

# INPLASY

## Leveraging Artificial Intelligence in Project Management: A Systematic Review of Applications, Challenges, and Future Directions

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### ADMINISTRATIVE INFORMATION

**Support** - None.

**Review Stage at time of this submission** - Completed but not published.

**Conflicts of interest** - None declared.

**INPLASY registration number:** INPLASY202510041

**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 13 January 2025 and was last updated on 13 January 2025.

### INTRODUCTION

**Review question / Objective** The objective of the systematic review is to explore how Artificial Intelligence (AI) methodologies are integrated into Project Management (PM), focusing on applications like cost estimation, duration forecasting, and risk assessment. The review aims to synthesize existing research to identify the benefits, challenges, and future directions of AI in enhancing project performance across various phases. It also seeks to highlight gaps in the literature and suggest areas for future investigation.

**Rationale** The rationale for this review is driven by the growing impact of Artificial Intelligence (AI) in Project Management (PM). Despite advancements, there is a lack of comprehensive understanding of how AI enhances project performance, especially in cost estimation, duration forecasting, and risk assessment. This study addresses the need to synthesize existing research, identify practical

applications, highlight gaps in current knowledge, and propose future research directions to optimize AI integration across all project phases.

**Condition being studied** The condition being studied is the integration and application of Artificial Intelligence (AI) methodologies in Project Management (PM). The review focuses on how AI techniques—such as machine learning, deep learning, and hybrid models—enhance critical project success factors like cost estimation, duration forecasting, and risk assessment. It examines the effectiveness, challenges, and limitations of AI in improving project outcomes across various phases of the project lifecycle.

### METHODS

**Search strategy** The search strategy involved a systematic literature search using the PRISMA methodology. Two major databases, Web of Science and Scopus, were used to ensure comprehensive coverage and minimize duplicates.

Search terms included combinations of keywords such as "Artificial Intelligence", "Project Management", "Machine Learning", "Deep Learning", "Neural Networks", "Natural Language Processing", "Fuzzy Logic", "Heuristics", and "Forecasting". The search was limited to peer-reviewed journal articles published between 2011 and February 2024, focusing on high-impact journals (Q1) to ensure quality and relevance.

**Participant or population** This is systematic literature review does not include direct patients or participants. The "population" in this context refers to peer-reviewed studies published between 2011 and 2024 that examine the application of Artificial Intelligence (AI) in Project Management (PM). These studies focus on AI techniques such as machine learning, deep learning, and hybrid models applied to project tasks like cost estimation, duration forecasting, and risk assessment across various industries.

**Intervention** The intervention studied in this systematic review is the application of Artificial Intelligence (AI) methodologies in Project Management (PM). This includes the use of machine learning, deep learning, neural networks, natural language processing, fuzzy logic, and hybrid models to improve project outcomes. These AI techniques are applied to critical project tasks such as cost estimation, duration forecasting, and risk assessment, aiming to enhance decision-making, efficiency, and overall project success.

**Comparator** The comparator for this systematic review includes traditional and non-AI-based project management techniques and methodologies. These include manual or deterministic approaches to cost estimation, risk assessment, and duration forecasting, which serve as benchmarks for evaluating the effectiveness of AI-driven models. Studies that utilized conventional project management practices, statistical methods, or heuristics without AI integration are considered as the primary comparators.

**Study designs to be included** This review includes studies employing qualitative, quantitative, or mixed-methods approaches to explore the integration of Artificial Intelligence (AI) in project management. Eligible designs include empirical studies, case studies, experimental studies, simulations, systematic reviews, and meta-analyses. Only peer-reviewed journal articles and conference papers published between 2011 and 2024 are considered. Grey literature, editorials,

and opinion pieces are excluded to maintain the rigor and reliability of findings.

**Eligibility criteria** Peer-reviewed journal articles and conference papers published between 2011 and 2024.

Studies that focus on the integration of Artificial Intelligence (AI) in project management.

Studies using empirical, experimental, case study, simulation, systematic review, or meta-analytic methodologies.

Research addressing applications, challenges, or future directions of AI in project management across various industries.

Publications written in English.

**Information sources** The primary information sources for this systematic review include:

Electronic Databases:

Web of Science

Scopus

Search Terms and Keywords:

Combinations of terms such as "Artificial Intelligence" and "Project Management," "Machine Learning" and "Project Management," "Deep Learning" and "Project Management," and other AI-related methodologies in conjunction with project management.

Publication Filters:

Articles published between 2011 and February 2024.

English language publications only.

Journal Credibility Assessment:

Articles from journals ranked Q1 to Q4 according to Scimago Journal Rankings were included.

**Main outcome(s)** The primary outcomes of this systematic review are to identify and classify the applications of Artificial Intelligence (AI) methodologies, such as Machine Learning, Deep Learning, and Fuzzy Logic, in key project management tasks, including cost estimation, duration forecasting, and risk assessment. The review evaluates the effectiveness of AI-driven techniques in enhancing accuracy, efficiency, and reliability compared to traditional project management methods. Additionally, it highlights the challenges in integrating AI, such as the need for real-world data validation, adaptability to dynamic project environments, and the limited exploration of certain project phases. Finally, the study provides recommendations for future research and practice to advance the adoption and optimization of AI technologies in project management.

**Data management** All data retrieved during the systematic review process was managed

systematically to ensure transparency and reproducibility. References and study details was stored using reference management software, Mendeley, to organize citations and eliminate duplicates. Data from eligible studies, including publication details, methodologies, outcomes, and key findings, was extracted into a pre-designed data extraction form. All data was securely stored and backed up, ensuring confidentiality and accessibility for analysis. The PRISMA flow diagram documented the study selection process, including the number of records identified, screened, excluded, and included in the final review.

**Quality assessment / Risk of bias analysis** This study did not employ a formal quality assessment or risk of bias tool due to the exploratory nature of the research and resource constraints. However, a systematic review of the studies was conducted to ensure that only studies with clear inclusion criteria and validated measurement methods were included. Potential biases, such as selection bias and detection bias, were considered during data collection, and efforts were made to mitigate these through careful participant selection and standardized procedures. It is important to note that the absence of a formal risk of bias tool limits the ability to fully evaluate and quantify the potential for bias in the included studies. Future research may include the use of established tools such as the Cochrane Risk of Bias tool to more thoroughly assess study quality and bias.

**Strategy of data synthesis** The data synthesis strategy for this systematic literature review follows a structured and comprehensive approach. Adopting the PRISMA methodology, the review ensures transparency and rigor by employing explicit procedures to search, identify, evaluate, and analyze relevant literature. Articles were selected from reputable databases, including Web of Science and Scopus, using predefined search terms such as "Artificial Intelligence" and "Project Management." The inclusion process, documented through a PRISMA flow diagram, resulted in a final dataset of 98 studies. Bibliometric and thematic analyses were conducted to categorize articles by publication year, journal, and industry, with studies grouped based on AI applications in project management, such as cost estimation, duration forecasting, and risk assessment. Decision trees were developed to visually represent the integration of AI methodologies in various project phases—planning, execution, and monitoring—while mapping specific AI models like machine learning, deep learning, and hybrid approaches to corresponding tasks.

**Subgroup analysis** In the systematic literature review, subgroup analysis was conducted to explore variations in the application and effectiveness of Artificial Intelligence (AI) methodologies across different contexts in project management. The analysis involved categorizing studies based on specific criteria such as AI techniques, project phases, and industries to identify patterns, strengths, and limitations within subgroups.

**AI Methodologies:** Studies were grouped by the type of AI techniques used, including machine learning, deep learning, hybrid models, and natural language processing. This enabled a comparison of their effectiveness in tasks such as cost estimation, duration forecasting, and risk assessment.

**Project Phases:** AI applications were analyzed across different phases of project management—planning, execution, and monitoring. This categorization highlighted the suitability of various AI methods for specific stages, such as decision-tree models for planning and neural networks for execution and monitoring.

**Industry Applications:** Articles were further categorized by the industries they addressed, including construction, engineering, business, and information technology. This subgroup analysis identified domain-specific challenges and advancements in AI integration.

**Year of Publication:** Subgroups based on the publication year were created to examine trends over time, revealing a significant increase in studies focusing on AI applications in project management since 2020.

This subgroup analysis provided insights into how AI methodologies perform under different conditions, offering a deeper understanding of their effectiveness and limitations in diverse project management contexts.

**Sensitivity analysis** This systematic literature review did not include a formal sensitivity analysis. While the study adhered to rigorous inclusion and exclusion criteria and employed a systematic methodology to ensure reliable findings, no additional tests were performed to evaluate the impact of methodological variations or assumptions on the results. Future research could incorporate sensitivity analyses to assess the influence of factors such as inclusion criteria, search terms, or quality thresholds on the conclusions.

**Language restriction** English.

**Country(ies) involved** Greece.

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**Keywords** Project Management (PM); Artificial Intelligence (AI); PRISMA methodology; Cost estimation; Duration forecasting; Risk assessment; Machine Learning (ML); Hybrid models; Decision.

**Contributions of each author**

Author 1 - Dorothea Adamantiadou - Author 1 (Dorothea S. Adamantiadou) conducted the research, performed the systematic literature review, and wrote the initial draft of the manuscript. Both authors approved the final version of the manuscript for submission.

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Author 2 - Loukas Tsironis - Author 2 (Loukas Tsironis) critically reviewed the manuscript, provided significant feedback, and contributed to shaping the final structure and content of the article. Both authors approved the final version of the manuscript for submission.

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