leads to the inefficient allocation of time, personnel, and finances.

In this context, artificial intelligence (AI) opens up new opportunities for improving the efficiency of IT project management. The use of AI technologies, such as machine learning, neural networks, and big data analytics, makes it possible to: predict risks based on the analysis of large volumes of data from previous projects, identifying patterns that cannot be detected using traditional methods; optimize management processes by automating resource planning, effort estimation, and schedule forecasting; and improve the quality of decision-making through the use of analytical models for scenario-based forecasting and early detection of potential issues.

The scientific significance of the problem lies in the need to develop effective methodologies for integrating AI into IT project management processes, including risk forecasting, performance evaluation, and support for strategic decision-making. The practical significance lies in the fact that the implementation of such approaches can:

1) reduce delays and budget overruns;
2) lower the risks of failing to meet key project milestones;
3) improve team productivity and planning accuracy.

Thus, the issue of integrating AI into IT project management is both relevant from a scientific perspective (the development of new forecasting models and risk assessment algorithms) and important from a practical perspective (enhancing the efficiency and resilience of real-world projects in a dynamic environment).

ANALYSIS OF RECENT RESEARCH AND PUBLICATIONS

In recent years, there has been a significant increase in interest in the scientific and professional literature regarding the application of artificial intelligence (AI) in the field of IT project management, particularly for risk forecasting and improving management efficiency. Research shows that traditional approaches to risk management are often limited: they rely on historical data and expert assessments, which do not always adequately reflect the dynamics of modern projects with a high degree of uncertainty.

In particular, studies on the use of AI tools in risk management demonstrate the effectiveness of machine learning, deep neural networks, and generative models for risk forecasting and assessing the probability of critical events occurring in projects [1]. Furthermore, literature reviews indicate that integrating AI into project management processes enables the optimization of resource planning, reduces task completion times, and improves the accuracy of forecasts regarding potential problems [2].

The studies also highlight the specifics of AI application in agile methodologies such as Scrum and Agile. It has been found that the use of intelligent algorithms can significantly improve early risk detection, critical path assessment, and team productivity [3,6]. Generative AI models make it possible to automate certain management processes, including forecasting effort, timelines, and potential risks, which significantly enhances the efficiency of project management [4].

Another important aspect is the integration of AI into strategic-level decision-making processes. Research shows that AI-driven approaches facilitate more accurate risk forecasting, resource optimization, and a reduction in the likelihood of project budget overruns and schedule delays [5].

Thus, recent studies demonstrate that the application of artificial intelligence in project management is a promising direction that not only improves the accuracy of risk assessment but also contributes to the overall improvement of the efficiency and sustainability of IT projects. At the same time, the scientific community notes the need for further development of AI integration methodologies, harmonization of application standards, and evaluation of the effectiveness of such approaches in various types of IT projects.

STATEMENT OF THE ARTICLE'S OBJECTIVES

The purpose of this article is to explore the possibilities and characteristics of implementing AI technologies for risk forecasting and improving the effectiveness of IT project management, as well as to develop approaches for their practical application in the face of uncertainty in the project environment.

OVERVIEW OF THE MAIN CONTENT

1. Analysis of modern approaches to IT project management and risk forecasting methods. Contemporary approaches to IT project management are based on the use of both traditional (Waterfall) and agile (Agile, Scrum) methodologies. Traditional models are characterised by a clear sequence of stages and a high level of formalisation, which ensures controllability but reduces adaptability to change. In contrast, agile approaches focus on iterative development and rapid response to change, which is critically important in a dynamic IT environment [6,7]. Risk forecasting methods in such approaches typically include expert assessments, SWOT analysis, the Monte Carlo method and sensitivity analysis. However, their limitation lies in their dependence on the quality of input data and the subjectivity of the assessment, which complicates accurate forecasting in conditions of uncertainty.

2. Research into the potential applications of artificial intelligence in risk management processes. Artificial intelligence opens up new possibilities for automating and improving the accuracy of risk management. Machine learning methods enable the analysis of large volumes of historical project data, revealing hidden patterns and trends. In particular, classification algorithms can be used to determine the probability of risk events occurring, whilst regression models can be used to assess the impact of risks on project timelines and budgets [8,9]. Neural networks and deep learning enable a more sophisticated analysis of non-linear dependencies, which is particularly relevant for large and complex IT projects.

3. Identifying factors influencing the effectiveness of AI in risk forecasting. The effectiveness of artificial intelligence depends on many factors. Firstly, this concerns the quality and completeness of the data used to train the models. Insufficient or incorrect information can lead to inaccurate forecasts. Secondly, the level of AI integration into project management business processes is crucial. A lack of alignment between analytical tools and management decisions reduces the effectiveness of AI. And thirdly, staff qualifications and the organisation's readiness to adopt innovative technologies play a significant role.

4. Development of a conceptual model for the integration of artificial intelligence. The integration of artificial intelligence into the IE project management system requires the construction of a comprehensive conceptual model that ensures interaction between data, analytical tools and management decisions. Such a model must be geared towards a continuous cycle of data collection, processing, analysis and real-time decision support.

At the initial stage, a data collection and preparation layer is established, which involves gathering information from various sources: project management systems (Jira, Trello, MS Project), code repositories (Git), version control systems, as well as historical data on completed projects. Such data includes metrics on completed tasks, the duration of stages, resource usage, identified risks and their consequences. An important component of this level is the cleaning, normalisation and structuring of data, as the quality of the input information directly affects the accuracy of subsequent forecasts.

Next is the analytical level, where the artificial intelligence algorithm is implemented. Depending on the tasks at hand, various approaches may be applied:

- ✓ classification algorithms to determine the probability of risks occurring;
- ✓ regression models to forecast project timelines and costs;
- ✓ clustering methods to identify typical project development scenarios;
- ✓ neural networks to analyse complex non-linear relationships.

At this stage, models are trained on historical data and subsequently validated to ensure the accuracy of the results. The third component of the model is the interpretation and decision-support layer. The outputs of the AI models are transformed into indicators that managers can understand: risk assessments, probability of delays, and recommendations for resource optimisation. An important feature of this level is the explainability of the models (Explainable AI), which allows the forecasts to be justified and increases trust in the system.

The final element is the level of managerial influence, where the recommendations obtained are used to adjust project plans, reallocate resources, change task priorities, or implement risk mitigation measures. At this level, AI acts as a decision-support tool, whilst the final decision remains with the project manager.

An important feature of the proposed model is the presence of feedback, which ensures that models are constantly updated based on new data regarding the project's progress. This allows for improved forecast accuracy and enables the system to adapt to changes in the project implementation environment (fig. 1).

Thus, the conceptual model for integrating artificial intelligence constitutes a multi-level adaptive system that facilitates the transition from traditional reactive management to proactive management based on data and predictive analytics. This paves the way for increased efficiency, reduced risks and improved quality of management decisions in IT projects.

5. Practical significance and assessment of the impact of AI on management effectiveness. The practical significance of the proposed approach to integrating artificial intelligence can be usefully illustrated by the example of the activities of the international IT company 'European Regional Agency' LLC, which specialises in software development and the implementation of digital solutions [10]. As part of the study, the implementation of an intelligent risk forecasting system, integrated into the existing project management infrastructure, was proposed. The implementation of this approach involved a phased rollout. The first stage involved the collection and integration of data from internal systems (Jira, Git, time-tracking systems), enabling the creation of a unified analytical database. The second stage involved the development and training of artificial intelligence models to enable risk forecasting, assessment of their impact, and identification of critical factors. In the third stage, the models were integrated into the management system with the results visualised in the form of dashboards, providing managers with real-time access to predictive information. The fourth stage involved using forecasts to inform management decisions, including adjusting plans, reallocating resources and implementing preventive measures. Integration with CI/CD processes enables data to be updated promptly and enhances the system's adaptability.

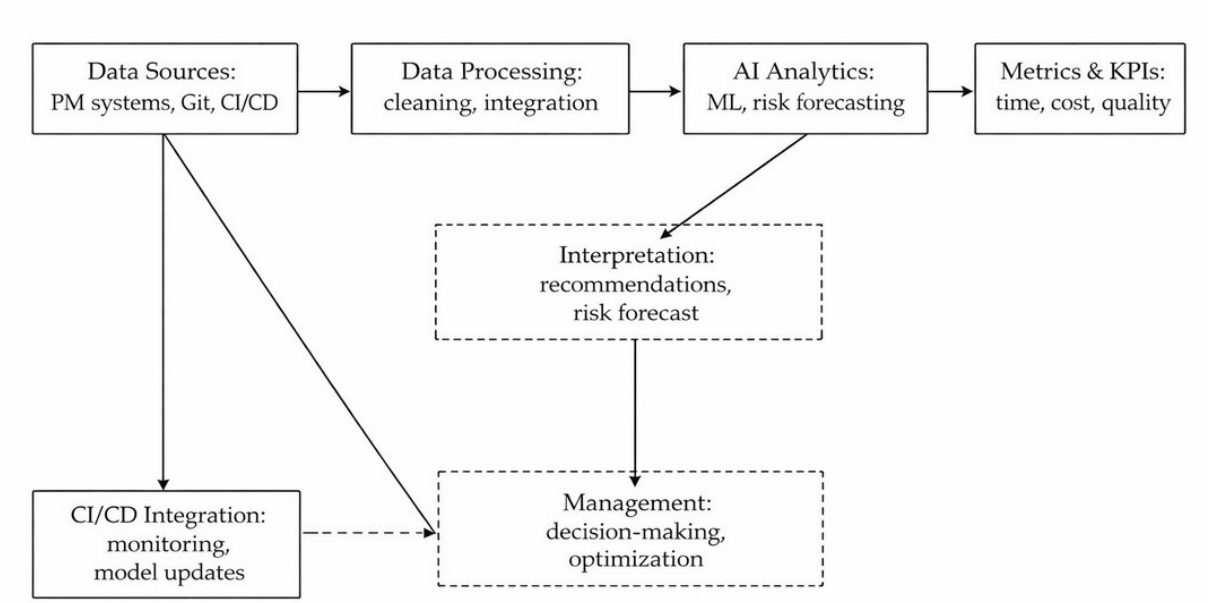

Fig. 1. A conceptual (extended) model of artificial intelligence integration in IT project management (including KPIs and CI/CD)

The implementation of the proposed approach resulted in the following quantitative performance indicators:

1) a 31% reduction in the number of critical risks through their early detection;
2) a 27% improvement in the accuracy of project completion date forecasts;
3) a 18.5% reduction in budget overruns;
4) a 31% reduction in response times to risk events;
5) a 12.5% improvement in resource utilisation efficiency;
6) an 18% increase in the overall productivity of the project team.

Furthermore, the implementation of AI has reduced the influence of human error in risk assessment and enabled a shift towards evidence-based decisions grounded in data analysis. This has enhanced the transparency of management processes and strengthened confidence in decision-making.

Thus, the implementation of an AI-based risk forecasting system at European Regional Agency LLC enabled a transition to a proactive management model, which contributed to increased efficiency, reduced uncertainty and strengthened the company's competitive position in the international IT services market.

6. Identifying the benefits, limitations and risks of implementing AI. The main benefits of using AI include: process automation, improved forecasting accuracy and a reduction in the human factor. At the same time, there are certain limitations: high implementation costs; complex integration with existing systems; the need for significant volumes of high-quality data; and risks associated with the incorrect interpretation of results. Furthermore, it is important to consider the ethical and organisational aspects of using AI, particularly the transparency of algorithms and trust in automated decisions.

CONCLUSIONS FROM THIS RESEARCH AND PROSPECTS FOR FURTHER DEVELOPMENT IN THIS FIELD

The study found that the implementation of artificial intelligence technologies in IT project management processes is an effective tool for improving the quality of risk forecasting and the overall effectiveness of project activities. Modern approaches to IT project management have been analysed and their limitations under conditions of high uncertainty identified, which justifies the use of AI technologies.

The study confirmed that the application of machine learning methods, data analytics and neural networks allows for a significant improvement in the accuracy of risk forecasting, the timely identification of potential threats and the minimisation of their impact on project outcomes. The proposed conceptual model for the integration of artificial intelligence provides a comprehensive approach to data processing, analysis and support for managerial decision-making.

Based on a practical example of implementation at the IT company European Regional Agency LLC, it has been demonstrated that the use of AI helps to reduce the number of risky situations, improve planning accuracy, optimise resource utilisation and shorten response times to deviations during project implementation.

Thus, the research findings confirm that the integration of artificial intelligence enables a shift from reactive to proactive management of IT projects, which is a key factor in enhancing their efficiency and competitiveness.

Prospects for further research in this area include: the development of more accurate and adaptive risk prediction models based on deep learning; the integration of AI with other digital technologies, in particular Big Data, the Internet of Things (IoT) and Digital Twins; the refinement of methods for assessing the effectiveness of AI

implementation in project management; research into explainability (Explainable AI) and increasing trust in automated decisions; and the development of industry standards for the application of artificial intelligence in IT project management.

Consequently, further development of this area of research will contribute to the creation of a new generation of intelligent management systems, aimed at enhancing the efficiency, flexibility and resilience of IT projects in the current context of digital transformation.

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