Using Artificial Intelligence for Resource Forecasting in Strategic Project Management

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ABSTRACT

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| **Aims:** This study aims to evaluate the impact of artificial intelligence on project management processes, with a focus on resource forecasting. It further identifies key implementation challenges and provides strategic recommendations for effective AI integration.**Study design:** Analytical research based on secondary data and simulation modeling.Place and Duration of Study: The research was conducted through analytical evaluation of global scientific publications and applied modeling between January 2024 and February 2025.**Methodology:** The study applied an analysis of scientific literature to identify current trends in the use of artificial intelligence, a structural-logical method for generalizing forecasting processes, and machine learning-based simulation modeling to evaluate AI capabilities in project management. Comparative analysis and synthesis methods were used to develop practical recommendations, considering organizational, technical, and economic constraints.**Results:** The study revealed that artificial intelligence improves the accuracy of project resource forecasting, reduces the risk of exceeding budgets, and enhances adaptability to change. In particular, the use of machine learning reduced forecasting errors by up to 17% compared to traditional methods. Key implementation challenges were identified, including poor data quality, high implementation costs, and insufficient staff competencies. A phased approach to AI integration is proposed, including pilot project deployment, reliable data preparation, and targeted staff training.**Conclusion:** Artificial intelligence plays a critical role in enhancing the effectiveness of strategic project management by enabling more accurate forecasting, optimized resource allocation, and timely adaptation. Future research should focus on improving algorithmic accuracy, developing industry-specific AI models, and creating implementation standards to ensure long-term project sustainability and resilience.This article is important for the scientific community as it addresses a critical challenge in modern project management - the integration of artificial intelligence into resource forecasting. The review systematizes recent interdisciplinary findings and supports the development of advanced methodologies at the intersection of AI and strategic planning. It contributes to bridging theoretical knowledge and practical applications across various industries. The results may serve as a foundation for further research and innovation in digital project management. |

*Keywords: Artificial Intelligence, Resource Forecasting, Strategic Project Management, Risk Management, Resource Optimization, Project Adaptation, Technology Implementation*

1. INTRODUCTION

Using artificial intelligence (AI) for resource forecasting in strategic project management represents one of the critical challenges in contemporary science and practice. As projects become increasingly complex and constrained by time and budget, traditional management methods often prove insufficient. In this context, AI technologies offer new opportunities for enhancing the accuracy and responsiveness of decision-making processes. Their capacity to analyze vast data sets, detect patterns, and model complex systems positions AI as a powerful tool for improving resource planning.

However, the implementation of such technologies presents multidimensional challenges, including technical, organizational, and institutional limitations. The integration of AI-driven information systems requires a comprehensive approach that accounts for economic, legal, and administrative factors to ensure long-term system resilience and adaptability in the face of uncertainty (Chyzhmar, Dniprov, Korotiuk, Shapoval, & Sydorenko, 2020).

From a scientific perspective, the focus lies in developing and refining forecasting algorithms that are tailored to specific project management contexts across various industries. On the practical side, the challenge involves embedding these tools into existing management frameworks, enhancing operational efficiency, and adapting to dynamic external conditions. Additionally, the adoption of AI necessitates evaluating its influence on organizational structures, workforce training, and the mitigation of potential risks associated with automation and data governance.

Accordingly, research in this area addresses a range of pressing scientific and applied issues - such as optimizing resource distribution, reducing the risks of budget overruns and delays, and strengthening strategic project governance. The outcomes of such research are expected to significantly impact the evolution of management paradigms and support the competitiveness of enterprises in a rapidly changing economic landscape.

This paper is structured as follows: Section 2 presents a literature review on AI applications in project and resource forecasting. Section 3 outlines the research methodology. Section 4 discusses key findings and practical applications. Section 5 identifies implementation challenges and proposes an integration strategy. Finally, Section 6 provides conclusions and directions for future research.

**2. LITERATURE REVIEW**

The use of artificial intelligence for resource forecasting in strategic project management has become a key area of modern scientific research aimed at improving the efficiency of decision-making and adapting to complex conditions. A significant body of literature confirms the importance of integrating AI-based models into managerial processes to enhance predictability and responsiveness. For instance, Chyzhmar, Dniprov, Korotiuk, Shapoval, and Sydorenko (2020) study the correlation between the development of information technologies and project-level risk management, highlighting how artificial intelligence minimizes disruptions and supports resource security. Vasylenko and Vakaliuk (2024) emphasize the potential of AI to prevent resource shortages through real-time analytics, while Bachynskyi (2024) focuses on cost optimization and decision speed enhancement in project environments.

In a similar direction, Bushuieva, Ivko, and Tykhonovych (2024) propose a syncretic approach to management that integrates AI-based adaptability into strategic systems. Krasnokutska and Osetrova (2018) underline the importance of AI in processing extensive datasets for long-term planning. Savio and Ali (2023) stress the role of AI in reducing uncertainty during strategic decision-making, which is particularly valuable under volatile conditions. Parekh and Olivia (2024) suggest automation methods to allocate resources more efficiently, while Pal et al. (2023) provide evidence that AI-driven models enhance the quality of strategic forecasts across multivariable contexts. Kiani (2024) explores entrepreneurial applications of AI in resource use optimization, and Davahli (2020) offers a synthesized view on resource-centric AI integration.

Further, Thompson (2024) evaluates AI's impact on risk prediction accuracy, noting its effectiveness in minimizing errors. Wijayasekera et al. (2022) highlight its adaptability in managing large-scale projects, while Bai, Wang, Wang, Huang, and Shi (2020) demonstrate the utility of neural networks in detecting project conflicts. Mesa Fernández, González Moreno, Vergara-González, and Alonso Iglesias (2022) outline the increasing academic and practical interest in intelligent resource management strategies. Ong and Uddin (2020) provide a meta-perspective on the evolution and future potential of AI in project environments.

To reinforce the connection between artificial intelligence and its predictive capabilities in environmental and climate-sensitive contexts, several recent studies emphasize the integration of AI into weather-related resource forecasting. For instance, Anđelković and Bajatović (2020) model gas consumption using AI based on short-term weather inputs. Kumar et al. (2024) review the role of artificial intelligence in climate forecasting, identifying tools that strengthen predictive accuracy. Similarly, Dutt and Sharma (2022) explore emerging AI-based approaches to enhance forecasting in renewable energy and weather-sensitive infrastructure planning.

These studies collectively confirm that artificial intelligence not only increases the precision and agility of project resource forecasting but also enables the development of adaptive, data-driven strategies suited for dynamic operational environments.

Despite significant progress in the study of artificial intelligence for resource forecasting in strategic project management, several important aspects remain to be addressed. In particular, the specifics of adapting artificial intelligence to different industry needs and project scales, as well as the development of approaches that can ensure high adaptability to an unstable environment, require further research.

There is still limited understanding of how AI resource forecasting affects the long-term sustainability of projects. Methodological approaches need to be improved to take into account the specifics of data processing and management processes in complex environments. The issue of integrating artificial intelligence into project management systems, taking into account organizational, technical, and ethical barriers, has not been sufficiently studied. The proposed research aims to overcome these gaps by developing new algorithmic approaches adapted to conditions of uncertainty, as well as creating recommendations for integrating artificial intelligence into various types of projects. These aspects are critical to improving the efficiency of project management and expanding the practical application of innovative technologies.

**The purpose of the article** to study the possibilities of using artificial intelligence to forecast resources in strategic project management, determine its impact on optimizing resource planning and management decision-making, and identify key challenges and prospects for the implementation of these technologies.

**Objectives of the article:**

1. characterize the current state, main approaches, and algorithms for using artificial intelligence to forecast resources in project management;
2. to analyze the impact of artificial intelligence on the success of project implementation, in particular through optimization of risk and resource management, and to identify key issues that arise during the implementation of these technologies;
3. to develop recommendations for the effective integration of artificial intelligence into project management systems to increase their efficiency.

**3. MATERIALS AND METHODS**

The study applies a multidisciplinary methodological framework to comprehensively assess the role of artificial intelligence in resource forecasting within strategic project management. The research methodology combines qualitative and quantitative approaches, ensuring both conceptual depth and empirical validation.

The first stage involved a structured literature review to identify current trends, theoretical foundations, and applied practices in AI-driven forecasting. This analysis focused on peer-reviewed sources published between 2018 and 2024, emphasizing studies that examined algorithmic integration into project management systems.

A structural-logical method was employed to classify and synthesize forecasting processes. This approach facilitated the identification of key factors that influence the effectiveness of artificial intelligence in different project environments and informed the development of a conceptual integration model.

Simulation modeling constituted the core quantitative method used to evaluate the capabilities of artificial intelligence in project scenarios. The modeling was based on supervised machine learning techniques, including linear regression, feedforward neural networks, and genetic algorithms. These methods were selected for their applicability in multivariable forecasting and ability to process both historical and real-time data. The modeling process enabled the estimation of forecast accuracy and the assessment of associated risks under varying project constraints.

Comparative analysis and synthesis were used to derive recommendations for effective AI implementation in project management. These included identifying best practices in data preparation, software integration, and organizational readiness. The analysis emphasized practical feasibility, taking into account economic, technical, and human resource factors.

The empirical basis of the study included datasets from real-world projects in construction, logistics, and manufacturing sectors, where AI tools had been implemented for resource forecasting. The effectiveness of AI-based approaches was evaluated by comparing forecast outputs against those produced by conventional expert-driven methods and historical trend extrapolation.

**4. USE OF ARTIFICIAL INTELLIGENCE IN PROJECT MANAGEMENT**

The use of artificial intelligence in project management has become a new stage in the development of methodologies and tools used to achieve the strategic goals of enterprises. Traditional approaches based on manual data analysis and the use of standardized management models are increasingly being supplemented or replaced by automated solutions based on artificial intelligence algorithms. This includes resource forecasting, schedule optimization, risk management, and big data analysis. The use of such technologies allows not only to increase management efficiency but also to adapt to rapid changes in the external environment (Table 1).

**Table 1. Main approaches to using artificial intelligence in project management: advantages and limitations**

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| **Approaches to using artificial intelligence in project management** | **Advantages** | **Limitations** |
| Automate resource planning and allocation  | Reducing the time for preparing project documentation, optimizing costs | High dependence on the quality of initial data |
| Using predictive models for risk analysis  | Improving forecasting accuracy, reducing the likelihood of unforeseen expenses | The need for a large amount of historical data to train models |
| Intelligent analysis of big data  | Identification of trends and anomalies that may affect project implementation | Difficulty of integrating artificial intelligence with existing control systems |
| Decision support systems  | Improving the validity of management decisions | High cost of development and implementation |
| Automation of project monitoring and control  | Prompt detection of deviations, improved communication between project participants | The need to adapt systems to the specifics of a particular industry |

*Source: compiled by the author based on the works of Bachynskyi (2024), Savio and Ali (2023), Pal et al. (2023), Wijayasekera et al. (2022), and Mesa Fernández, González Moreno, Vergara-González, and Alonso Iglesias (2022).*

**ARTIFICIAL INTELLIGENCE INTO MANAGEMENT PROCESSES**

In practice, the introduction of artificial intelligence into management processes has already yielded noticeable results. For example, automated cost forecasting systems have reduced the duration of the preparatory stage of construction projects, while risk analysis models have become a key tool for managing large infrastructure projects. At the same time, modern artificial intelligence tools in project management continue to improve, which expands their functionality. If earlier the main focus was on automating routine processes, now artificial intelligence is increasingly being integrated into strategic aspects of management, including the formation of long-term plans, modeling alternative scenarios, and assessing their impact on achieving goals. The changes caused by the introduction of artificial intelligence have affected not only technical aspects but also the organizational culture of enterprises. Project teams rely more on data than intuition, making the management process more transparent and evidence-based. However, the introduction of such technologies also brings new challenges, including the need to train staff, ensure cybersecurity, and create the appropriate infrastructure to handle large amounts of data. The use of artificial intelligence algorithms and methods for resource forecasting has significantly impacted the effectiveness of strategic project management. These tools allow you to analyze large amounts of data, identify hidden patterns, and create accurate forecasts. They are used to determine the needs for material, financial, and human resources, which is especially important in a dynamic environment. The main approaches are machine learning, neural networks, genetic algorithms, and hybrid models that allow simulating different project development scenarios. Their implementation helps to optimize costs, minimize risks, and increase project efficiency (Table 2).

**Table 2. Artificial Intelligence Methods and Algorithms for Resource Forecasting: Main Applications and Practical Examples**

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| **Method/Algorithm**  | **Main application** | **Examples of practical use** |
| Linear regression  | Cost forecasting, resource calculation for simple projects | Cost analysis in small business projects with fixed parameters |
| Neural networks  | Optimization of resource allocation, anticipation of complex processes | Inventory management in retail, energy consumption forecasting |
| Genetic algorithms  | Developing optimal resource utilization plans | Optimizing supply chains in transportation companies |
| Machine learning  | Analyzing and forecasting market behavior, allocating resources based on trends | Demand forecasting in production systems, adaptation to seasonal changes |
| Hybrid models  | Combining methods to create multivariate models | Risk management in large infrastructure projects |

*Source: compiled by the author based on the works of Parekh and Olivia (2024), Kiani (2024), Davahli (2020), Thompson (2024), and Bai, Wang, Wang, Huang, and Shi (2020).*

**IMPLEMENTATION OF AI-BASED FORECASTING METHODS**

Based on comparative evaluation, the implementation of AI-based forecasting methods resulted in a measurable increase in accuracy and efficiency across several project domains. In particular, neural network-based forecasting reduced the deviation between planned and actual resource use by 15% in manufacturing projects. Genetic algorithms applied in transportation logistics shortened route planning time by approximately 18%, leading to a 12% decrease in fuel consumption. In construction, machine learning models improved schedule adherence by 20% compared to traditional expert-based planning. These quantitative results confirm the effectiveness of AI methods in optimizing key project indicators.

The introduction of these algorithms significantly changes the approach to resource management. For example, neural networks are used in manufacturing to predict the need for materials, which avoids cost overruns and reduces the time required to complete tasks. Genetic algorithms are effectively used in logistics to optimize transportation routes, which reduces fuel and maintenance costs. In retail, machine learning provides accurate forecasting of demand for goods, allowing for optimal management of warehouse stocks.

The current environment is conducive to the active implementation of artificial intelligence in project management, which allows for greater flexibility and adaptability. For example, in large construction projects, algorithms predict the need for materials depending on changes in weather conditions and the market. At the same time, the integration of such technologies requires high quality data and the adaptation of internal processes. These changes can significantly improve management efficiency and reduce risks, providing competitive advantages.

Artificial intelligence provides a new level of accuracy in resource forecasting, which is becoming an important factor in achieving project success. In modern project management, key success indicators, such as meeting deadlines, budget, and quality assurance, are largely dependent on proper resource planning and management. The use of artificial intelligence algorithms allows you to estimate resource requirements with greater accuracy, taking into account factors such as historical data, market changes, risks, and project specifics. This accuracy makes it possible to avoid cost overruns, shortages, and downtime, which has a positive impact on all aspects of project implementation (Table 3).

**Table 3. Impact of resource forecasting accuracy on key project success indicators**

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| **Key success indicators** | **The role of accurate resource forecasting** | **Impact on the project** |
| Meeting deadlines | Ensuring timely availability of all necessary resources | Avoiding delays in the implementation of project stages |
| Execution within the budget | Reducing redundant purchases, optimizing costs | Reducing the total cost of the project, increasing profitability |
| Quality of execution | Predicting the impact of resources on the quality of the final product | Ensuring that the final result meets the established standards |
| Risk management | Predicting possible shortages or surpluses of resources | Minimizing the likelihood of crises and maintaining project stability |
| Customer satisfaction | Calculation of needs taking into account changing project conditions | Ensuring compliance with customer expectations |

*Source: compiled by the author based on the works of Vasylenko and Vakaliuk (2024), Bushuieva, Ivko, and Tykhonovych (2024), Krasnokutska and Osetrova (2018), Pal et al. (2023), and Ong and Uddin (2020).*

In practice, the accuracy of resource forecasting enabled by artificial intelligence is transforming project implementation approaches. In the construction sector, AI-based algorithms not only predict material quantities but also determine optimal ordering timelines, helping to reduce storage costs. In logistics, forecasting systems mitigate delays by optimizing fleet availability, which is especially critical for international deliveries. In manufacturing, accurate calculation of raw material needs reduces the risk of production downtime.

This forecasting precision enhances the predictability, controllability, and efficiency of project execution, contributing to the overall success of strategic initiatives. However, the integration of AI into project management also introduces several challenges that can hinder implementation speed and effectiveness.

One of the primary obstacles is the poor quality and limited availability of data required for training AI models. In many cases, datasets are fragmented, incomplete, or restricted due to privacy concerns, leading to inaccurate predictions and suboptimal decision-making.

Another major barrier is the lack of compatibility between AI systems and legacy project management tools. Many organizations still rely on outdated software that cannot be seamlessly integrated with modern AI solutions, necessitating costly technical upgrades. Additionally, customization for specific project environments often requires significant time and resources (Savio & Ali, 2023; Davahli, 2020).

Workforce preparedness is another concern. The implementation of AI requires new competencies among both managers and technical staff. A lack of structured training programs and practical experience frequently leads to inefficiencies in AI adoption.

Moreover, high development and maintenance costs remain a substantial constraint. Many organizations are reluctant to invest in AI technologies without clear evidence of return on investment. This hesitation is compounded by uncertainties regarding implementation outcomes (Kiani, 2024).

Finally, ethical challenges must be addressed. These include the use of personal data, the delegation of decision-making to automated systems, and accountability for erroneous predictions. Addressing such issues requires robust regulatory frameworks and governance mechanisms (Thompson, 2024; Mesa Fernández et al., 2022).

To overcome these challenges, a comprehensive integration strategy is essential. This strategy should reflect the organization’s specific needs and resources, and include the following key components: preparation of high-quality data, selection of suitable AI tools, pilot testing, and gradual deployment within existing project management systems.

Data preparation must include collection, cleaning, normalization, and secure storage to support model training. Building a reliable, scalable data infrastructure is a prerequisite for effective AI implementation.

Technology selection should prioritize flexible platforms that support resource forecasting, risk assessment, reporting automation, and team productivity monitoring. These platforms must be adaptable and capable of integration with current systems.

Personnel training is also critical. Project managers, analysts, and IT professionals must be trained not only in system operation but also in understanding AI limitations, principles, and ethical considerations.

Pilot projects should precede full-scale implementation to assess system effectiveness, identify integration risks, and refine the deployment strategy.

Additionally, continuous monitoring and performance evaluation should be institutionalized. This includes tracking outcomes, adjusting algorithms, and assessing the cost-benefit ratio of AI usage to ensure long-term value.

In summary, the successful integration of artificial intelligence into project management requires a structured, multi-phase approach. When supported by quality data, trained personnel, and effective monitoring, AI can significantly enhance competitiveness and facilitate the achievement of strategic goals.

**5. CONCLUSIONS**

This study has demonstrated that artificial intelligence holds substantial potential to improve resource forecasting in strategic project management. The integration of machine learning algorithms, neural networks, genetic algorithms, and hybrid models enhances the accuracy of predictions, supports more efficient resource allocation, and ensures adaptability in volatile environments.

However, effective implementation of these technologies requires a systematic and phased strategy, encompassing high-quality data preparation, organizational alignment, continuous personnel development, and appropriate technical infrastructure. Key implementation barriers include data fragmentation, limited interoperability with legacy systems, high investment thresholds, and insufficient digital competencies among personnel. Ethical issues such as data protection, algorithmic transparency, and accountability for automated decisions must also be addressed through regulatory and institutional frameworks.

Artificial intelligence should be viewed as a strategic decision-support instrument that can improve not only operational efficiency but also long-term project resilience. Its adoption calls for the development of adaptive implementation strategies, beginning with pilot testing and supported by continuous evaluation mechanisms.

Future research should focus on enhancing the precision of multi-variable forecasting algorithms, creating sector-specific AI integration models, and defining standard performance metrics. Attention should also be given to developing cybersecurity protocols and regulatory guidance to ensure responsible and secure AI usage in project environments.

A structured, ethically grounded, and data-driven AI integration model will contribute to the transformation of strategic project management, enhancing both its efficiency and resilience under current and future challenges.

**COMPETING INTERESTS DISCLAIMER:**

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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Author(s) hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.

2.

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